UNIT 1 *Logic* Activities

Activities

ACTIVITY 1.1 *Two Way Tables*

This is a whole-class or group activity.

You are going to divide up into groups according to *two* criteria. You need to either use the four corners of your classroom, or make sufficient space in one area of the room.

In each case, divide up into the appropriate corner or 'cell' according to the criteria given.

1.

	Boys	*Girls*
No sisters or brothers		
At least one sister or brother		

Add up the total number of pupils in each cell. What does this tell you?

2.

	No sisters	*One or more sisters*
No brothers		
One or more brothers		

What must the total number of pupils in each cell add up to?

3.

	No sisters	*One sister*
No brothers		
One brother		

What does the total number of pupils in each cell now add up to?

Describe the criteria for pupils who are not in any of the cells.

ACTIVITY 1.2 *Shapes in Two Way Tables*

This activity requires the use of a set of shapes (given on A 1.2a).

You will also need large (A3) 2×2 and 3×3 tables on which to place the shapes.

In each case, put the complete set of shapes, 40 in total, into the appropriate cell, according to the criteria given.

1. (a)

	No. of edges	
	All straight	Not all straight
Shaded		
Not shaded		

(b)

	No. of edges	
	2 or less	3 or more
Shaded		
Not shaded		

2.

	No. of edges		
	3 or less	4	5 or more
Shaded			
Not shaded			

3.

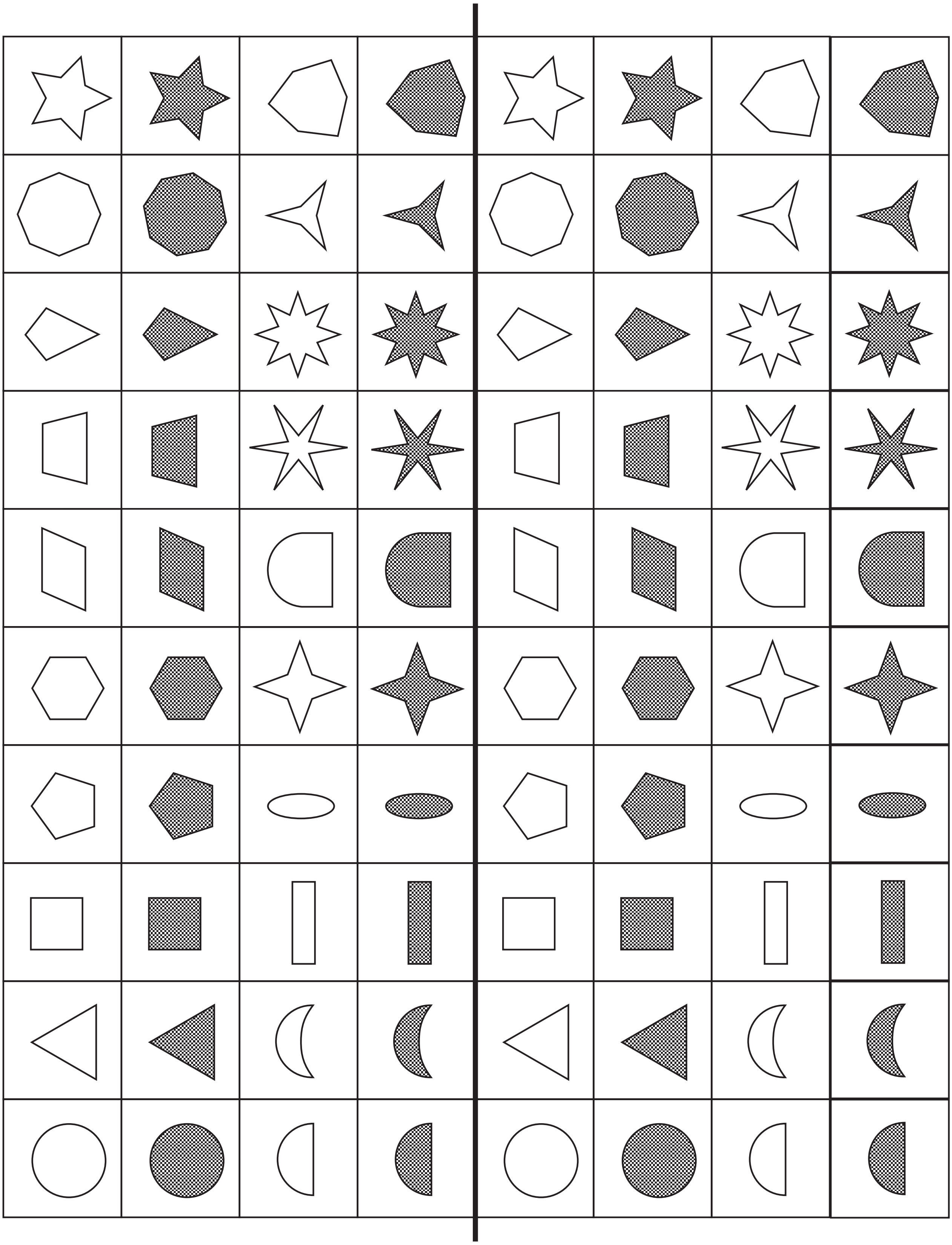
		No. of edges		
		3 or less	4	5 or more
Type of edge	All round			
	Some round and some straight			
	All straight			

4.

		No. of edges		
		3 or less	4	5 or more
No. of vertices	None or one			
	Two or three			
	Four or more			

Do all the shapes belong in a cell?

ACTIVITY 1.2 a *Shapes*



ACTIVITY 1.2 b *Numbers*

10	20	30	40	10	20	30	40
9	19	29	39	9	19	29	39
8	18	28	38	8	18	28	38
7	17	27	37	7	17	27	37
6	16	26	36	6	16	26	36
5	15	25	35	5	15	25	35
4	14	24	34	4	14	24	34
3	13	23	33	3	13	23	33
2	12	22	32	2	12	22	32
1	11	21	31	1	11	21	31

ACTIVITY 1.2 c *Letters*

J	T	D	N	X	H	R	
I	S	C	M	W	G	Q	
H	R	B	L	V	F	P	Z
G	Q	A	K	U	E	O	Y
F	P	Z	J	T	D	N	X
E	O	Y	I	S	C	M	W
D	N	X	H	R	B	L	V
C	M	W	G	Q	A	K	U
B	L	V	F	P	Z	J	T
A	K	U	E	O	Y	I	S

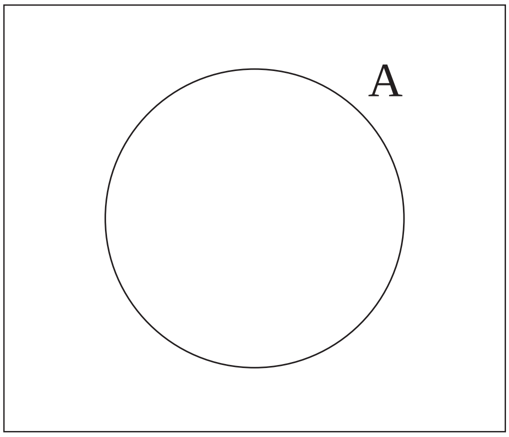
ACTIVITY 1.3 *Venn Diagrams*

This a whole-class or group activity.

You are going to be placed in sets according to the given criteria, and you must find your appropriate place on a Venn diagram of the type shown below, which will be indicated on the classroom floor.

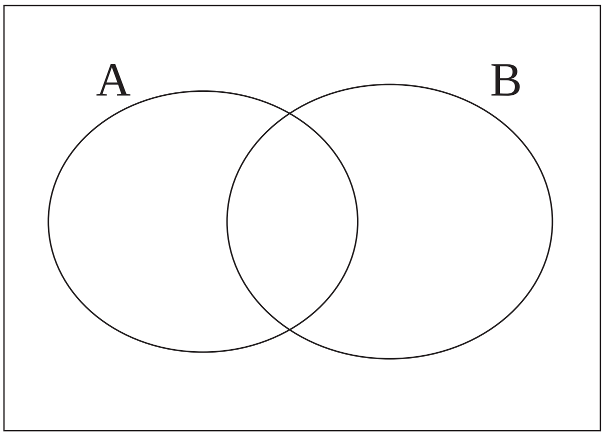
In all cases, the complete set consists of *all* the pupils in the class.

Type 1



or

Type 2



1. Using *Type 1*, A = set of boys.

   Describe the set of girls in terms of A.

2. Using *Type 1*, A = set of pupils who are 11 years old.

   Describe pupils in the *complement* of A.

3. Using *Type 2*, A = boys, B = girls.

   What can you say about (i) the *union* of A and B,

   (ii) the *intersection* of A and B,

   (iii) the *complement* of A and B?

4. Using *Type 2*, A = pupils with at least one sister,

   B = pupils with at least one brother.

   State in words, what is shown by (i) the *intersection* of A and B,

   (ii) the *complement* of the *union* of A and B.

ACTIVITY 1.4 *Numbers in Venn Diagrams*

This activity requires the use of a set of numbers (given on A 1.2b).

You will also need a large (A3) size Venn diagram (you could enlarge the diagram given on A 1.4a) on which to place the numbers.

In each case, put the given set of numbers into the appropriate region on the Venn diagram, according to the definition given for each set.

In all cases, the complete set is the set of whole numbers 1 to 40.

1. A = even numbers

   B = numbers divisible by 3

   What is in (i) the *intersection* of A and B,

   (ii) the *complement* of A and B?

2. A = single-digit, even numbers

   B = even numbers

   Describe the sets (i) the *intersection* of A with the *complement* of B,

   (ii) the *union* of A and B,

   (iii) the *complement* of the *union* of A and B.

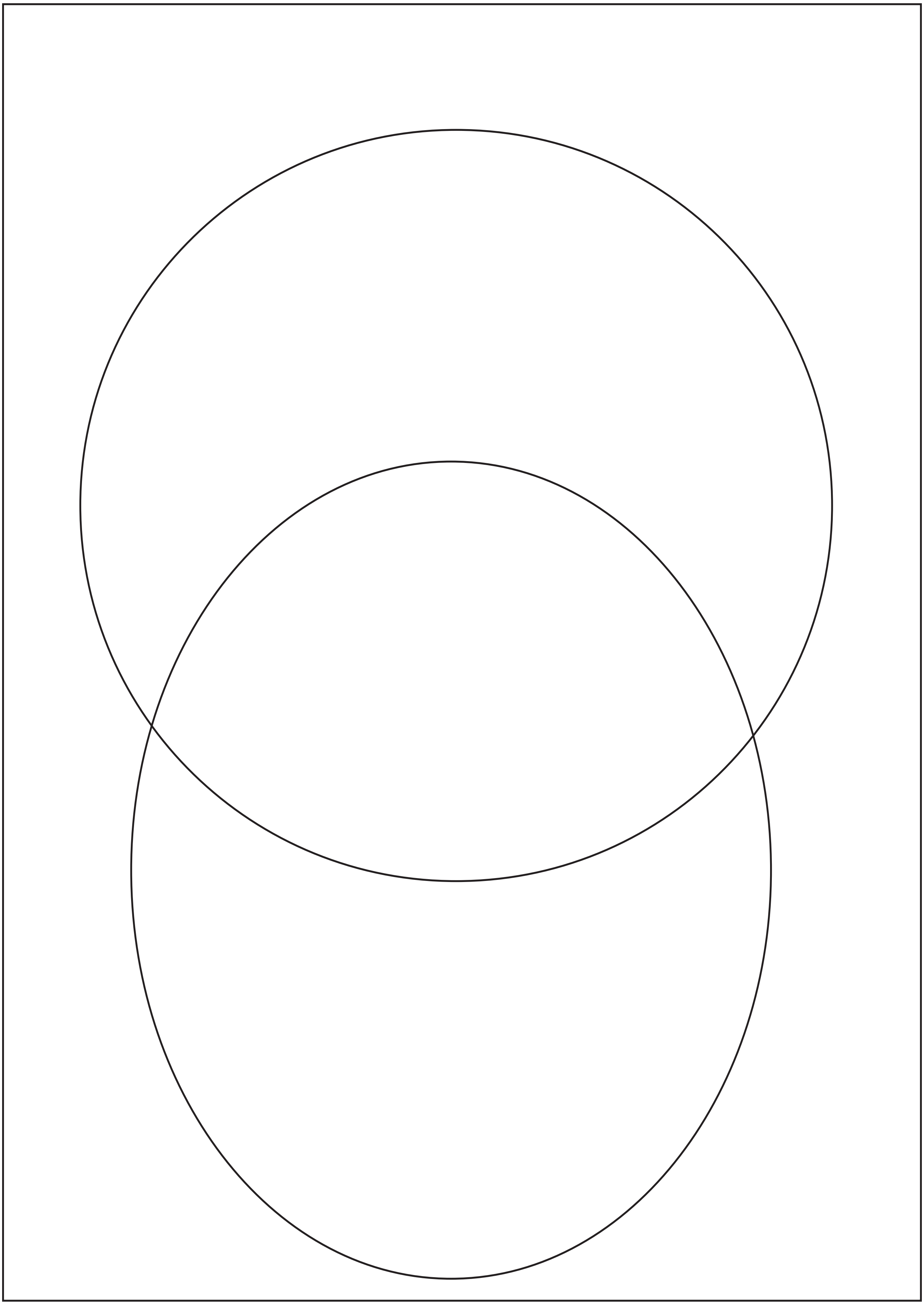
3. A = numbers divisible by 4

   B = numbers divisible by 3

   What is in (i) the *intersection* of A and B?

   (ii) the *intersection* of the *complement* of A with the *complement* of B?

ACTIVITY 1.4 a *Venn Diagram*



ACTIVITY 1.5 *Plane Passengers*

In a plane flying to London, five passengers are seated in a row next to each other.

Their professions are

journalist, singer, teacher, sailor, engineer;

and their nationalities, in any order, are:

English, French, German, Italian, Dutch.

Their ages are

21 years, 24 years, 32 years, 40 years, 52 years,

and each plays a different one of the following sports

handball, swimming, volleyball, athletics, football.

They will each travel from London to a different destination

Liverpool, Birmingham, Manchester, Newcastle or *Plymouth.*

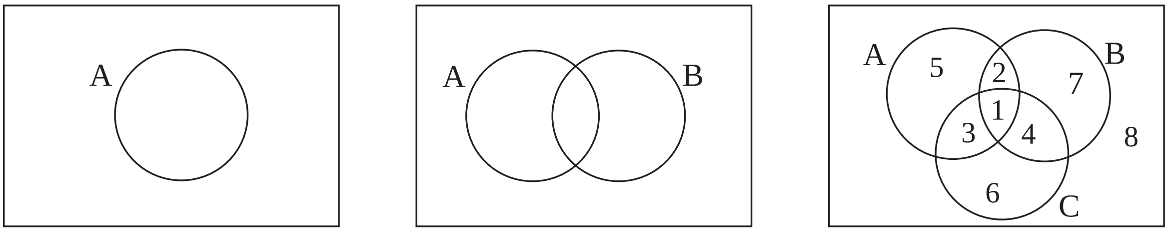
Clue 1	The engineer is seated on the extreme left.
Clue 2	The volleyball player is seated in the middle.
Clue 3	The Englishman is a journalist.
Clue 4	The singer is 21 years old.
Clue 5	The teacher's sport is swimming.
Clue 6	The sailor is travelling to Plymouth.
Clue 7	The handball player is French.
Clue 8	The passenger from Holland is bound for Birmingham.
Clue 9	The passenger bound for Liverpool is 32 years old.
Clue 10	The athlete is bound for Newcastle.
Clue 11	The French passenger is seated next to the German.
Clue 12	The 52-year-old passenger is seated next to the passenger who is bound for Manchester.
Clue 13	The 24-year-old passenger is seated next to the passenger who is travelling to Birmingham.
Clue 14	The engineer is seated next to the Italian.

Use the clues to deduce the answers to these questions:

1. How old is the sailor?
2. What is the nationality of the football player?

ACTIVITY 1.6 *Representing Sets by Venn Diagrams*

Introduced by the English mathematician, *John Venn* (1834-1923), so called Venn diagrams are a convenient way of representing subsets of a universal set. For one, two or three subsets, it is easy to see that these diagrams can represent all the probabilities.



For example, for three subsets, A, B and C, you need separate regions to represent all the combinations that can exist.

1. Complete the table below and check that all the combinations are represented on the Venn diagram by the numbered regions.

A	B	C	On diagram
✓	✓	✓	✓ (1)
✓	✓	✕	✓ (2)
✓	✕	✓	✓ (3)
...	...	...	
...	...	...	
...	...	...	
...	...	...	
...	...	...	

2. Try to represent four subsets, A, B, C and D in a similar way. Check that, in your proposed diagram, all the possibilities are represented.

ACTIVITIES 1.1 - 1.3 *Notes and Solutions*

Notes and solutions are only given where appropriate.

1.1 You must ensure that there is plenty of room for this activity, and that it is relatively easy or pupils to move around.

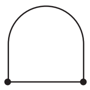
1/2. The total will be the total number in the class, but this may not be the case in questions 3 and 4.

3. Any cell can be classified as 'having more than one sister or more than one brother (or both)'.

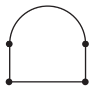
1.2 This is again a teacher-led activity. You will need to supply the shapes (preferably already cut out!), and might find it helpful to use the large 2×2 and 3×3 tables, photocopied onto A3 (OS 1.17 and OS 1.18).

Problems 1-3 should not cause difficulties, although the number of edges and vertices for the  shape depends on how you define a vertex.

e.g.



2 vertices and 2 edges



4 vertices and 4 edges

There is also a potential problem with the circle for problem 4, although the entry 'none or one' for the number of vertices should sort this out.

These problems can be made:

(i) easier, by restricting the number of shapes used;

(ii) more complex, by having more criteria and hence more cells.

You can also design similar activities using numbers (A 1.2b) or letters (A 1.2c), where you could, for example, use the criteria

- vowels or consonants,
- no. of lines of symmetry.

1.3 This is a teacher-led activity, and will need careful planning to ensure that the Venn diagram is physically large enough (you could perhaps borrow some ropes from the PE department!). Of course, the sets will need modifying for single sex schools!

1. The set of girls is the complement of A.

2. Pupils in the complement of A are either older than 11 or younger than 11.

3. (i) all pupils in the class, (ii) the empty set, (iii) the empty set.

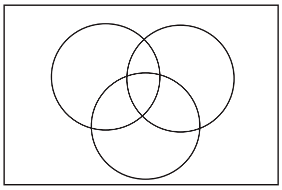
4. (i) pupils with both at least one sister and at least one brother,
   (ii) pupils with no brother or sister.

ACTIVITIES 1.4 - 1.5 *Notes and Solutions*

1.4 This is a teacher-led activity, and you will need to supply numbers (A 1.2b). This problem can be made:

(i) easier by restricting the numbers used (e.g. 1 – 20);

(ii) more complex with different definitions of the sets (e.g. prime numbers or square numbers), or even using three subsets on a sheet.



You can also design similar problems using shapes (A 1.2a) or letters (A 1.2c), where you could classify according to lines of symmetry and rotational symmetry.

1. (i) { 6, 12, 18, 24, 30, 36 }

   (ii) { 1, 5, 7, 11, 13, 17, 19, 23, 25, 29, 31, 35, 37 }

2. (i) empty set (ii) even numbers (iii) odd numbers

3. (i) { 12, 24, 36 }

   (ii) { 1, 2, 5, 6, 7, 10, 11, 13, 14, 17, 18, 19, 23, 25, 26, 29, 30, 31, 34, 35, 37, 38 }

1.5 There are many ways of tackling this problem, ranging from trial and error to more systematic methods. For example, you could make 25 small squares with one piece of information on each square, and then combine them according to the constraints.

Another method would be to use transparent strips, with each of the given combinations written in the appropriate columns on each strip. The strips can be placed on top of one another without obscuring any information, and related pieces of information will be kept together.

The final solution is:

Engineer	*Teacher*	*Journalist*	*Sailor*	*Singer*
Dutch	Italian	English	French	German
52 years old	24 years old	32 years old	40 years old	21 years old
Birmingham	Manchester	Liverpool	Plymouth	Newcastle
Football	Swimming	Volleyball	Handball	Athletics

giving the answers:

1. 40 years old

2. Dutch

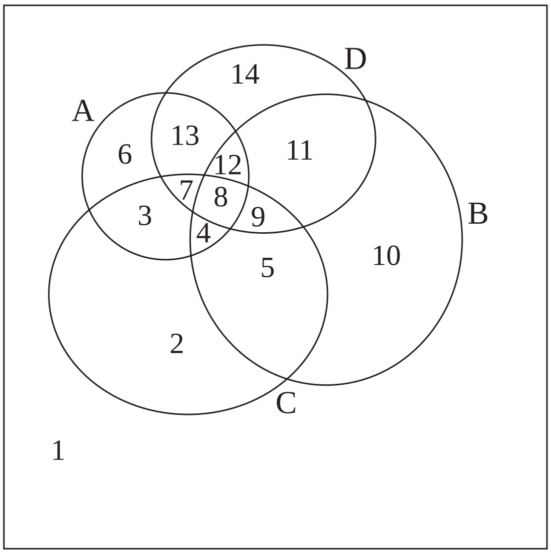
ACTIVITIES 1.6 *Notes and Solutions*

1.6 This is not an easy problem, and it doesn't even have a satisfactory answer – but it is a fascinating problem for really talented and creative pupils.

1. Yes, they are all represented.

A	B	C	On diagram
✓	✓	✓	✓ (no.1)
✓	✓	✗	✓ (no.2)
✓	✗	✓	✓ (no.3)
✗	✓	✓	✓ (no.4)
✗	✗	✓	✓ (no.5)
✗	✓	✗	✓ (no.6)
✓	✗	✗	✓ (no.7)
✗	✗	✗	✓ (no.6)

2. The obvious extension does not work.



There are 14 regions here, but you need, in fact, 16 distinct regions for every combination to be represented: the two opposite are not included.

A	B	C	D
✗	✗	✓	✓
✓	✓	✗	✗

UNIT 1 *Logic* Extra Exercises 1.1

1. At a food shop three children each chose one packet of their favourite biscuits. Decide which child chose which type of biscuits.

   Clue 1: Hester chose biscuits with chocolate in them.

   Clue 2: Ravi does not like jam.

	Choc-Chip Cookies	*Jammy Dodgers*	*Custard Creams*
Hester			
Ravi			
Leanne			

2. Jai, James and Jill all have different pets. They have one pet each. Their pets are a hamster, a budgie and a dog.

   Use these clues to work out who owns which pet.

   Clue 1: Jill's pet has more legs than James' pet.

   Clue 2: Jai's pet is smaller than Jill's pet.

	Hamster	*Budgie*	*Dog*
Jai			
James			
Jill			

3. Rory, Halim, Alex and Tom each support a different football team. All the teams are listed in the table.

   Decide who supports which team.

   Rory's team's name does not include the word 'United'.

   Halim's team does not have an 'l' in its name.

   Alex's team's name contains the letter 's'.

   Tom's team's name contains the letter 'c'.

	Manchester United	*Newcastle United*	*Arsenal*	*Liverpool*
Rory				
Halim				
Alex				
Tom				

UNIT 1 *Logic* Extra Exercises 1.2

1. Paul gathered information on the cars in a car park, and recorded it in this table.

    (a) How many Ford Escorts were in the car park?

    (b) How many cars were in the car park?

    (c) How many red cars were in the car park?

    (d) How many of the cars in the car park were not red?

	Ford Escort	*Other Cars*
Red	12	18
Other colours	34	182

2. There were 500 people at a concert. There were 220 men and the rest were women. As they left the concert, 80 people said they had not enjoyed the concert. Of these people, 42 were men.

    (a) Copy and complete this table.

	Men	*Women*
Enjoy		
Did not enjoy		

    (b) How many men enjoyed the concert?

    (c) How many women did not enjoy the concert?

3. This table gives information about the numbers of children there are in Years 7, 8 and 9 of a school.

	Boys	*Girls*
Year 7	92	101
Year 8		96
Year 9	99	

    (a) Copy the table and use this information to fill in the empty boxes.

    - *There are 286 boys in Years 7, 8 and 9.*
    - *There are 571 pupils in Years 7, 8 and 9.*

    (b) How many pupils are there in Year 7?

    (c) How many girls are there in Years 7, 8 and 9?

    (d) In which year are there more boys than girls?

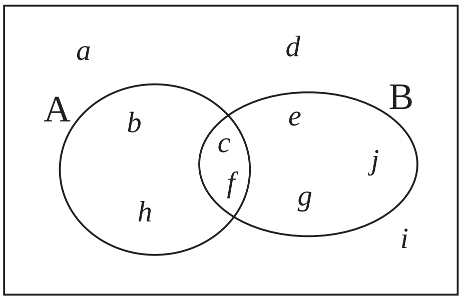
UNIT 1 *Logic* Extra Exercises 1.3

1. Draw a Venn diagram for the sets listed below:

$$A = \{7,\ 9,\ 11,\ 13\}$$
$$B = \{3,\ 5,\ 7,\ 9\}$$

Include all the whole numbers from 1 to 15 in your diagram.

2. This Venn diagram illustrates the sets A and B.



(a) Which letters are in set A?

(b) Which letters are in set B?

(c) Which letters are in set A , but not in set B?

(d) Which letters are not in set A or set B?

(e) Which letters are in both set A and set B?

3. The numbers 1 to 16 are sorted into sets:

A : Multiples of 4
B : Even numbers

(a) Which numbers are in A?

(b) Are there any numbers in A that are also in B?

(c) Draw a Venn diagram to show these two sets.

UNIT 1 *Logic* — Extra Exercises 1.4

1. If $\xi = \{21, 22, 23, 24, 25, 26, 27, 28, 29, 30\}$

   $A = \{21, 28\}$

   $B = \{21, 24, 27, 30\}$

   and $C = \{22, 24, 26, 28, 30\}$

   find:

   (a) $A \cap B$ (b) $A \cup B$

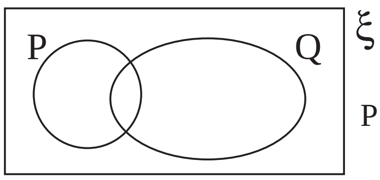
   (c) $A \cap C$ (d) $A \cup C$

   (e) $B \cap C$ (f) $B \cup C$

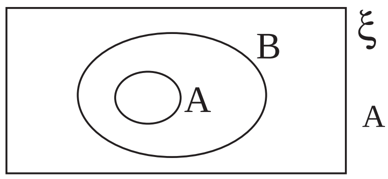
   (g) A' (h) B'

   (i) $A' \cap B'$ (j) $A' \cup B'$

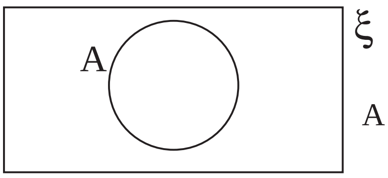
2. On a copy of each diagram, shade the region stated.

   (a)


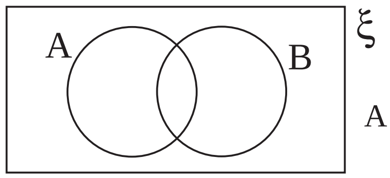
$P \cap Q$

   (b)


$A \cup B$

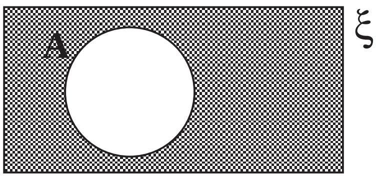
   (c)


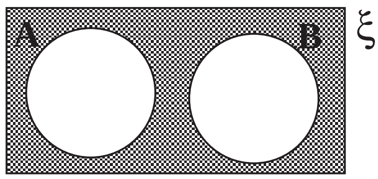
A'

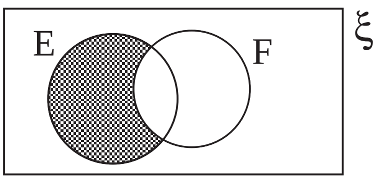
   (d)


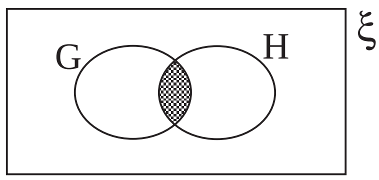
$A' \cup B$

3. Describe each of the shaded regions, using set notation.

   (a)


   (b)


   (c)


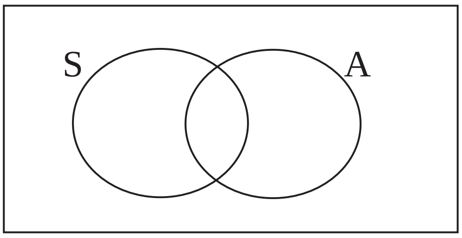
   (d)


UNIT 1 *Logic* Extra Exercises 1.5

1. In a class of 30 children there are 8 children who wear glasses. There are 17 boys in the class. If 5 boys wear glasses, how many girls do not wear glasses?

2. Claire and Laura have 20 CDs in their collection. One of them likes every CD. Claire likes 16 of the CDs and Laura likes 12 of them. How many do they both like?

3. At a school there is an art club (A) and a sports club (S). The diagram represents this.



Make 4 copies of the diagram.

Shade on different diagram the parts that represent:

(a) pupils who belong to both clubs,

(b) pupils who belong to only the art club;

(c) pupils who belong to only the sports club;

(d) pupils who do not belong to either club.

4. 40 teenagers belong to a youth club. They all play at least one of badminton, darts and pool.

8 teenagers play all three games.

10 teenagers play badminton and darts.

20 teenagers play darts and pool.

12 teenagers play pool and badminton.

30 teenagers play pool.

23 teenagers play darts.

(a) How many of the teenagers play *only* badminton?

(b) How many of the teenagers play badminton?

Extra Exercises 1.1 Answers

1.

	Choc-Chip Cookies	*Jammy Dodgers*	*Custard Creams*
Hester	✓	✗	✗
Ravi	✗	✗	✓
Leanne	✗	✓	✗

Hester : *Choc-Chip Cookies*
Ravi : *Custard Creams*
Leanne : *Jammy Dodgers*

2.

	Hamster	*Budgie*	*Dog*
Jai	✓	✗	✗
James	✗	✓	✗
Jill	✗	✗	✓

Jai : *Hamster*
James : *Budgie*
Jill : *Dog*

3.

	Manchester United	*Newcastle United*	*Arsenal*	*Liverpool*
Rory	✗	✗	✗	✓
Halim	✓	✗	✗	✗
Alex	✗	✗	✓	✗
Tom	✗	✓	✗	✗

Rory : *Liverpool*
Halim : *Manchester United*
Alex : *Arsenal*
Tom : *Newcastle United*

Extra Exercises 1.2 Answers

1. (a) 46 (b) 246 (c) 30 (d) 216

2. (a)

	Men	*Women*
Enjoy	178	242
Did not enjoy	42	38

(b) 178 men enjoyed the concert.

(c) 38 women did not enjoy the concert.

3. (a)

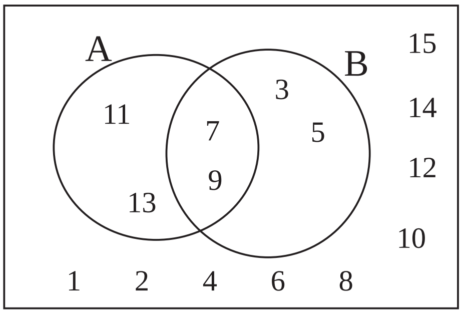
	Boys	*Girls*
Year 7	92	101
Year 8	95	96
Year 9	99	88

(b) 193 pupils in Year 7.

(c) 285 girls

(d) Year 9

Extra Exercises 1.3 Answers

1. 

2. (a) A = { b, c, f, h }

   (b) B = { c, e, f, g, j }

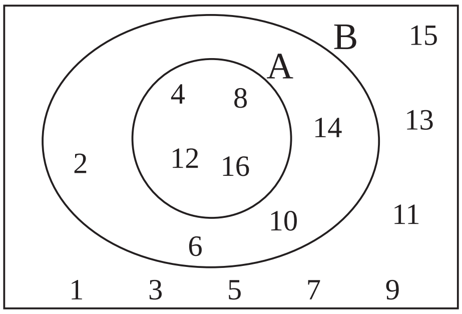
   (c) { b, h }

   (d) { a, d, i }

   (e) { c, f }

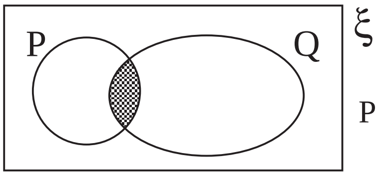
3. (a) A = { 4, 8, 12, 16 }

   (b) All of them are in B.

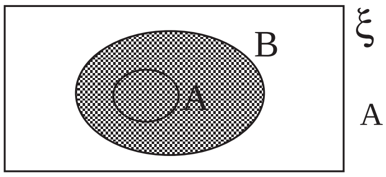
   (c) 

Extra Exercises 1.4 Answers

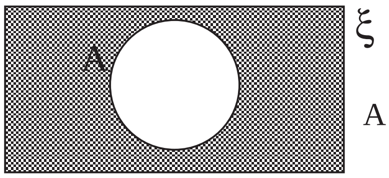
1. (a) $A \cap B = \{ 21 \}$
   (b) $A \cup B = \{ 21, 24, 27, 28, 30 \}$
   (c) $A \cap C = \{ 28 \}$
   (d) $A \cup C = \{ 21, 22, 24, 26, 28, 30 \}$
   (e) $B \cap C = \{ 24 \}$
   (f) $B \cup C = \{ 21, 22, 24, 26, 27, 28, 30 \}$
   (g) $A' = \{ 22, 23, 24, 25, 26, 27, 29, 30 \}$
   (h) $B' = \{ 22, 23, 25, 26, 28, 29 \}$
   (i) $A' \cap B' = \{22, 23, 25, 26, 29 \}$
   (j) $A' \cup B' = \{ 22, 23, 24, 25, 26, 27, 28, 29, 30 \}$

2. (a)


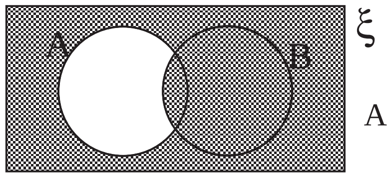
$P \cap Q$

(b)


$A \cup B$

(c)


A'

(d)


$A' \cup B$

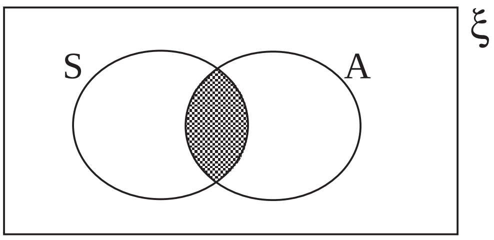
3. (a) A'
   (b) $A' \cap B'$
   (c) $E \cap F'$
   (d) $G \cap H$

Extra Exercises 1.5 Answers

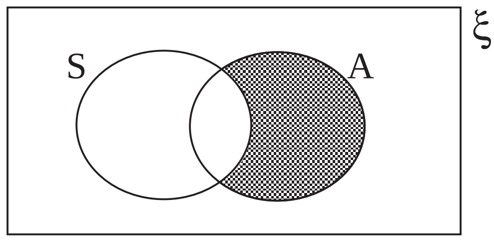
1. 10 girls do not wear glasses.

2. They both like 8 of the CDs.

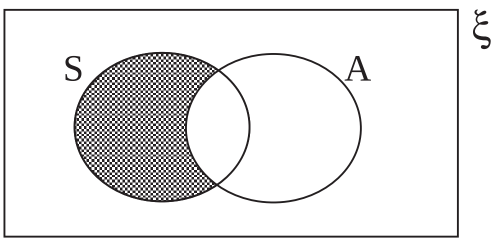
3. (a)



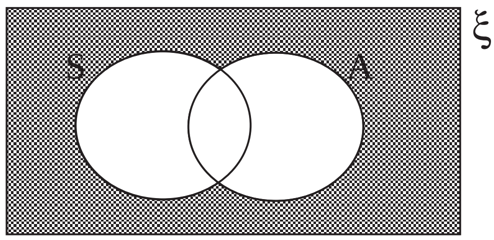
(b)



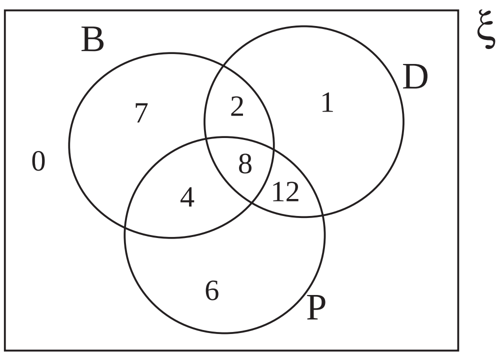
(c)



(d)



4.



(a) 7

(b) 21

UNIT 1 *Logic* Lesson Plans **St**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Logic Puzzles 1**	
	Introducing interactive example	OS 1.1
	Practice	PB 1.1, Q1
	Discuss solution to Q1	
	Practice	PB 1.1, Q2 and Q4
	Discuss solutions to Q2 and Q4	
	Set homework	PB 1.1, Q3 and Q6
2.	**Logic Puzzles 2**	
	Mental Practice – basic arithmetic	
	Discuss homework, particularly Q6	OS 1.3
	Practice	PB 1.1, Q7
	Discuss solution to Q7	
	Practice	PB 1.1, Q8 and Q9
	Discuss solutions and introduce Q10	
	Set homework	PB 1.1, Q10
3.	**Two Way Tables 1**	
	Discuss homework	
	Practical whole class activity	Activity 1.1
	Introductory worked example	OS 1.4
	Practice	PB 1.2, Q1
	Discuss solution to Q1	
	Practice	PB 1.2, Q3
	Discuss solution to Q3	
	Set homework	PB 1.2, Q4
4.	**Two Way Tables 2**	
	Mental Practice – basic arithmetic	
	Discuss homework	
	Practical activity	Activity 1.2
	Practice	PB 1.2, Q5
	Discuss solution to Q5	
	Practice	PB 1.2, Q8
	Set homework	PB 1.2, Q7

UNIT 1 *Logic* Lesson Plans **St**

Lesson No.	*Suggested Plan*	*References*
5.	**Sets and Venn Diagrams**	
	Mental Test	M1.1 (Standard)
	Discuss answers	
	Introduce sets and Venn diagrams	OS 1.7 and OS 1.8
	Activity	OS 1.9 (or Activity 1.3)
	Set homework	PB 1.3, Q3
6.	**Recap**	
	Discuss homework	
	Introduce union and intersection	OS 1.10
	Revision Test	RT 1.1 (Standard)
7.	**Revision**	
	Give back marked tests	
	Go over test questions	
	Revise topics	

UNIT 1 *Logic* Lesson Plans **A**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Logic Puzzles**	
	Introductory interactive example	OS 1.1
	Practice	PB 1.1, Q1
	Discuss solution to Q1	
	Practice	PB 1.1, Q3 or Q6
	Discuss solutions	
	Set homework	PB 1.1, Q2 and Q10
2.	**Two Way Tables 1**	
	Discuss homework	
	Practical whole class activity	Activity 1.1
	Introductory worked example	OS 1.4
	Practice	PB 1.2, Q1
	Discuss solution to Q1	
	Practice	PB 1.2, Q3
	Discuss solution to Q3	
	Set homework	PB 1.2, Q4
3.	**Two Way Tables 2**	
	Mental practice – basic arithmetic	
	Discuss homework	
	Practical activity	Activity 1.2
	Practice	PB 1.2, Q5
	Discuss solution to Q5	
	Practice	PB 1.2, Q8
	Set homework	PB 1.2, Q7
4.	**Sets and Venn Diagrams 1**	
	Mental practice – basic arithmetic	
	Discuss homework	
	Introduce sets and Venn diagrams (including union and intersection)	OS 1.7, OS 1.8 and OS 1.10
	Class activity	Activity 1.3
	Practice	PB 1.3, Q2
	Discuss solution to Q2	
	Set homework	PB 1.3, Q3 and Q5

UNIT 1 *Logic* Lesson Plans **A**

Lesson No.	*Suggested Plan*	*References*
5.	**Sets and Venn Diagrams 2**	
	Discuss homework	
	Mental Test	M1.2 (Academic)
	Activity	Activity 1.4
	Practice	PB 1.3, Q7
	Discuss solution to Q7	
	Set homework	PB 1.3, Q8 and Q10
6.	**Recap**	
	Discuss homework	
	Revision Test	RT 1.2 (Academic)
7.	**Revision**	
	Give back marked tests	
	Give out test questions	
	Revise topics	

UNIT 1 *Logic* Lesson Plans **E**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Logic Puzzles**	
	Introductory interactive example	OS 1.1
	Practice	PB 1.1, Q1
	Discuss solution to Q1	
	Practice	PB 1.1, Q3 or Q6
	Discuss solutions	
	Set homework	PB 1.1, Q2 and Q10
2.	**Two Way Tables**	
	Discuss homework	
	Practical activity	Activity 1.2
	Introductory worked example	OS 1.4
	Practice	PB 1.2, Q5
	Discuss solution to Q5	
	Practice	PB 1.2, Q8
	Discuss solution to Q8	
	Set homework	PB 1.2, Q4 and Q7
3.	**Sets and Venn Diagrams 1**	
	Mental practice – basic arithmetic	
	Discuss homework	
	Introduce sets and Venn diagrams (including union and intersection)	OS 1.7, OS 1.8 and OS 1.10
	Class activity	Activity 1.3
	Practice	PB 1.3, Q2
	Discuss solution to Q2	
	Set homework	PB 1.3, Q3 and Q5
4.	**Sets and Venn Diagrams 2**	
	Discuss homework	
	Mental Test	M1.2 (Academic)
	Activity	Activity 1.4
	Practice	PB 1.3, Q7
	Discuss solution to Q7	
	Set homework	PB 1.3, Q8 and Q10

UNIT 1 *Logic* Lesson Plans **E**

Lesson No.	*Suggested Plan*	*References*
5.	**Set Notation** ***(Optional)***	
	Introduction (interactive)	OS 1.12 and OS 1.13
	Practice	PB 1.4, Q2
	Discuss solution to Q2	
	Identifying regions in Venn diagrams	OS 1.14 and OS 1.15
	Practice	PB 1.4, Q8
	Discuss solution to Q8	
	Practice	PB 1.4, Q9
	Discuss solution to Q9	
	Set homework	PB 1.4, Q9 and Q10
6.	**Logic Problems and Venn Diagrams**	
	Introductory interactive activity	OS 1.16
	Practice	PB 1.5, Q3
	Discuss solution to Q3	
	Mental Test	M1.3 (Express)
	Activity	Activity 1.5
	Discuss solutions	
	Set homework	PB 1.5, Q9 or Activity 1.6
7.	**Recap**	
	Discuss homework	
	Revision Test	RT 1.3 (Express)
8.	**Revision**	
	Give back marked tests	
	Give out test questions	
	Revise topics	

Y7	**UNIT 1: *Logic*** Lesson Plan 1	*Logic Puzzles*
Number	***Activity***	***Notes***
1	**Introduction** T: Introduce Y7 course and Practice Books. T: How much mathematics have you remembered? T: The foundations of mathematics depend on logic. So we start with some simple problems. M 1.1 Q1 Q2 Q3 Q4 *5 mins*	Let Ps give examples, at speed, get as many as possible to respond. Whole class activity, question by question; get Ps to explain answers and their method (particularly Qs 3 and 4)
2	**Logic tables** T: Now we will tackle more complex problems. OS 1.1 (or prepared on BB). T: We need a logic table to help solve this problem. What should the rows and columns contain? How do we mark 'true' / 'not true'? T: What can we fill in? What can we be sure about? *15 mins*	Initially keep logic table covered up. Ask Ps if they have understood problem and how to solve it. Ps suggest √ and X. T gives hints if needed, e.g. which numbers out of the 3 are in 4 times table and which are not?
3	**PB 1.1, Q1** T: You have 5 minutes to solve this problem. T: Who would like to show their solution? Explain your answers! T: Check your solution, and if necessary, correct it. *22 mins*	Each P has copy of blank logic table, OS 1.18, to work on. Keep to time limit; check P's working and help individuals who are having problems starting. P works on OS 1.18 on OHP. Agreement/disagreement. Praising correct solution.
4	**PB 1.2, Q2 (or Q6 if no problems with Q1)** T: Answer this one in your Ex.B. T: Stop now and we will review answers. (Also review Q6 if stronger Ps have completed this.) *37 mins*	Encourage Ps to work in pairs if they need help; T monitoring work, helping slower Ps. Ps give answers on OHP. Class check each answer. Agreement/feedback/self-correction. Praising.

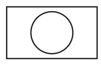
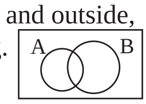
Y7	**UNIT 1: *Logic*** Lesson Plan 1	*Logic Puzzles*
Number	***Activity***	***Notes***
5	**PB 1.1, Q4** T: Finally, we have a more difficult problem, where the answer is not obvious at first sight. T gives hints, e.g. Can Charlie be the oldest boy? So, what can we put and where? What else does Clue 1 tell us? *45 mins*	Whole class activity, but first Ps read Q. Table drawn on BB or OHP. Ps work in Ex.B. Discussion; agreement. T and Ps put √ and X in their own tables.
6	**Set homework** PB 1.1, Q3, Q7 and Q10	

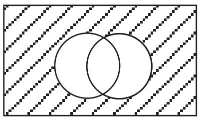
<table>
<tr><td>Y7</td><td>UNIT 1: Logic Lesson Plan 2</td><td>Two-Way Tables</td></tr>
<tr><td>Number</td><td>Activity</td><td>Notes</td></tr>
<tr><td>1</td><td>Checking homework
T: Check your answers to Q3 and Q7.
T: Who got them both correct? Who didn't?
What was the problem?
T: It is impossible to check all solution to Q10, but we will try one ...
Who would like to give their clues?
8 mins</td><td>T has prepared OS or BB with solutions to Q3 and Q7.
Encourage Ps to discuss any problems.
P reads out their clues, and other Ps say where to put √ or X in logic table.
Agreement, correction. Praising.</td></tr>
<tr><td>2</td><td>Activity 1.1
T: Before we make our brains work, we will make our bodies work!
T: Ps with no sisters or brothers, go to the front; others go to the back.
T: Now boys go to the right; girls to the left.
Similar for parts 2 and 3 of Activity.
For Part 3
T: What is the total number now?
Is it equal to the total number of Ps in class?
If not, why not?
18 mins</td><td>You need sufficient space for this activity (you could use the four corners of the classroom).
When in place, T puts the result on BB or OHP.
After each formation, Ps dicuss what is in each part of the formation, and add up total number of Ps in each cell, and the total.
Ps give ideas; establish that the categories have to be opposite to include all Ps.</td></tr>
<tr><td>3</td><td>PB 1.2, Q1
T: Read this question carefully and answer in your Ex.B.
You have 3 minutes for this!
T: We will check answers.
24 mins</td><td>T monitoring work, checking progress.
Ps give answers in turn. T writes them on BB. Checking, feed-back, self-correction. Praising.</td></tr>
<tr><td>4</td><td>Revision
T: It's time to see what you have remembered from your numerical work in Primary School.
T: (for example) 3 + 5   5 + 3   7 + 12   14 + 9
20 + 50   23 + 32   42 + 39   39 + 42
8 − 3   15 − 8   3 − 2   2 − 3
26 − 7   50 − 20   42 − 23   82 − 38
3 × 2   …
T: Now in Ex.Bs – try to find a quick method:
36 + 48 + 64   43 + 132 + 56   237 − 189
3 × 2   …
T: (after 2 minutes): We will review answers.
33 mins</td><td>At speed, around class by name (encourage strugglers with easier tasks).
For review of answers, encourage Ps to work on BB or OHP. Discuss methods such as
$36 + 48 + 64 = (36 + 64) + 48$
$= 100 + 48$
$= 148$
$237 - 189 = 37 + (200 - 189)$
$= 37 + 11 = 48$</td></tr>
</table>

Y7	**UNIT 1: *Logic*** Lesson Plan 2	*Two-Way Tables*
Number	***Activity***	***Notes***
5	**Incomplete tables** T: Now we will see how to complete tables that are incomplete. **PB 1.2, Q5** T: Read the first part of the question. What data do we know apart from that in the table? Does every P have a place in this table? Why? How do we complete the table? What is the total? (436) What do we do now? T: Fine; but how can we answer part (a)? ((b), (c))	Whole class activity. Ps count in PB and record answer in Ex.B. Let Ps answer in chorus. Ps offer reasons. Ps give numbers to be added; T on BB. P demonstrates on BB $(484 - 436 = 48)$ Class helps with subtraction; Ps put calculation in Ex.B. Discussion; praising. Ps volunteer answers; agreement. Praising.
	39 mins	
6	**Filling in logic table** T: Now we can try to fill in a complete table. **PB 1.2, Q6** T: Who can fill in one of the boxes? T: What information do we start with? Why?	Whole class activity. Put empty table on BB or OHP. Ps volunteer and fill in table, giving reasons. Agreement, discussion. Ps copy table into Ex.B. Praising.
	45 mins	
7	**Set homework** PB 1.2, Q4 and Q7 (and Q9 for stronger Ps) Also, find out some facts about John Venn, e.g. who he was, when and where he lived, why he is famous.	Encourage use of library and/or internet for information.

Y7 UNIT 1: *Logic* — Lesson Plan 3

Sets and Venn Diagrams

Number	*Activity*	*Notes*
1	**Checking homework** **PB 1.2, Q4** T: Who was successful? Who was not? What was your mistake?	T points to Ps to give answers (and reasons). Praise. Agreement, feedback, self-correction. Praise.
	Similar for PB 1.2, Q7, PB 1.2, Q9 (stronger pupils) T: Who tried this question?	P volunteer gives solutions on BB or OHP. Class follows; agreement ment, feedback, self-correction. Praise.
	T: We will discuss the information about John Venn later in the lesson.	
	8 mins	
2	**Illustrating sets** T: This is another aspect of logic. First, though, we must make a large space for everyone to stand in (or all move to the hall!).	This is based on Activity 1.3, but here we use it for introducing sets and Venn diagrams.
	T: *On BB* Set A = {pupils with brown eyes}	
	T: All Ps in set A come into the circle.	T draws circle around the group (or use rope, etc.). Volunteer P draws similar shape on BB.
	T: Who are in the circle? (Ps with brown eyes.)	P puts answer inside circle on BB.
	T: Who are outside the circle? (Ps whose eyes are not brown.)	Some Ps might say "blue eyes" or "green eyes", but "not brown eyes" is required. P puts answer outside circle on BB and completes with another circle or rectangle, e.g. 
	New example: T: *On BB* Set B = {boys} T: Ps in set B move into the circle. T: Who is in the circle? (boys) T: Who is on the outside? (not boys)	Volunteer P draws circle and rectangle on BB and writes in answers.
	Another example: Set A = {pupils with brown eyes} Set B = {pupils wearing glasses}	This time T arranges two overlapping circles and outside, e.g.  on floor (and P on BB).
	T: Who are inside A but not inside B? (Ps with brown eyes but no glasses) T: Who are inside B but not inside A? (Ps with glasses but not brown eyes) T: Who are in both sets? (Ps with brown eyes and glasses) T: Now move to your places.	Ps move in appropriate position and T checks that they are correct!
	20 mins	

Y7	UNIT 1: *Logic* Lesson Plan 3	*Sets and Venn Diagrams*
Number	***Activity***	***Notes***
3	**James Venn** T: What have you found out about James Venn? *26 mins*	Ps write information on BB. Discussion. Praising.
4	**Using Venn diagrams: OS 1.7** (on OHP or drawn on BB) T: Where can we put any of the numbers? *(T could introduce names, i.e. intersection, union, complement)* *32 mins*	Whole class activity. Ps come to OHP/BB to put a number in the appropriate place. Discussion (other numbers?) Praising.
5	**Intersection and union: OS 1.10** T: What are the members of set Y and set X ? Describe the sets X (and Y) in words. T: Now we will complete the sheet. Put (a)? etc. *37 mins*	Whole class activity. Each P has copy of OS 1.10 to work on. P gives answers to class. Ps give answers and complete worksheets. T writes answers on OHP. Agreement. Praising.
6	**PB 1.3, Q2** T: Read the question carefully and answer in your Ex.B. T: Set A ? Set B ? Part (b) T: Also, what is the intersection of A and B? (2, 8) T: What is the complement of the union of A and B? (7, 9) *45 mins*	Individual work; monitored; help given. After a few minutes, start checking. P writes on BB. Checking. Praising. P offer answers; agreement. Praising. Help Ps with the meaning of this, e.g.  Agreement. Praising.
7	**Set homework** PB 1.3, Q3, and Q5 with added questions for stronger Ps: (e) What is the intersection of S and E ? (f) What is the complement of E ? (g) What is the complement of the union of S and E ?	

Y7	**UNIT 1: *Logic*** Lesson Plan 4	*Sets and Venn Diagrams: Notation*
Number	***Activity***	***Notes***
1	**Checking homework** **PB 1.3, Q3** T: What have you noticed here? (every element in B is also in A) T: Could we use the Venn diagram in PB 1.3, Q2 for this task? What is the intersection of A and B? {4, 8, 12} What is the union? {4, 8, 12, 2, 6, 10} Hence? (you can use the usual notation) **PB 1.3, Q5** (a) E = {2, 4, 6, 8, 10, 12, 14, 16, 18, 20} (b) S = {1, 4, 9, 16} (c) E = {even numbers} and S = {square numbers } (d) Union of E and S = {1, 2, 4, 6, 8, 9, 10, 12, 14, 16, 18, 20} (e) Intersection of E and S = {4, 16} (f) Complement of E = {1, 3, 5, 7, 9, 11, 13, 15, 17, 19} (g) Complement of the union of E and S = {3, 5, 7, 11, 13, 15, 17, 19} *8 mins*	T asks, Ps give answers. Agreement, feedback, self-correction. Praising. T discusses this special case with Ps. T introduces the concept of subset. T prepares OS with solution or on BB, as shown opposite. Feedback, self-correction. Praising.
2	**Simplifying notation** T: Gosh; writing out all these names is exhausting! We need a shorter method. Can anyone suggest what we could do? **OS 1.12** *(big sigh from T!)* T: We will use the notation here to revise my solutions to PB 1.3, Q5. T: What is the empty set? T: Name something that does not exist. T: How about "the pink dogs sitting under my table"? *18 mins*	Try to lead Ps to the concept of notation for intersection, union and complement. Ps help to rewrite solutions on BB (with OS 1.12 on OHP). Discussion, brainstorming (work in pairs to name things that do not exist).
3	**Using set notation OS 1.13** T: Look at this problem. We will answer parts (a) to (e). *23 mins*	Whole class activity. P volunteers to put answers on OHP (and state reasons). Agreement. Praising.

Y7	**UNIT 1: *Logic*** Lesson Plan 4	*Sets and Venn Diagrams: Notation*
Number	***Activity***	***Notes***
4	**Practising 1** T: Look at PB 1.3, Q4 and add (c) $P \cup Q$ (d) Q' T: Who would like to draw Venn diagram on the BB? T: Who can answer the questions? *29 mins*	Whole class activity. P read tasks from PB. P draws Venn diagram (if P does not use best possible figure, still use it, unless other Ps suggest changing it, but comment on it at the end). Ps give answers and T writes on BB. Agreement. Praising.
5	**Practising 2** T: PB 1.3, Q7, but rewritten as (a) the same (b) $R \cap Q = ?$ (c) $R \cup Q = ?$ (d) $Q' = ?$ (e) $(R \cup Q)' = ?$ (f) $Q' \cap R = ?$ T: We will check answers. Draw Q to I in Venn diagram on BB. *39 mins*	Individual work. Use prepared BB or OH slides or on sheet of paper. Ps answer in Ex.B. Ps draw one shape each in Venn diagram on BB or OHP. Parts (b) to (d) should be OK, but stronger pupils to do parts (e) and (f) and explain answers. Agreement, feedback, self-correction. Praising.
6	**Logic problems OS 1.16** T: Here is a more difficult problem. T: Can we start by writing 13 and 19 into H and F ? (no) Why not? What *can* we start with? *45 mins*	Whole class activity. Interactive discussion along the lines of the solution given on p19/20 in PB 7A. T leads Ps to find out how many more is $7 + 13 + 19$ than the total. Praising.
7	**Set homework** PB 1.4, Q2 (a) to (e) and PB 1.5, Q6	

Y7	**UNIT 1: *Logic*** Lesson Plan 5	*Solving Logic Problems with Venn Diagrams*
Number	***Activity***	***Notes***
1	**Check homework** **PB 1.4, Q2 (a) to (e)** T: Do you agree with the answers? **PB 1.5, Q6** T: What is the final answer? (3) T: Who was successful? *6 mins*	(Note that if you have missed out Lesson Plan 5, you need to refer to the start of Lesson Plan 5 for correct review.) T has already asked P to write up answers as soon as P arrives. Checking, discussion. Agreement, feedback, self-correction. Praising. T asks P who was not successful to draw Venn diagram on BB and explain their solution. Other Ps help to correct solution. Self-correction. Praising.
2	**Practice** Tasks (given out by T): 1. MT 1.2, Q1 2. Extra Exercises 1.1, Q3 3. MT 1.2, Q2 4. MT 1.2 Q3 with (c) what is the intersection of B and complement of A ? (d) use set notation to describe these regions of the Venn diagram. 5. PB 1.5, Q4 6. PB 1.4, Q4 (b), (e) and (f) *36 mins*	Individual work for the remainder of the lesson. T to complete worksheet as shown opposite. Ps work in Ex.B at their own pace. If they finish one task, they move on to the next one. T monitors progress and helps when needed.
3	**Checking answers** T: Who can list set A? ($A = \{ 2, 4, 6, 8, 10 \}$) T: Is that correct? Who agrees? T: What is the intersection of A and B ? (6) T: How can we mark this region on the Venn diagram? *45 mins*	T has OH slides prepared with answers and used when needed, e.g. M 1.2, Q3 Interactively, particularly tasks 5 and 6, which some Ps will not have reached. T uncovers solutions on OHP as they are dealt with.
4	**Set homework** PB 1.1, Q5 PB 1.2, Q10 PB 1.3, Q6 and list sets $O,\ M,\ O \cap M,\ M',\ (O \cup M)',\ O' \cap M$	

Y7	**UNIT 1: *Logic*** Lesson Plan 6	*Recap*
Number	***Activity***	***Notes***
1	**Check homework** **PB 1.1, Q5** **PB 1.2, Q10** **PB 1.3, Q6** For each task, T: Who was successful? T: Who was not? T: What were the problems? *10 mins*	T prepares OH slide with answers on it. At start, T puts slide on and Ps check answers in their Ex.Bs. T shows answers question by question. T concentrates on any misconceptions.
2	**Test: RT 1.2** (answers given in but pupils keep a copy) *45 mins*	T gives out copies of RT 1.2, and Ps work on copies or in special test book. Stronger Ps, who finish early, can continue with extra tasks (e.g. activity 1.5).
3	**Set homework** Study copy of answers for RT 1.2 and try to find mistakes. Stronger Ps continue with extra work.	

Y7	***Logic*** *Revision* Lesson Plan 7	*UNIT 1*
Number	***Activity***	***Notes***
1	**Revision** T and Ps go over test questions. e.g. **Question 1** T: Who did *not* get the correct answer? Who found their mistake at home? T: OK, come to BB and explain where your mistake was *(T draws logic table on BB).* T: First clue was: "Ben's yo-yo was not green." What did you do? P: *This was clear; I put X in Ben's row in the third column (P does this on BB).* T: OK! The second clue is: "Tom's yo-yo is not red or green." What did you do now? P: *I was confused. I thought it meant:* *"Tom's yo-yo is not red but green."* *and so I put a X in the first column of Tom's row and a √ in the third row.* T: What did you do next? P: *As there was no contradiction, I completed the table, answered the question but did not notice my fault.* T: And what is the correct solution? etc.	Between lessons 6 and 7, T must mark the test, and bring corrected test papers to give back to Ps. T chooses P who has discovered their mistake at home so that they can explain how they noticed it. This P writes on BB, explaining mistake and correcting it. If no such Ps, T asks one of the Ps who got it wrong to work at BB and, with help, correct their mistake. If every P was successful, T praises the class, and goes over the test quickly. P gives correct solution on BB. In this way, Ps find the solution to each question, learn from mistakes (their own and others) and revise Unit 1; covering • how to solve logic problems • how to use 2-way tables • when to use sets • how to use sets to solve problems.

UNIT 1 Logic Mental Tests

M 1.1 Standard Route *(no calculator)*

1. Tom is 4 years older than Mark. Mark is 10 years old.
   How old is Tom? (14)

2. Two children in a family are aged 10 and 12. Alan is older than Kate.
   How old is Alan? (12)

3. In a swimming race, Jane finished before Kim; Pam finished before Jane.
   (a) Who finished first? (Pam)
   (b) Who finished last? (Kim)

4. Sue is 1 year older than Rachel and 2 years younger than Jane.
   Jane is 9 years old.
   (a) How old is Sue? (7)
   (b) How old is Rachel? (6)

5. In a class of 30 boys and girls, there are 6 pupils who are left-handed
   4 of whom are girls. There are 10 right-handed boys.
   How many:
   (a) boys are left-handed, (2)
   (b) boys are there in total, (12)
   (c) girls are there in total? (18)

6. From the whole numbers { 1, 2, 3, . . . , 10 }, the set A is defined as the
   set of even numbers, and B is defined as the set of number divisible by 3.
   What number (or numbers) is common to both sets? (6)

UNIT 1 Logic Mental Tests

M 1.2 Academic Route *(no calculator)*

1. Sue is 1 year older than Rachel and 2 years younger than Jane.
   Jane is 9 years old.
   (a) How old is Sue? (7)
   (b) How old is Rachel? (6)

2. In a class of 30 boys and girls, there are 6 pupils who are left-handed 4 of whom are girls. There are 10 right-handed boys.
   How many:
   (a) boys are left-handed, (2)
   (b) boys are there in total, (12)
   (c) girls are there in total, (18)
   (d) girls are right-handed? (14)

3. From the whole numbers { 1, 2, 3, . . . , 10 }, the set A is defined as the set of even numbers, and B is defined as the set of number divisible by 3.
   (a) What is the intersection of A and B? (6)
   (b) What numbers are not in the union of A and B? { 1, 5, 7 }

4. From the whole numbers { 1, 2, 3, . . . , 20 }, the set A is defined as the set of numbers divisible by 3, and B is defined as the set of numbers divisible by 5.
   (a) What is the intersection of A and B? { 15 }
   (b) What is the intersection of B and the complement of A? { 5, 10, 20 }

UNIT 1 Logic Mental Tests

M 1.3 Express Route *(no calculator)*

1. In a class of 30 boys and girls, there are 6 pupils who are left-handed 4 of whom are girls. There are 10 right-handed boys.
   How many:
   (a) boys are left-handed, (2)
   (b) boys are there in total, (12)
   (c) girls are there in total, (18)
   (d) girls are right-handed? (14)

2. From the whole numbers { 1, 2, 3, . . . , 10 }, the set A is defined as the set of even numbers, and B is defined as the set of number divisible by 3.
   (a) What is the intersection of A and B? (6)
   (b) What numbers are not in the union of A and B? { 1, 5, 7 }

3. From the whole numbers { 1, 2, 3, . . . , 20 }, the set A is defined as the set of numbers divisible by 3, and B is defined as the set of numbers divisible by 5.
   (a) What is the intersection of A and B? { 15 }
   (b) What is the intersection of B and the complement of A? { 5, 10, 15, 20 }

4. From the whole numbers { 1, 2, 3, . . . , 15 }, the set A is defined as the set of numbers with two digits, and B is defined as the set of numbers divisible by 3 or 4.
   (a) What is the complement of the union of A and B? { 1, 2, 5, 7 }
   (b) What is the intersection of A with the complement of B? { 10, 11, 13, 14 }

UNIT 1 *Logic* Overhead Slides

Overhead Slides

OS 1.1 3×3 *Logic Puzzle 1*

Rana, Toni and Millie are sisters. You need to deduce which sister is 9 years old, which one is 12 and which one is 14.

You have two clues:

Clue 1 : *Toni's age is not in the 4-times table.*

Clue 2 : *Millie's age can be divided exactly by the number of days in a week.*

Use the logic table to solve this problem.

OS 1.2 3×3 *Logic Puzzle 2*

Rachel, Emma and Hannah are sisters.
Their ages are 2 years, 7 years and 10 years.

Clue 1 Emma is older than Hannah.

Clue 2 Emma's age is a prime number.

Use the logic grid below to solve the problem

OS 1.3 4×4 *Logic Puzzle*

In Bakers Row there are 4 houses, each numbered 1, 2, 3 or 4.

The following people live in Bakers Row, one in each house:

Ted, Alice, Ernie and Gita

Use these clues to find out who lives in which house, using the logic table below.

Clue 1 The number of Ted's house is an *even* number.

Clue 2 The number of Ernie's house is an *odd* number.

Clue 3 The number of Alice's house is greater than the number of Ted's house.

Clue 4 The number of Gita's house is less than the number of Ernie's house.

OS 1.4 *Two Way Tables 1*

Emma collected information about the cats and dogs that children in her class have. She filled in the table below, but missed out one number.

	Has a dog	*Does not have a dog*
Has a cat	8	4
Does not have a cat	12	

(a) If there are 30 children in Emma's class, what is the missing number?

(b) How many children own at least one of these pets?

(c) Do more children own cats rather than dogs?

(d) Could it be true that some of the children do not have any pets?

OS 1.5 *Two Way Tables 2*

The table below gives information about the children in a class.

	Left-handed	*Right-handed*
Boys	3	14
Girls	2	13

(a) How many right-handed girls are there in the class?

(b) How many left-handed boys are there in the class?

(c) How many girls are there in the class?

(d) How many of the children are left-handed?

(e) How many children there are in the class?

OS 1.6 *Constructing Two Way Tables*

In Ben's class there are 12 girls and 18 boys.

There are 6 children who bring packed lunches and the rest eat school lunches.

Ben and Adam are the only boys who bring packed lunches.

(a) How many children are there in the class?

(b) How many girls eat school lunches?

	Boys	*Girls*	
Packed lunch			
School lunch			

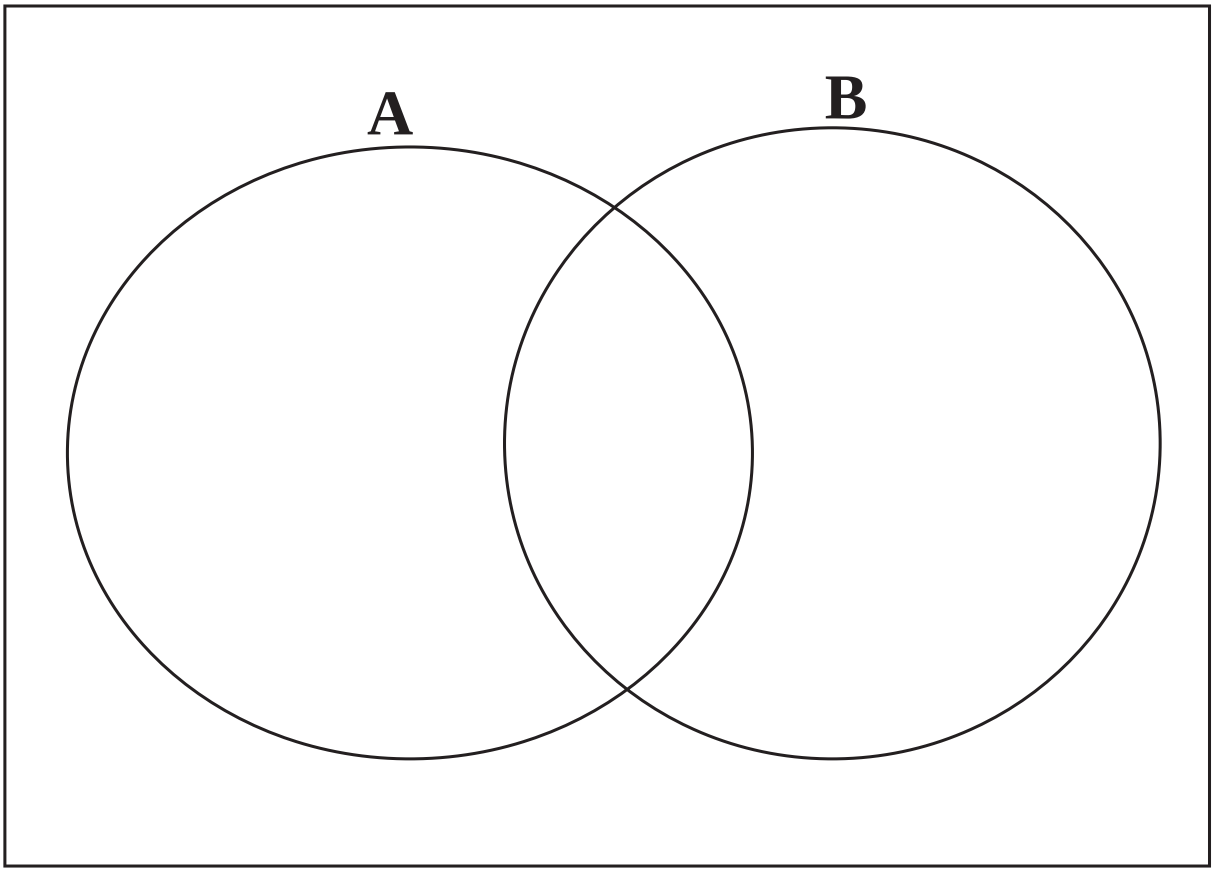
OS 1.7 *Illustrating Sets*

The sets A and B consist of numbers taken from the whole numbers 0, 1, 2, 3, . . . , 9, so that

Set A = { 4, 7, 9 }

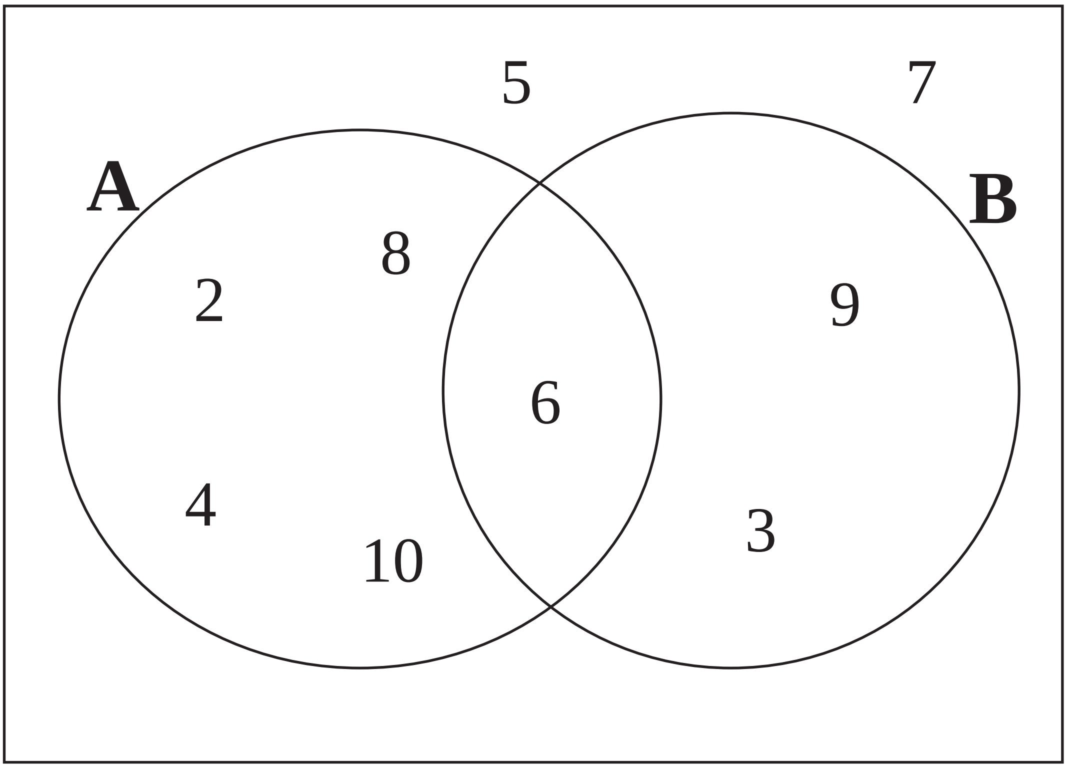
Set B = { 1, 2, 3, 4, 5 }

Illustrate these sets in a Venn diagram.



OS 1.8 *Identifying Sets*

The whole numbers from 1 to 10 are placed in a Venn diagram.



(a) Write down the members of the sets.

A = { . . . . }

B = { . . . . }

(b) Describe the sets A and B in words.

OS 1.9 *Identifying and Illustrating Sets*

Set A contains the whole numbers greater than 6 but less than 12.

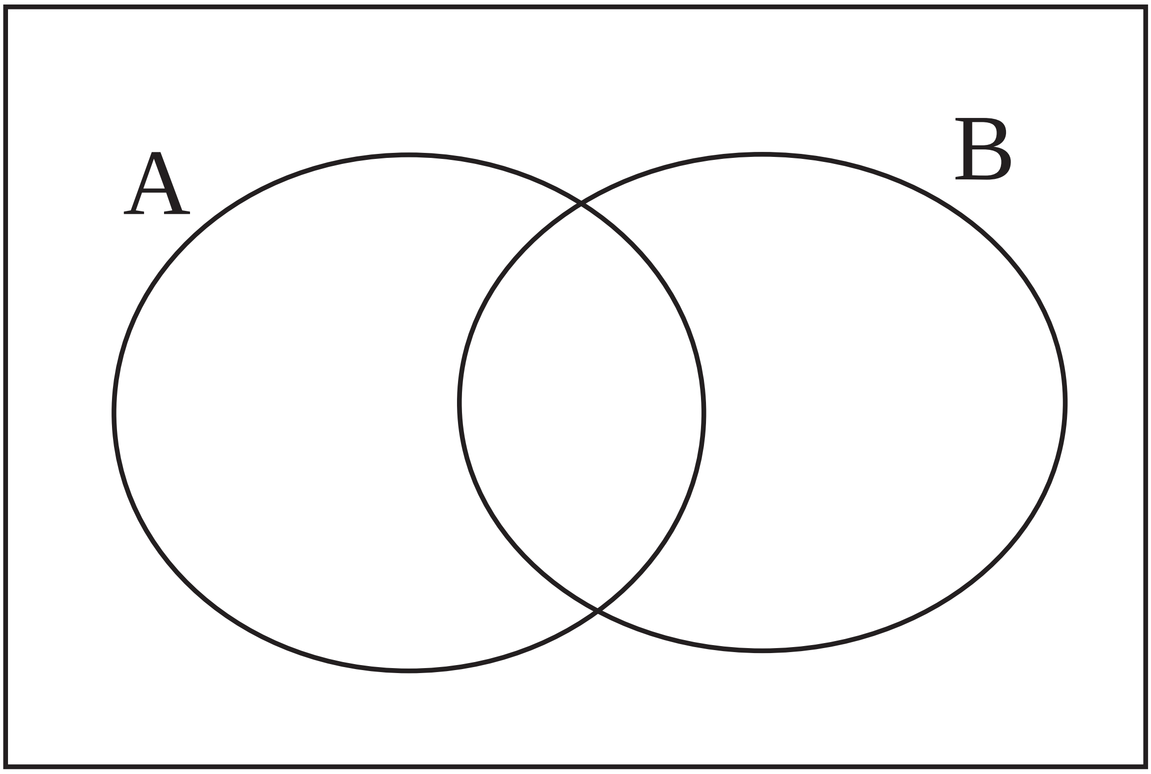
Set B contains the whole numbers greater than 2 but less than 10.

(a) List set A and set B.

A = { . . . . }

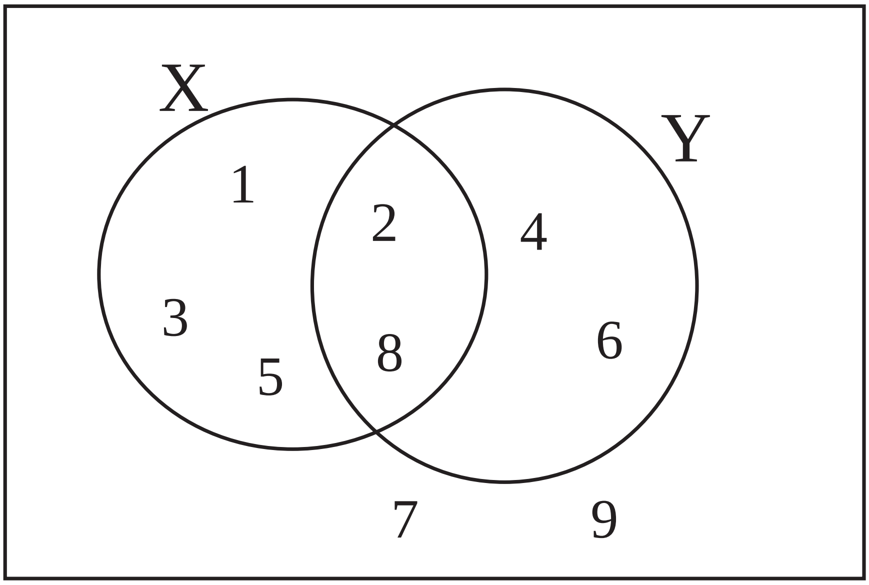
B = { . . . . }

(b) Illustrate the sets A and B on the Venn diagram below, including all the whole numbers from 1 to 15.



OS 1.10 *Intersection and Union*

The sets X and Y are shown in this Venn diagram.



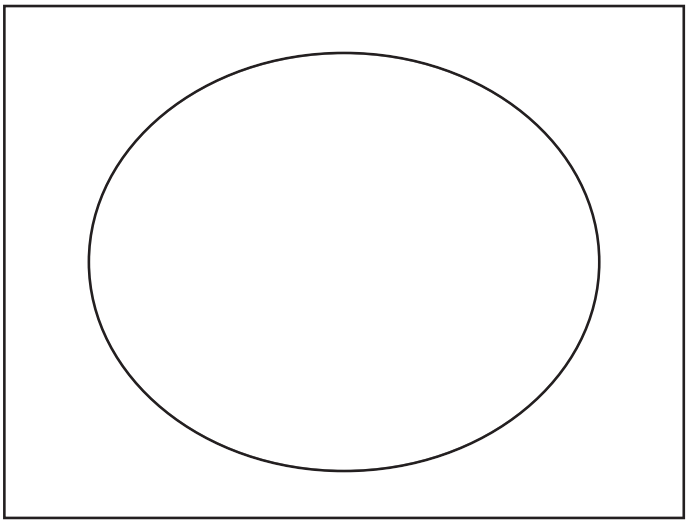
Find:

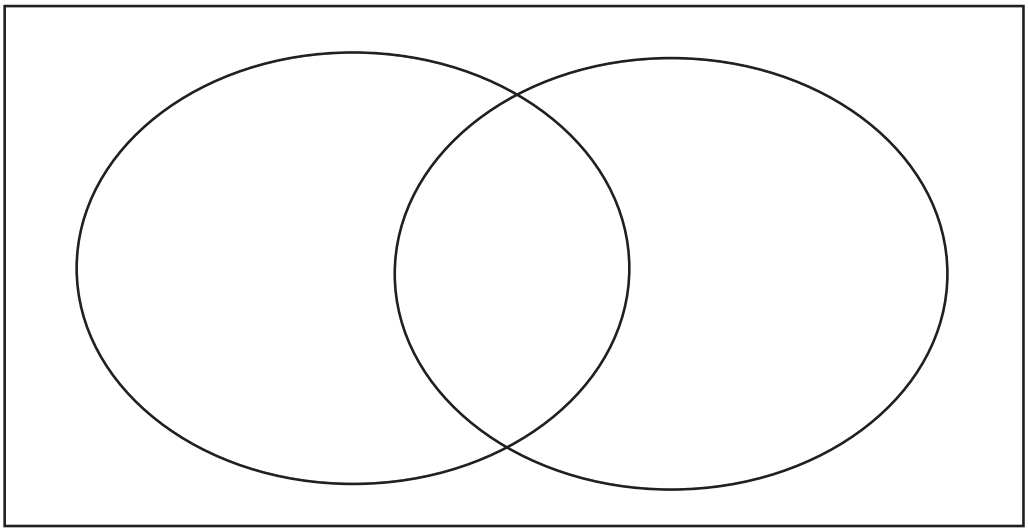
(a) the intersection of X and Y : { . . .. }

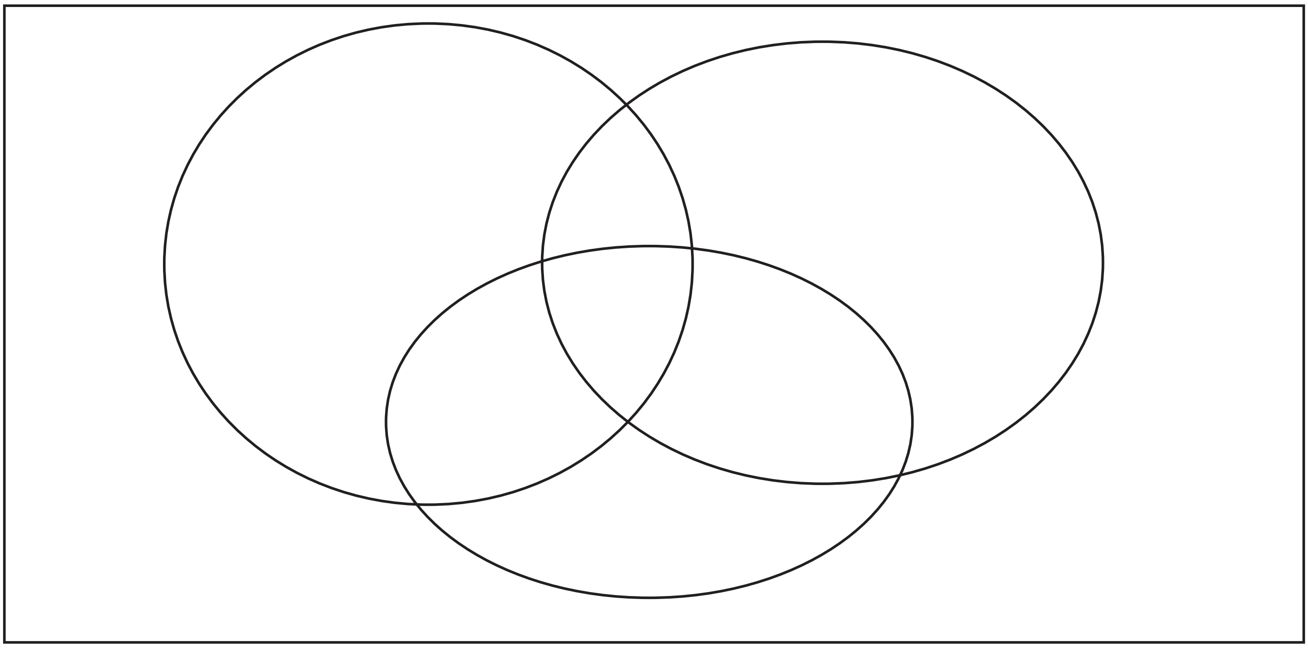
(b) the union of X and Y ; { . . . . }

(c) the complement of X : { . . . . }

OS 1.11 *Sets and Venn Diagrams*

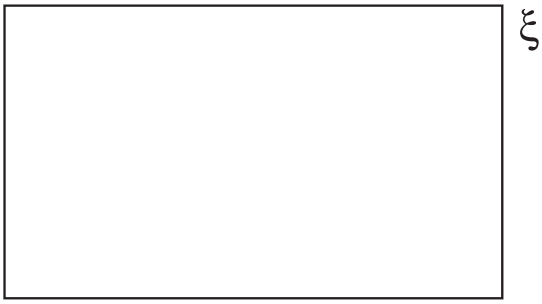




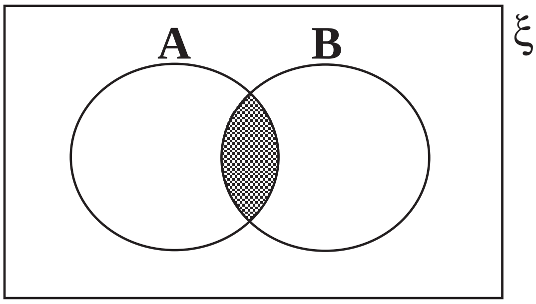


OS 1.12 *Definitions*

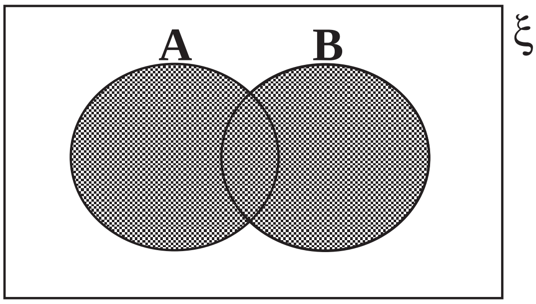
ξ : *universal set*



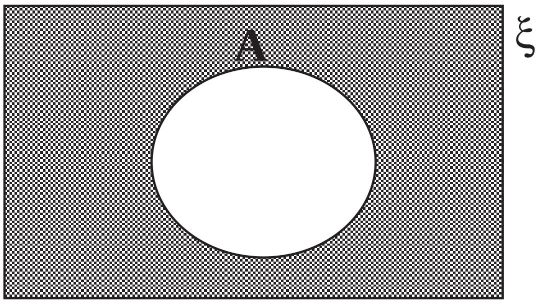
$A \cap B$: the *intersection* of A and B



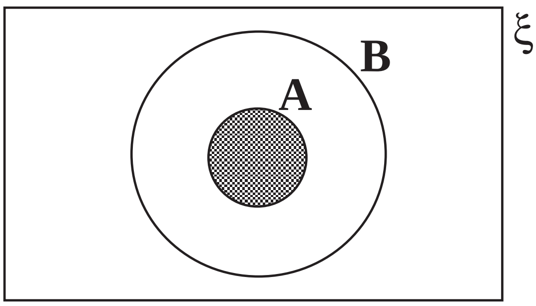
$A \cup B$: the *union* of A and B



A' : the *complement* of A and B

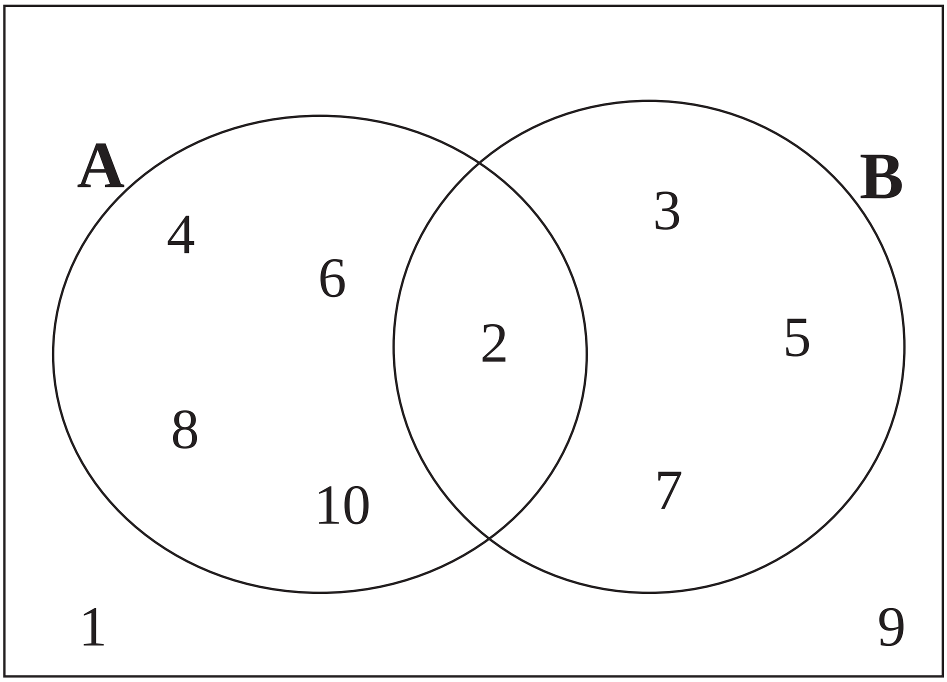


$A \subset B$: A is a *subset* of B



$\varnothing$: empty set

OS 1.13 *Using Set Notation*



1. Describe in words, set A and set B.

2. Find

(a) $A = \{ \ldots\ldots\ldots\ldots\ldots\ldots \}$

(b) $\xi = \{ \ldots\ldots\ldots\ldots\ldots\ldots \}$

(c) $A \cap B = \{ \ldots\ldots\ldots\ldots\ldots\ldots \}$

(d) $A \cup B = \{ \ldots\ldots\ldots\ldots\ldots\ldots \}$

(e) $A' = \{ \ldots\ldots\ldots\ldots\ldots\ldots \}$

(f) $A \cap A' = \{ \ldots\ldots\ldots\ldots\ldots\ldots \}$

(g) $(A \cap B)' = \{ \ldots\ldots\ldots\ldots\ldots\ldots \}$

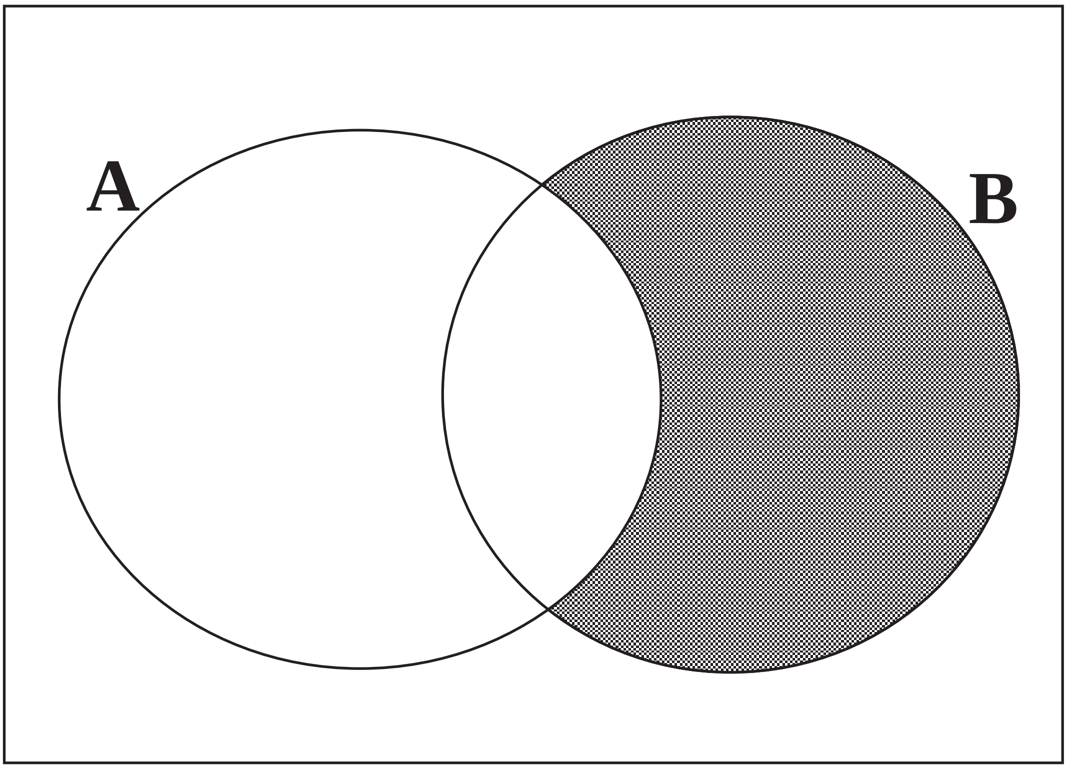
(h) $A \cap B' = \{ \ldots\ldots\ldots\ldots\ldots\ldots \}$

(i) $A \cup B' = \{ \ldots\ldots\ldots\ldots\ldots\ldots \}$

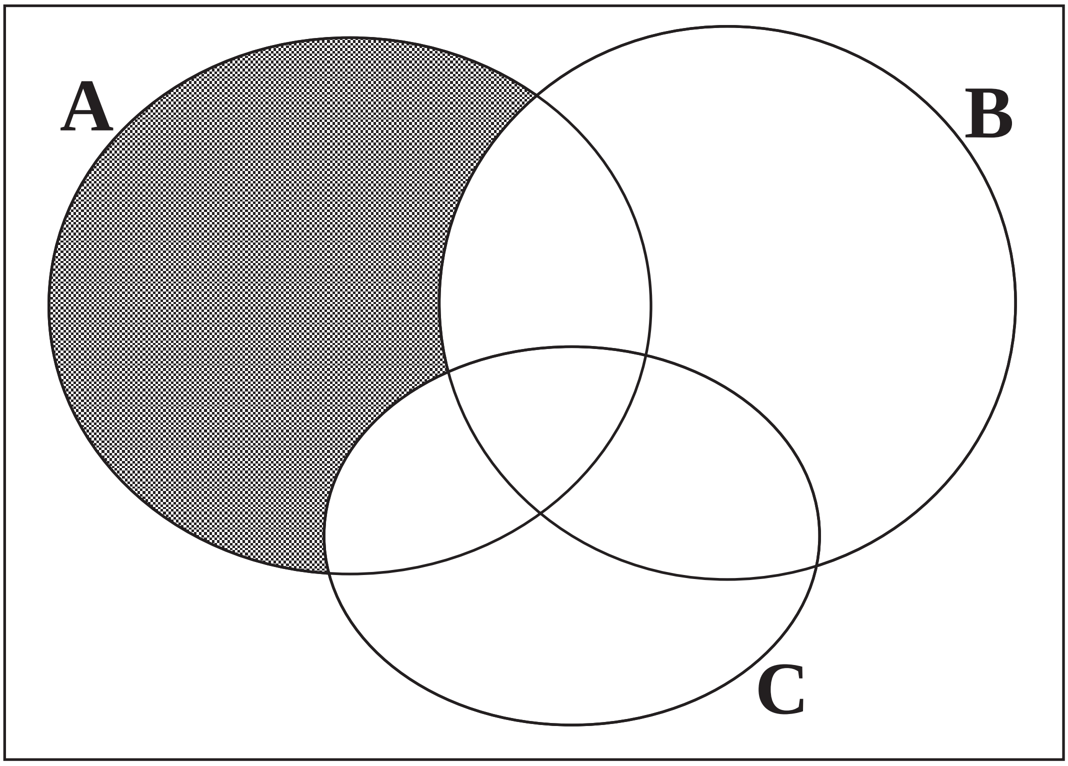
OS 1.14 *Describing Sets 1*

Use set notation to describe the shaded regions of these diagrams.

(a)



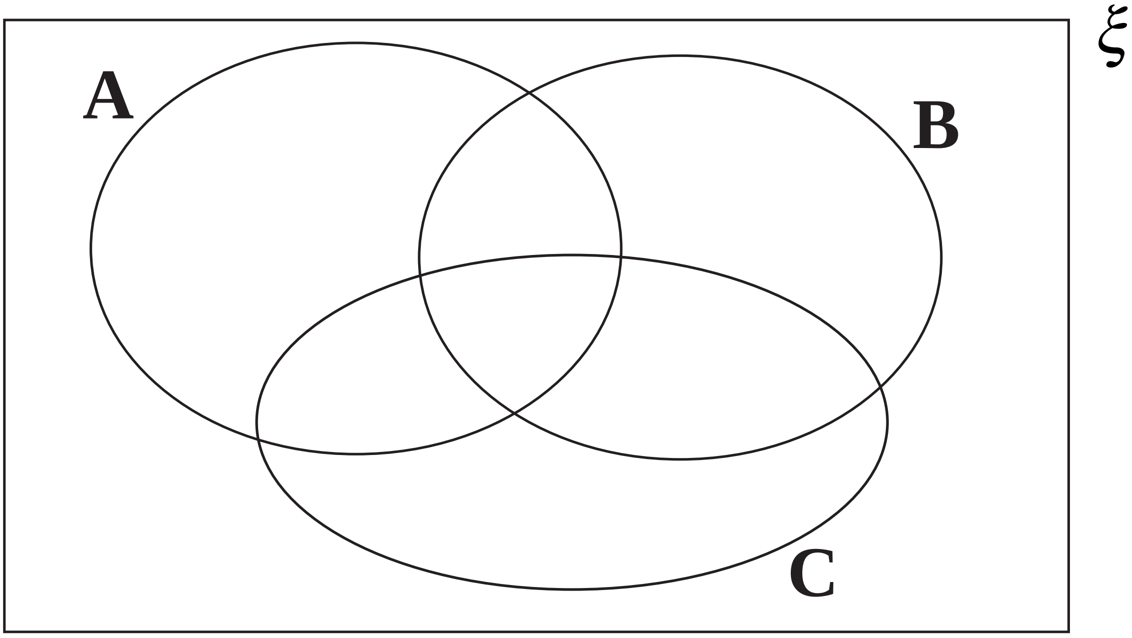
(b)



OS 1.15 *Describing Sets 2*

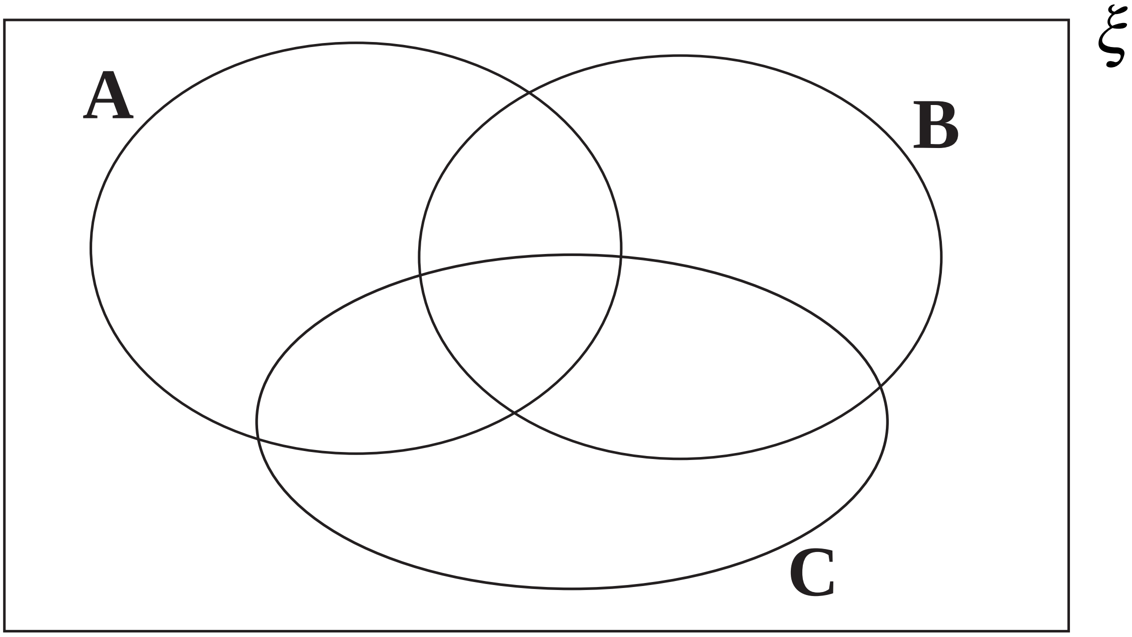
(a) On this diagram, shade the region that represents

$$(A \cup B) \cap C'$$



(b) On this diagram, shade the region that represents

$$A \cap B \cap C'$$

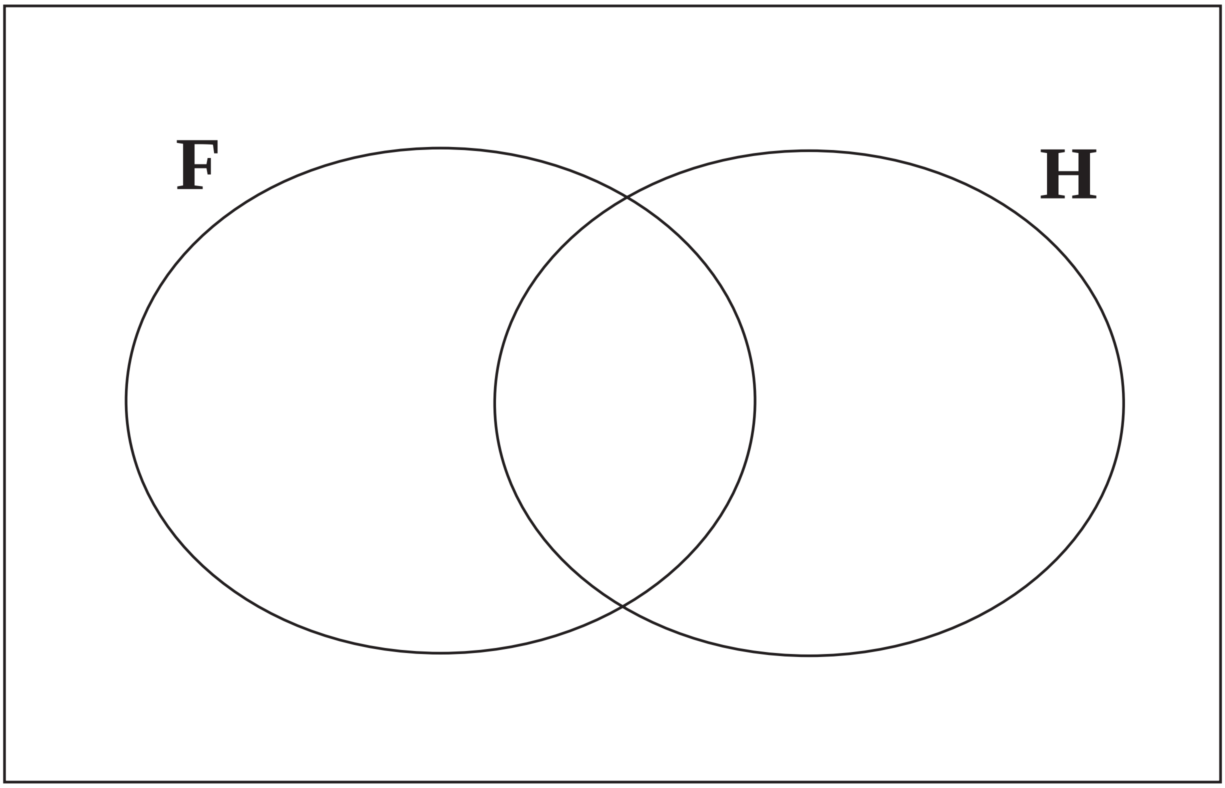


OS 1.16 *Logic Problems and Venn Diagrams*

In a class there are

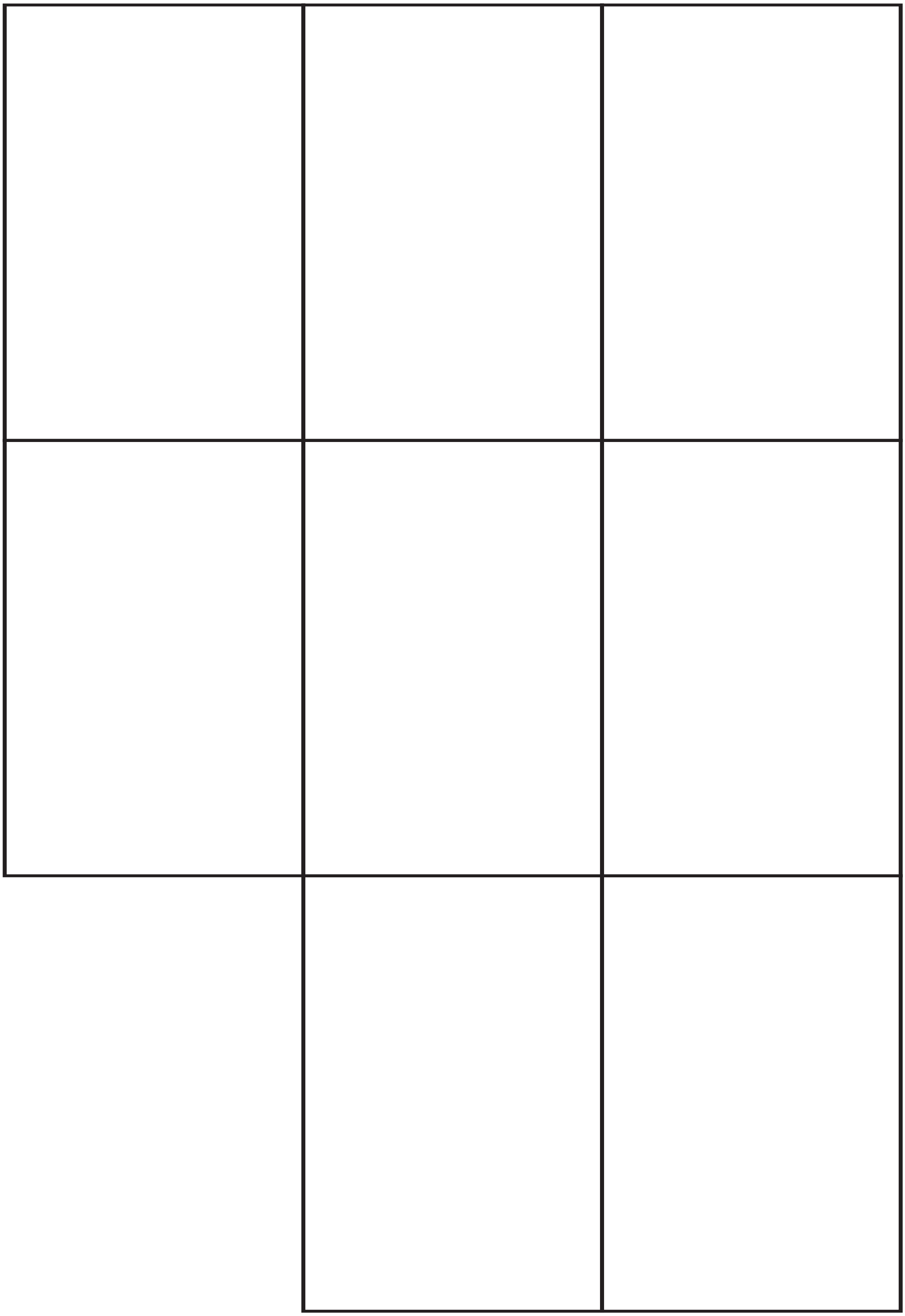
- 8 children who play football and hockey
- 7 children who do not play football or hockey
- 13 children who play hockey
- 19 children who play football.

Illustrate these facts on a Venn diagram, and find how many children there are in the class.

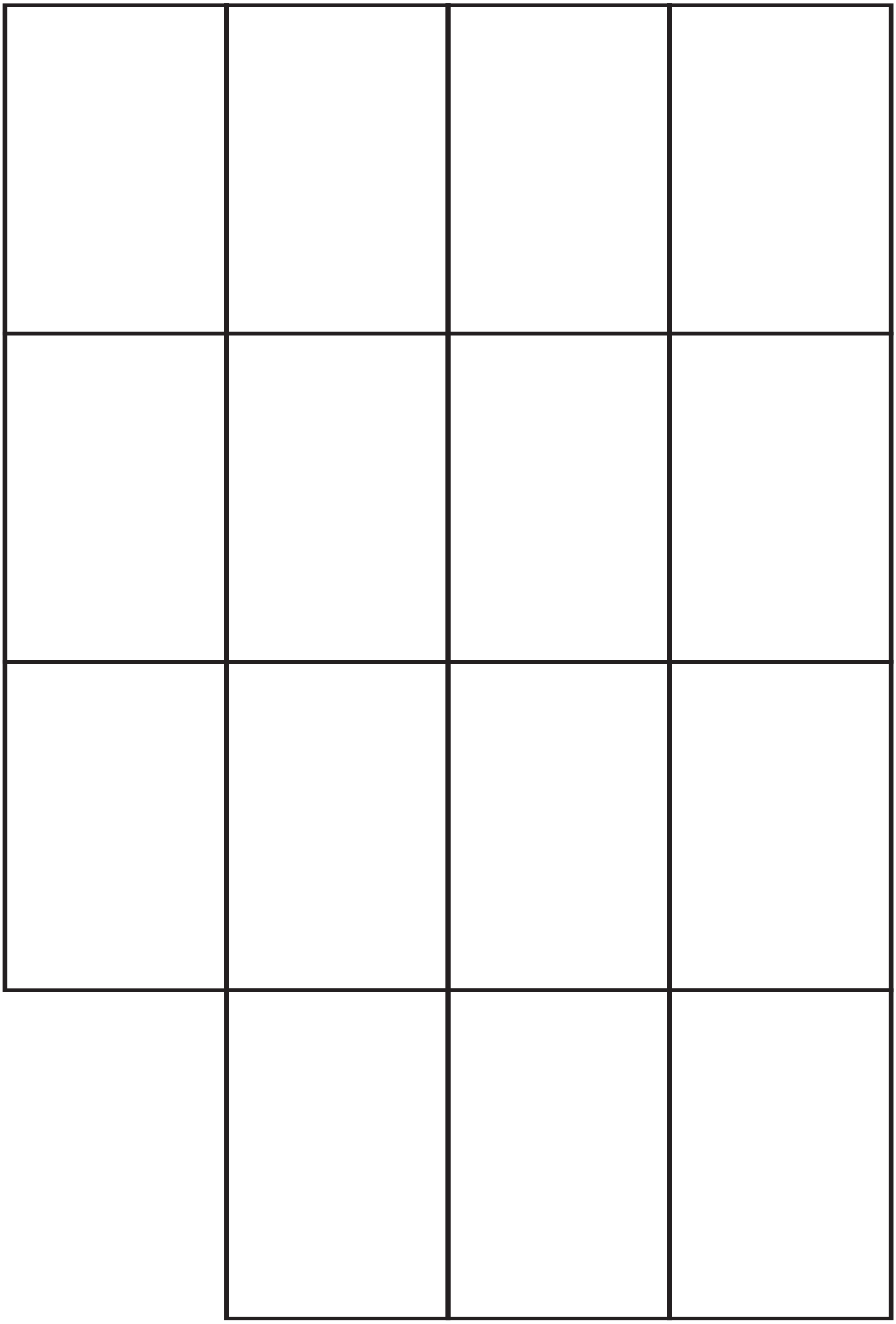


Total number of children in class =

OS 1.17 2×2 *Logic Table*



OS 1.18 3×3 *Logic Table*



UNIT 1 *Logic* Activities

Activities

ACTIVITY 1.1 *Two Way Tables*

This is a whole-class or group activity.

You are going to divide up into groups according to *two* criteria. You need to either use the four corners of your classroom, or make sufficient space in one area of the room.

In each case, divide up into the appropriate corner or 'cell' according to the criteria given.

1.

	Boys	*Girls*
No sisters or brothers		
At least one sister or brother		

Add up the total number of pupils in each cell. What does this tell you?

2.

	No sisters	*One or more sisters*
No brothers		
One or more brothers		

What must the total number of pupils in each cell add up to?

3.

	No sisters	*One sister*
No brothers		
One brother		

What does the total number of pupils in each cell now add up to?

Describe the criteria for pupils who are not in any of the cells.

ACTIVITY 1.2 *Shapes in Two Way Tables*

This activity requires the use of a set of shapes (given on A 1.2a).

You will also need large (A3) 2×2 and 3×3 tables on which to place the shapes.

In each case, put the complete set of shapes, 40 in total, into the appropriate cell, according to the criteria given.

1. (a)

	No. of edges	
	All straight	Not all straight
Shaded		
Not shaded		

(b)

	No. of edges	
	2 or less	3 or more
Shaded		
Not shaded		

2.

	No. of edges		
	3 or less	4	5 or more
Shaded			
Not shaded			

3.

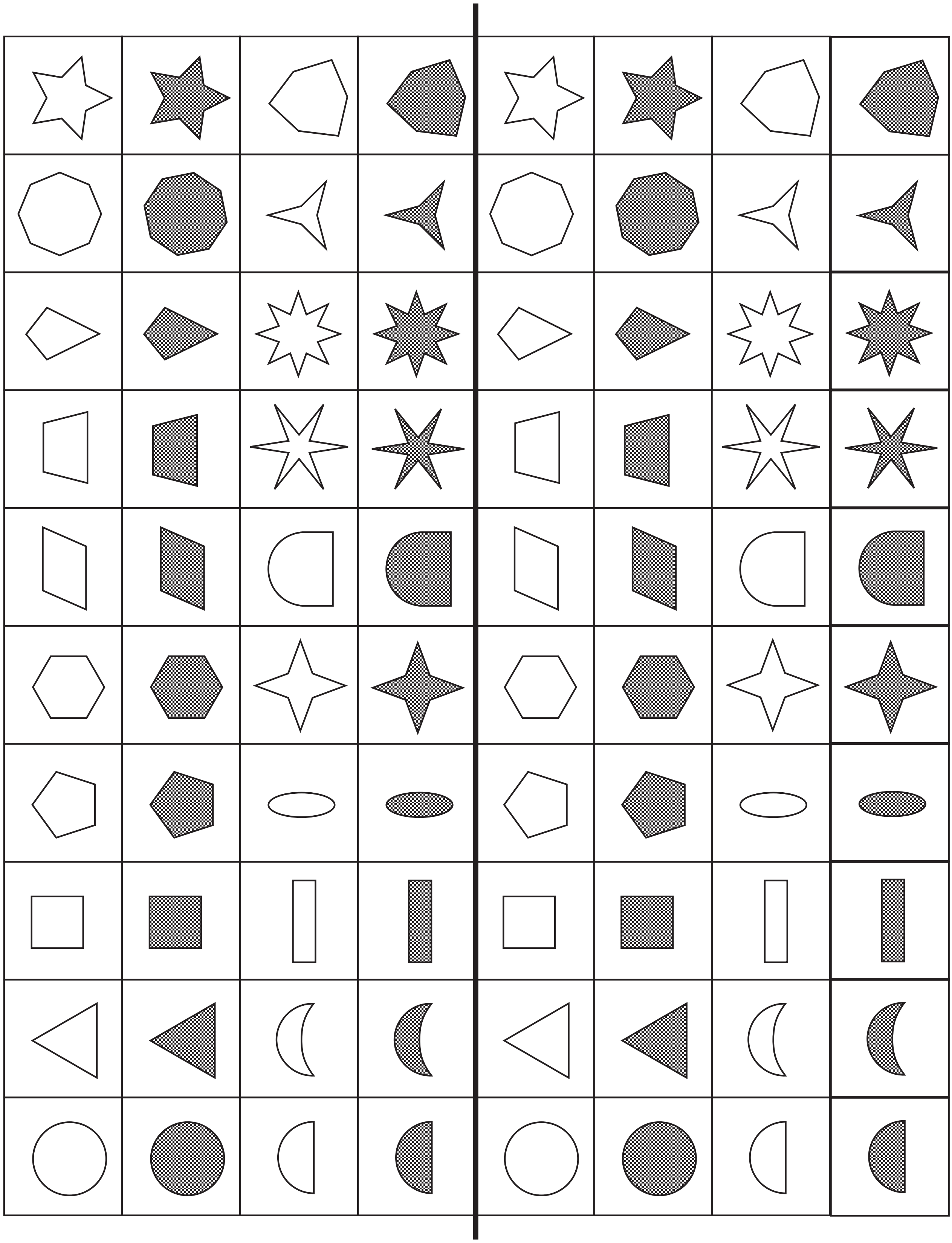
		No. of edges		
		3 or less	4	5 or more
Type of edge	All round			
	Some round and some straight			
	All straight			

4.

		No. of edges		
		3 or less	4	5 or more
No. of vertices	None or one			
	Two or three			
	Four or more			

Do all the shapes belong in a cell?

ACTIVITY 1.2 a *Shapes*



ACTIVITY 1.2 b *Numbers*

10	20	30	40	10	20	30	40
9	19	29	39	9	19	29	39
8	18	28	38	8	18	28	38
7	17	27	37	7	17	27	37
6	16	26	36	6	16	26	36
5	15	25	35	5	15	25	35
4	14	24	34	4	14	24	34
3	13	23	33	3	13	23	33
2	12	22	32	2	12	22	32
1	11	21	31	1	11	21	31

ACTIVITY 1.2 c *Letters*

J	T	D	N	X	H	R	
I	S	C	M	W	G	Q	
H	R	B	L	V	F	P	Z
G	Q	A	K	U	E	O	Y
F	P	Z	J	T	D	N	X
E	O	Y	I	S	C	M	W
D	N	X	H	R	B	L	V
C	M	W	G	Q	A	K	U
B	L	V	F	P	Z	J	T
A	K	U	E	O	Y	I	S

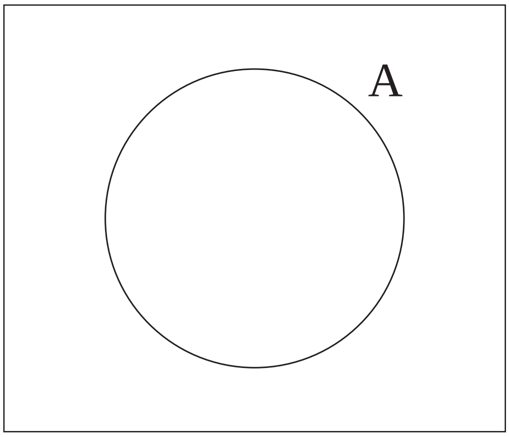
ACTIVITY 1.3 *Venn Diagrams*

This a whole-class or group activity.

You are going to be placed in sets according to the given criteria, and you must find your appropriate place on a Venn diagram of the type shown below, which will be indicated on the classroom floor.

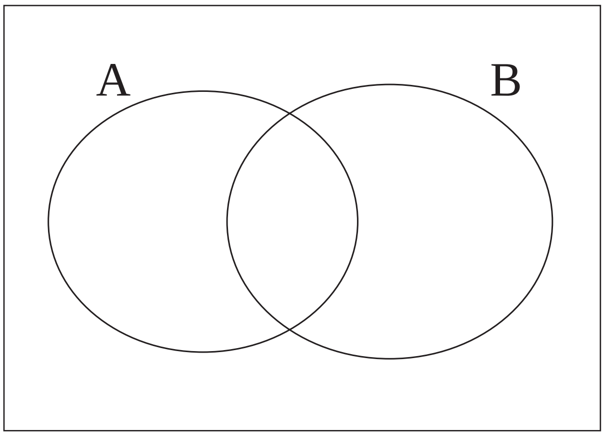
In all cases, the complete set consists of *all* the pupils in the class.

Type 1



or

Type 2



1. Using *Type 1*, A = set of boys.

   Describe the set of girls in terms of A.

2. Using *Type 1*, A = set of pupils who are 11 years old.

   Describe pupils in the *complement* of A.

3. Using *Type 2*, A = boys, B = girls.

   What can you say about (i) the *union* of A and B,

   (ii) the *intersection* of A and B,

   (iii) the *complement* of A and B?

4. Using *Type 2*, A = pupils with at least one sister,

   B = pupils with at least one brother.

   State in words, what is shown by (i) the *intersection* of A and B,

   (ii) the *complement* of the *union* of A and B.

ACTIVITY 1.4 *Numbers in Venn Diagrams*

This activity requires the use of a set of numbers (given on A 1.2b).

You will also need a large (A3) size Venn diagram (you could enlarge the diagram given on A 1.4a) on which to place the numbers.

In each case, put the given set of numbers into the appropriate region on the Venn diagram, according to the definition given for each set.

In all cases, the complete set is the set of whole numbers 1 to 40.

1. A = even numbers
   B = numbers divisible by 3

   What is in (i) the *intersection* of A and B,
   (ii) the *complement* of A and B?

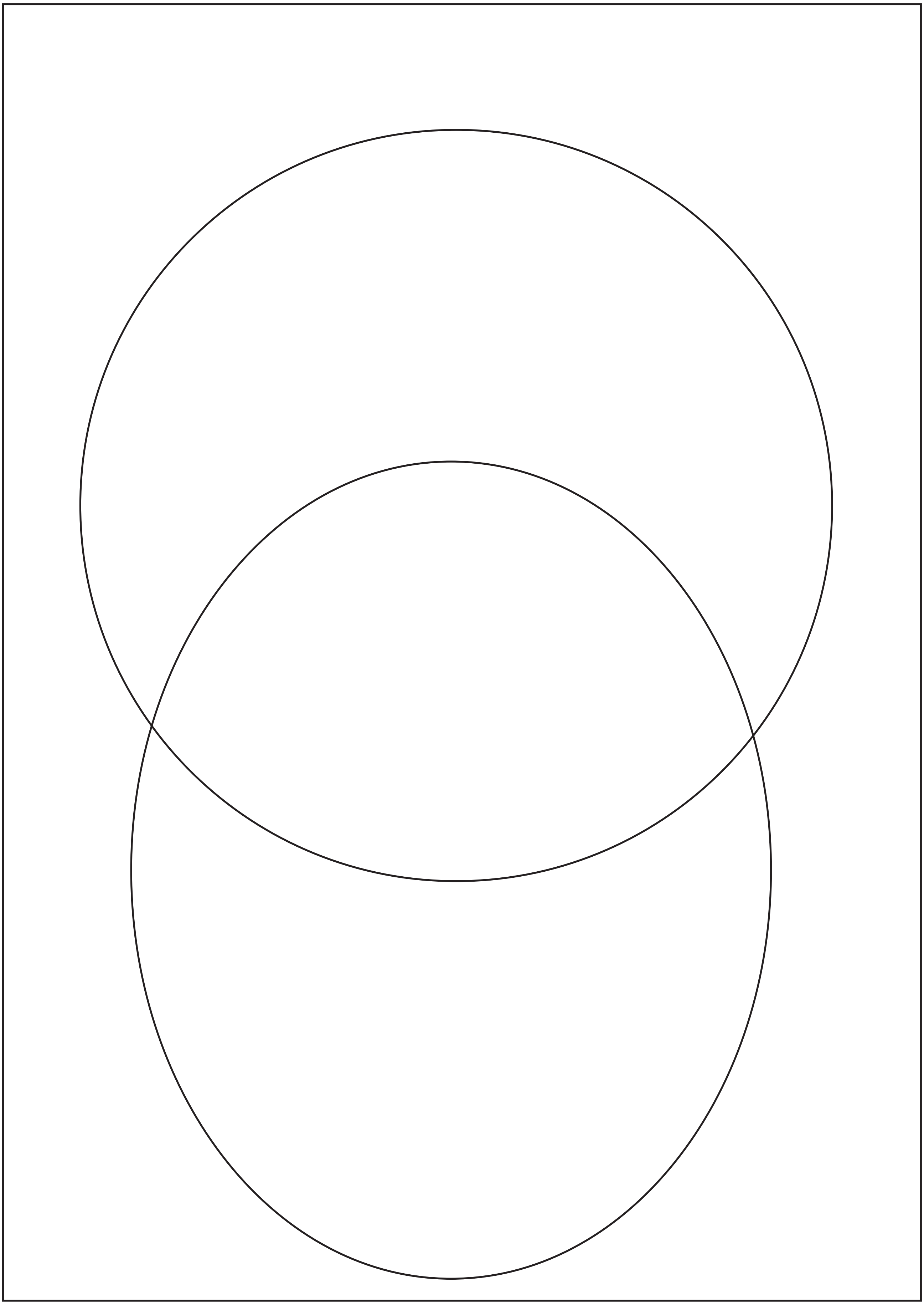
2. A = single-digit, even numbers
   B = even numbers

   Describe the sets (i) the *intersection* of A with the *complement* of B,
   (ii) the *union* of A and B,
   (iii) the *complement* of the *union* of A and B.

3. A = numbers divisible by 4
   B = numbers divisible by 3

   What is in (i) the *intersection* of A and B?
   (ii) the *intersection* of the *complement* of A with the *complement* of B?

ACTIVITY 1.4 a *Venn Diagram*



ACTIVITY 1.5 *Plane Passengers*

In a plane flying to London, five passengers are seated in a row next to each other.

Their professions are

journalist, singer, teacher, sailor, engineer;

and their nationalities, in any order, are:

English, French, German, Italian, Dutch.

Their ages are

21 years, 24 years, 32 years, 40 years, 52 years,

and each plays a different one of the following sports

handball, swimming, volleyball, athletics, football.

They will each travel from London to a different destination

Liverpool, Birmingham, Manchester, Newcastle or *Plymouth.*

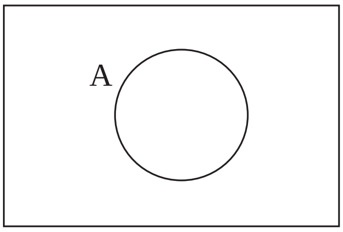
Clue 1	The engineer is seated on the extreme left.
Clue 2	The volleyball player is seated in the middle.
Clue 3	The Englishman is a journalist.
Clue 4	The singer is 21 years old.
Clue 5	The teacher's sport is swimming.
Clue 6	The sailor is travelling to Plymouth.
Clue 7	The handball player is French.
Clue 8	The passenger from Holland is bound for Birmingham.
Clue 9	The passenger bound for Liverpool is 32 years old.
Clue 10	The athlete is bound for Newcastle.
Clue 11	The French passenger is seated next to the German.
Clue 12	The 52-year-old passenger is seated next to the passenger who is bound for Manchester.
Clue 13	The 24-year-old passenger is seated next to the passenger who is travelling to Birmingham.
Clue 14	The engineer is seated next to the Italian.

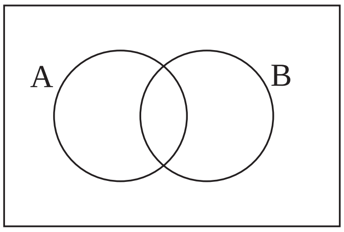
Use the clues to deduce the answers to these questions:

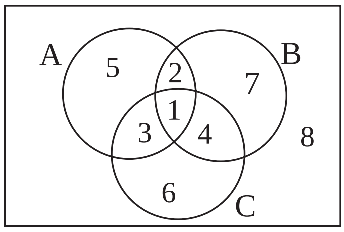
1. How old is the sailor?
2. What is the nationality of the football player?

ACTIVITY 1.6 *Representing Sets by Venn Diagrams*

Introduced by the English mathematician, *John Venn* (1834-1923), so called Venn diagrams are a convenient way of representing subsets of a universal set. For one, two or three subsets, it is easy to see that these diagrams can represent all the probabilities.







For example, for three subsets, A, B and C, you need separate regions to represent all the combinations that can exist.

1. Complete the table below and check that all the combinations are represented on the Venn diagram by the numbered regions.

A	B	C	On diagram
✓	✓	✓	✓ (1)
✓	✓	✗	✓ (2)
✓	✗	✓	✓ (3)
. . .	. . .	. . .	
. . .	. . .	. . .	
. . .	. . .	. . .	
. . .	. . .	. . .	
. . .	. . .	. . .	

2. Try to represent four subsets, A, B, C and D in a similar way. Check that, in your proposed diagram, all the possibilities are represented.

ACTIVITIES 1.1 - 1.3 *Notes and Solutions*

Notes and solutions are only given where appropriate.

1.1 You must ensure that there is plenty of room for this activity, and that it is relatively easy or pupils to move around.

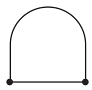
1/2. The total will be the total number in the class, but this may not be the case in questions 3 and 4.

3. Any cell can be classified as 'having more than one sister or more than one brother (or both)'.

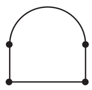
1.2 This is again a teacher-led activity. You will need to supply the shapes (preferably already cut out!), and might find it helpful to use the large 2×2 and 3×3 tables, photocopied onto A3 (OS 1.17 and OS 1.18).

Problems 1-3 should not cause difficulties, although the number of edges and vertices for the  shape depends on how you define a vertex.

e.g.



2 vertices and 2 edges



4 vertices and 4 edges

There is also a potential problem with the circle for problem 4, although the entry 'none or one' for the number of vertices should sort this out.

These problems can be made:

(i) easier, by restricting the number of shapes used;

(ii) more complex, by having more criteria and hence more cells.

You can also design similar activities using numbers (A 1.2b) or letters (A 1.2c), where you could, for example, use the criteria

- vowels or consonants,
- no. of lines of symmetry.

1.3 This is a teacher-led activity, and will need careful planning to ensure that the Venn diagram is physically large enough (you could perhaps borrow some ropes from the PE department!). Of course, the sets will need modifying for single sex schools!

1. The set of girls is the complement of A.

2. Pupils in the complement of A are either older than 11 or younger than 11.

3. (i) all pupils in the class, (ii) the empty set, (iii) the empty set.

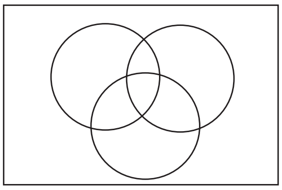
4. (i) pupils with both at least one sister and at least one brother,
   (ii) pupils with no brother or sister.

ACTIVITIES 1.4 - 1.5 *Notes and Solutions*

1.4 This is a teacher-led activity, and you will need to supply numbers (A 1.2b). This problem can be made:

(i) easier by restricting the numbers used (e.g. 1 – 20);

(ii) more complex with different definitions of the sets (e.g. prime numbers or square numbers), or even using three subsets on a sheet.



You can also design similar problems using shapes (A 1.2a) or letters (A 1.2c), where you could classify according to lines of symmetry and rotational symmetry.

1. (i) { 6, 12, 18, 24, 30, 36 }

   (ii) { 1, 5, 7, 11, 13, 17, 19, 23, 25, 29, 31, 35, 37 }

2. (i) empty set (ii) even numbers (iii) odd numbers

3. (i) { 12, 24, 36 }

   (ii) { 1, 2, 5, 6, 7, 10, 11, 13, 14, 17, 18, 19, 23, 25, 26, 29, 30, 31, 34, 35, 37, 38 }

1.5 There are many ways of tackling this problem, ranging from trial and error to more systematic methods. For example, you could make 25 small squares with one piece of information on each square, and then combine them according to the constraints.

Another method would be to use transparent strips, with each of the given combinations written in the appropriate columns on each strip. The strips can be placed on top of one another without obscuring any information, and related pieces of information will be kept together.

The final solution is:

Engineer	*Teacher*	*Journalist*	*Sailor*	*Singer*
Dutch	Italian	English	French	German
52 years old	24 years old	32 years old	40 years old	21 years old
Birmingham	Manchester	Liverpool	Plymouth	Newcastle
Football	Swimming	Volleyball	Handball	Athletics

giving the answers:

1. 40 years old

2. Dutch

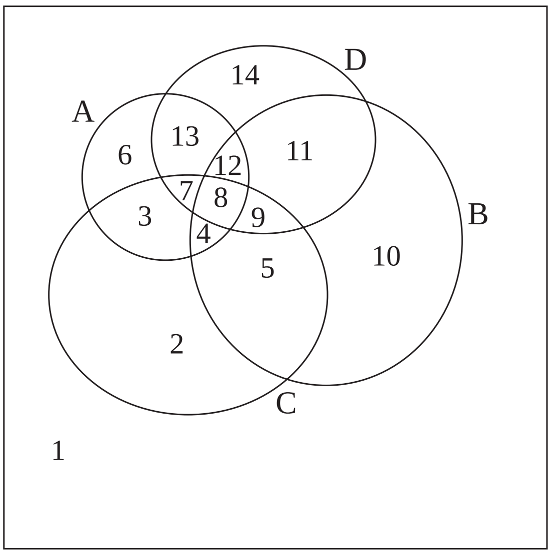
ACTIVITIES 1.6 *Notes and Solutions*

1.6 This is not an easy problem, and it doesn't even have a satisfactory answer – but it is a fascinating problem for really talented and creative pupils.

1. Yes, they are all represented.

A	B	C	On diagram
✓	✓	✓	✓ (no.1)
✓	✓	✗	✓ (no.2)
✓	✗	✓	✓ (no.3)
✗	✓	✓	✓ (no.4)
✗	✗	✓	✓ (no.5)
✗	✓	✗	✓ (no.6)
✓	✗	✗	✓ (no.7)
✗	✗	✗	✓ (no.6)

2. The obvious extension does not work.



There are 14 regions here, but you need, in fact, 16 distinct regions for every combination to be represented: the two opposite are not included.

A	B	C	D
✗	✗	✓	✓
✓	✓	✗	✗

UNIT 1 *Logic* Extra Exercises 1.1

1. At a food shop three children each chose one packet of their favourite biscuits.
   Decide which child chose which type of biscuits.

   Clue 1: Hester chose biscuits with chocolate in them.

   Clue 2: Ravi does not like jam.

	Choc-Chip Cookies	*Jammy Dodgers*	*Custard Creams*
Hester			
Ravi			
Leanne			

2. Jai, James and Jill all have different pets. They have one pet each. Their pets are a hamster, a budgie and a dog.
   Use these clues to work out who owns which pet.

   Clue 1: Jill's pet has more legs than James' pet.

   Clue 2: Jai's pet is smaller than Jill's pet.

	Hamster	*Budgie*	*Dog*
Jai			
James			
Jill			

3. Rory, Halim, Alex and Tom each support a different football team. All the teams are listed in the table.
   Decide who supports which team.

   Rory's team's name does not include the word 'United'.

   Halim's team does not have an 'l' in its name.

   Alex's team's name contains the letter 's'.

   Tom's team's name contains the letter 'c'.

	Manchester United	*Newcastle United*	*Arsenal*	*Liverpool*
Rory				
Halim				
Alex				
Tom				

UNIT 1 *Logic* Extra Exercises 1.2

1. Paul gathered information on the cars in a car park, and recorded it in this table.

   (a) How many Ford Escorts were in the car park?

   (b) How many cars were in the car park?

   (c) How many red cars were in the car park?

   (d) How many of the cars in the car park were not red?

	Ford Escort	*Other Cars*
Red	12	18
Other colours	34	182

2. There were 500 people at a concert. There were 220 men and the rest were women. As they left the concert, 80 people said they had not enjoyed the concert. Of these people, 42 were men.

   (a) Copy and complete this table.

	Men	*Women*
Enjoy		
Did not enjoy		

   (b) How many men enjoyed the concert?

   (c) How many women did not enjoy the concert?

3. This table gives information about the numbers of children there are in Years 7, 8 and 9 of a school.

	Boys	*Girls*
Year 7	92	101
Year 8		96
Year 9	99	

   (a) Copy the table and use this information to fill in the empty boxes.

   - *There are 286 boys in Years 7, 8 and 9.*
   - *There are 571 pupils in Years 7, 8 and 9.*

   (b) How many pupils are there in Year 7?

   (c) How many girls are there in Years 7, 8 and 9?

   (d) In which year are there more boys than girls?

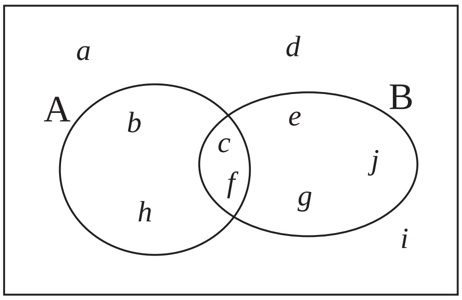
UNIT 1 *Logic* Extra Exercises 1.3

1. Draw a Venn diagram for the sets listed below:

$$A = \{7, 9, 11, 13\}$$
$$B = \{3, 5, 7, 9\}$$

Include all the whole numbers from 1 to 15 in your diagram.

2. This Venn diagram illustrates the sets A and B.



(a) Which letters are in set A?

(b) Which letters are in set B?

(c) Which letters are in set A , but not in set B?

(d) Which letters are not in set A or set B?

(e) Which letters are in both set A and set B?

3. The numbers 1 to 16 are sorted into sets:

A : Multiples of 4
B : Even numbers

(a) Which numbers are in A?

(b) Are there any numbers in A that are also in B?

(c) Draw a Venn diagram to show these two sets.

UNIT 1 *Logic* Extra Exercises 1.4

1. If $\xi = \{ 21, 22, 23, 24, 25, 26, 27, 28, 29, 30 \}$

   $A = \{ 21, 28 \}$

   $B = \{ 21, 24, 27, 30 \}$

   and $C = \{ 22, 24, 26, 28, 30 \}$

   find:

   (a) $A \cap B$ (b) $A \cup B$

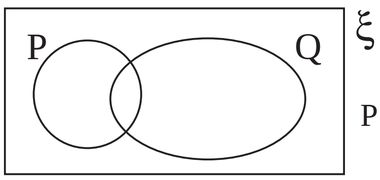
   (c) $A \cap C$ (d) $A \cup C$

   (e) $B \cap C$ (f) $B \cup C$

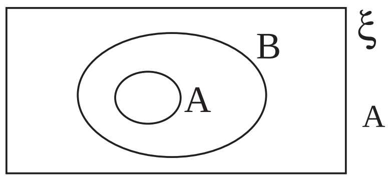
   (g) A' (h) B'

   (i) $A' \cap B'$ (j) $A' \cup B'$

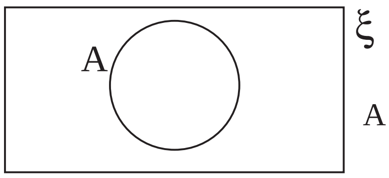
2. On a copy of each diagram, shade the region stated.

   (a)


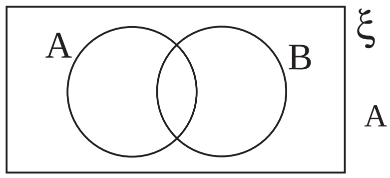
   $P \cap Q$

   (b)


   $A \cup B$

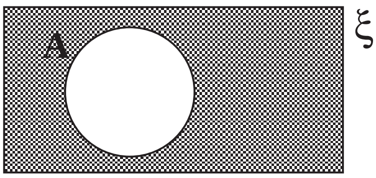
   (c)


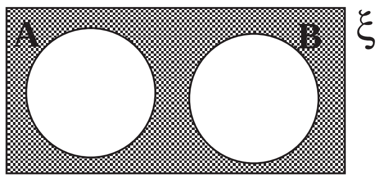
   A'

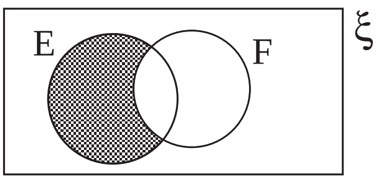
   (d)


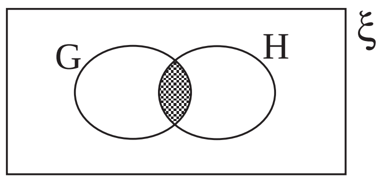
   $A' \cup B$

3. Describe each of the shaded regions, using set notation.

   (a)


   (b)


   (c)


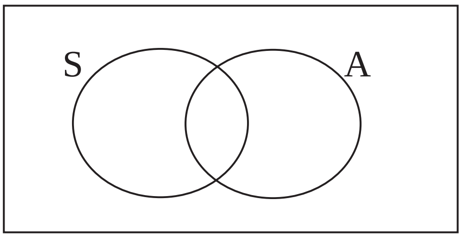
   (d)


UNIT 1 *Logic* Extra Exercises 1.5

1. In a class of 30 children there are 8 children who wear glasses. There are 17 boys in the class. If 5 boys wear glasses, how many girls do not wear glasses?

2. Claire and Laura have 20 CDs in their collection. One of them likes every CD. Claire likes 16 of the CDs and Laura likes 12 of them. How many do they both like?

3. At a school there is an art club (A) and a sports club (S). The diagram represents this.



Make 4 copies of the diagram.

Shade on different diagram the parts that represent:

(a) pupils who belong to both clubs,

(b) pupils who belong to only the art club;

(c) pupils who belong to only the sports club;

(d) pupils who do not belong to either club.

4. 40 teenagers belong to a youth club. They all play at least one of badminton, darts and pool.

8 teenagers play all three games.

10 teenagers play badminton and darts.

20 teenagers play darts and pool.

12 teenagers play pool and badminton.

30 teenagers play pool.

23 teenagers play darts.

(a) How many of the teenagers play *only* badminton?

(b) How many of the teenagers play badminton?

Extra Exercises 1.1 Answers

1.

	Choc-Chip Cookies	*Jammy Dodgers*	*Custard Creams*
Hester	✓	✗	✗
Ravi	✗	✗	✓
Leanne	✗	✓	✗

Hester : *Choc-Chip Cookies*
Ravi : *Custard Creams*
Leanne : *Jammy Dodgers*

2.

	Hamster	*Budgie*	*Dog*
Jai	✓	✗	✗
James	✗	✓	✗
Jill	✗	✗	✓

Jai : *Hamster*
James : *Budgie*
Jill : *Dog*

3.

	Manchester United	*Newcastle United*	*Arsenal*	*Liverpool*
Rory	✗	✗	✗	✓
Halim	✓	✗	✗	✗
Alex	✗	✗	✓	✗
Tom	✗	✓	✗	✗

Rory : *Liverpool*
Halim : *Manchester United*
Alex : *Arsenal*
Tom : *Newcastle United*

Extra Exercises 1.2 Answers

1. (a) 46 (b) 246 (c) 30 (d) 216

2. (a)

	Men	*Women*
Enjoy	178	242
Did not enjoy	42	38

   (b) 178 men enjoyed the concert.

   (c) 38 women did not enjoy the concert.

3. (a)

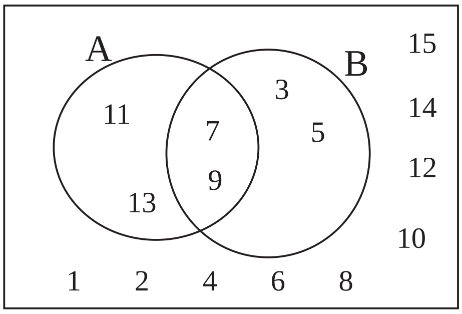
	Boys	*Girls*
Year 7	92	101
Year 8	95	96
Year 9	99	88

   (b) 193 pupils in Year 7.

   (c) 285 girls

   (d) Year 9

Extra Exercises 1.3 Answers

1. 

2. (a) A = { b, c, f, h }

   (b) B = { c, e, f, g, j }

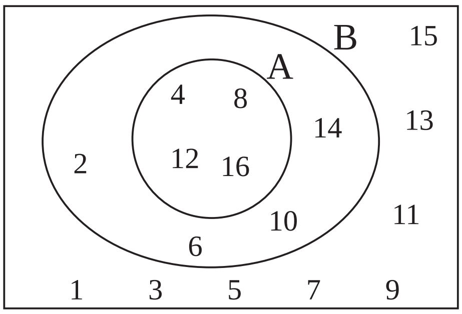
   (c) { b, h }

   (d) { a, d, i }

   (e) { c, f }

3. (a) A = { 4, 8, 12, 16 }

   (b) All of them are in B.

   (c) 

Extra Exercises 1.4 Answers

1. (a) $A \cap B = \{ 21 \}$

   (b) $A \cup B = \{ 21, 24, 27, 28, 30 \}$

   (c) $A \cap C = \{ 28 \}$

   (d) $A \cup C = \{ 21, 22, 24, 26, 28, 30 \}$

   (e) $B \cap C = \{ 24 \}$

   (f) $B \cup C = \{ 21, 22, 24, 26, 27, 28, 30 \}$

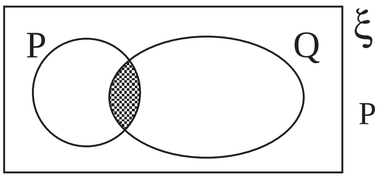
   (g) $A' = \{ 22, 23, 24, 25, 26, 27, 29, 30 \}$

   (h) $B' = \{ 22, 23, 25, 26, 28, 29 \}$

   (i) $A' \cap B' = \{22, 23, 25, 26, 29 \}$

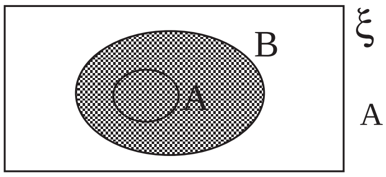
   (j) $A' \cup B' = \{ 22, 23, 24, 25, 26, 27, 28, 29, 30 \}$

2. (a)



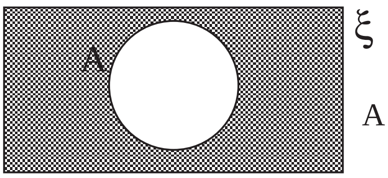
$P \cap Q$

(b)



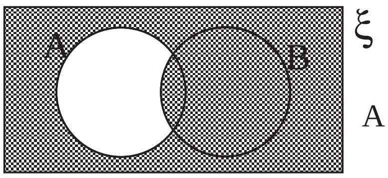
$A \cup B$

(c)



A'

(d)



$A' \cup B$

3. (a) A'

   (b) $A' \cap B'$

   (c) $E \cap F'$

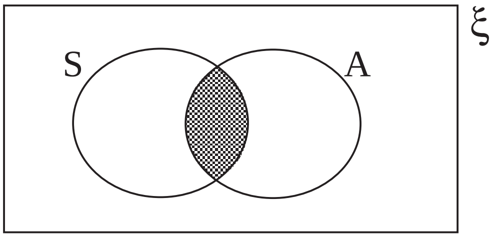
   (d) $G \cap H$

Extra Exercises 1.5 Answers

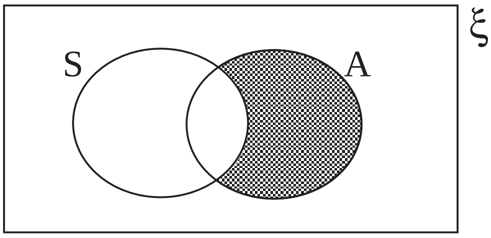
1. 10 girls do not wear glasses.

2. They both like 8 of the CDs.

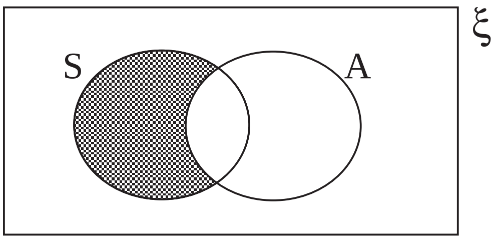
3. (a)



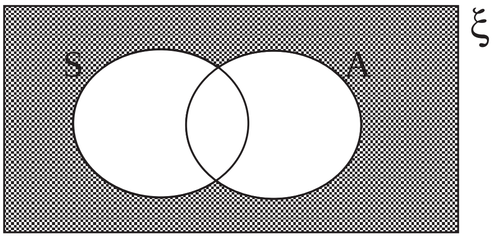
(b)



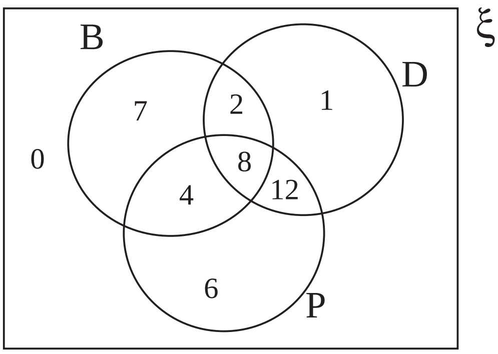
(c)



(d)



4.



(a) 7

(b) 21

UNIT 1 *Logic* Lesson Plans St

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Logic Puzzles 1**	
	Introducing interactive example	OS 1.1
	Practice	PB 1.1, Q1
	Discuss solution to Q1	
	Practice	PB 1.1, Q2 and Q4
	Discuss solutions to Q2 and Q4	
	Set homework	PB 1.1, Q3 and Q6
2.	**Logic Puzzles 2**	
	Mental Practice – basic arithmetic	
	Discuss homework, particularly Q6	OS 1.3
	Practice	PB 1.1, Q7
	Discuss solution to Q7	
	Practice	PB 1.1, Q8 and Q9
	Discuss solutions and introduce Q10	
	Set homework	PB 1.1, Q10
3.	**Two Way Tables 1**	
	Discuss homework	
	Practical whole class activity	Activity 1.1
	Introductory worked example	OS 1.4
	Practice	PB 1.2, Q1
	Discuss solution to Q1	
	Practice	PB 1.2, Q3
	Discuss solution to Q3	
	Set homework	PB 1.2, Q4
4.	**Two Way Tables 2**	
	Mental Practice – basic arithmetic	
	Discuss homework	
	Practical activity	Activity 1.2
	Practice	PB 1.2, Q5
	Discuss solution to Q5	
	Practice	PB 1.2, Q8
	Set homework	PB 1.2, Q7

UNIT 1 *Logic* Lesson Plans **St**

Lesson No.	*Suggested Plan*	*References*
5.	**Sets and Venn Diagrams**	
	Mental Test	M1.1 (Standard)
	Discuss answers	
	Introduce sets and Venn diagrams	OS 1.7 and OS 1.8
	Activity	OS 1.9 (or Activity 1.3)
	Set homework	PB 1.3, Q3
6.	**Recap**	
	Discuss homework	
	Introduce union and intersection	OS 1.10
	Revision Test	RT 1.1 (Standard)
7.	**Revision**	
	Give back marked tests	
	Go over test questions	
	Revise topics	

UNIT 1 *Logic* Lesson Plans **A**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Logic Puzzles**	
	Introductory interactive example	OS 1.1
	Practice	PB 1.1, Q1
	Discuss solution to Q1	
	Practice	PB 1.1, Q3 or Q6
	Discuss solutions	
	Set homework	PB 1.1, Q2 and Q10
2.	**Two Way Tables 1**	
	Discuss homework	
	Practical whole class activity	Activity 1.1
	Introductory worked example	OS 1.4
	Practice	PB 1.2, Q1
	Discuss solution to Q1	
	Practice	PB 1.2, Q3
	Discuss solution to Q3	
	Set homework	PB 1.2, Q4
3.	**Two Way Tables 2**	
	Mental practice – basic arithmetic	
	Discuss homework	
	Practical activity	Activity 1.2
	Practice	PB 1.2, Q5
	Discuss solution to Q5	
	Practice	PB 1.2, Q8
	Set homework	PB 1.2, Q7
4.	**Sets and Venn Diagrams 1**	
	Mental practice – basic arithmetic	
	Discuss homework	
	Introduce sets and Venn diagrams (including union and intersection)	OS 1.7, OS 1.8 and OS 1.10
	Class activity	Activity 1.3
	Practice	PB 1.3, Q2
	Discuss solution to Q2	
	Set homework	PB 1.3, Q3 and Q5

UNIT 1 *Logic* Lesson Plans **A**

Lesson No.	*Suggested Plan*	*References*
5.	**Sets and Venn Diagrams 2**	
	Discuss homework	
	Mental Test	M1.2 (Academic)
	Activity	Activity 1.4
	Practice	PB 1.3, Q7
	Discuss solution to Q7	
	Set homework	PB 1.3, Q8 and Q10
6.	**Recap**	
	Discuss homework	
	Revision Test	RT 1.2 (Academic)
7.	**Revision**	
	Give back marked tests	
	Give out test questions	
	Revise topics	

UNIT 1 *Logic* Lesson Plans **E**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Logic Puzzles**	
	Introductory interactive example	OS 1.1
	Practice	PB 1.1, Q1
	Discuss solution to Q1	
	Practice	PB 1.1, Q3 or Q6
	Discuss solutions	
	Set homework	PB 1.1, Q2 and Q10
2.	**Two Way Tables**	
	Discuss homework	
	Practical activity	Activity 1.2
	Introductory worked example	OS 1.4
	Practice	PB 1.2, Q5
	Discuss solution to Q5	
	Practice	PB 1.2, Q8
	Discuss solution to Q8	
	Set homework	PB 1.2, Q4 and Q7
3.	**Sets and Venn Diagrams 1**	
	Mental practice – basic arithmetic	
	Discuss homework	
	Introduce sets and Venn diagrams (including union and intersection)	OS 1.7, OS 1.8 and OS 1.10
	Class activity	Activity 1.3
	Practice	PB 1.3, Q2
	Discuss solution to Q2	
	Set homework	PB 1.3, Q3 and Q5
4.	**Sets and Venn Diagrams 2**	
	Discuss homework	
	Mental Test	M1.2 (Academic)
	Activity	Activity 1.4
	Practice	PB 1.3, Q7
	Discuss solution to Q7	
	Set homework	PB 1.3, Q8 and Q10

UNIT 1 *Logic* Lesson Plans E

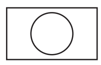
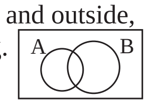
Lesson No.	*Suggested Plan*	*References*
5.	**Set Notation** ***(Optional)***	
	Introduction (interactive)	OS 1.12 and OS 1.13
	Practice	PB 1.4, Q2
	Discuss solution to Q2	
	Identifying regions in Venn diagrams	OS 1.14 and OS 1.15
	Practice	PB 1.4, Q8
	Discuss solution to Q8	
	Practice	PB 1.4, Q9
	Discuss solution to Q9	
	Set homework	PB 1.4, Q9 and Q10
6.	**Logic Problems and Venn Diagrams**	
	Introductory interactive activity	OS 1.16
	Practice	PB 1.5, Q3
	Discuss solution to Q3	
	Mental Test	M1.3 (Express)
	Activity	Activity 1.5
	Discuss solutions	
	Set homework	PB 1.5, Q9 or Activity 1.6
7.	**Recap**	
	Discuss homework	
	Revision Test	RT 1.3 (Express)
8.	**Revision**	
	Give back marked tests	
	Give out test questions	
	Revise topics	

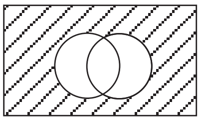
Y7	**UNIT 1: *Logic*** Lesson Plan 1	*Logic Puzzles*
Number	***Activity***	***Notes***
1	**Introduction** T: Introduce Y7 course and Practice Books. T: How much mathematics have you remembered? T: The foundations of mathematics depend on logic. So we start with some simple problems. M 1.1 Q1 Q2 Q3 Q4 *5 mins*	Let Ps give examples, at speed, get as many as possible to respond. Whole class activity, question by question; get Ps to explain answers and their method (particularly Qs 3 and 4)
2	**Logic tables** T: Now we will tackle more complex problems. OS 1.1 (or prepared on BB). T: We need a logic table to help solve this problem. What should the rows and columns contain? How do we mark 'true' / 'not true'? T: What can we fill in? What can we be sure about? *15 mins*	Initially keep logic table covered up. Ask Ps if they have understood problem and how to solve it. Ps suggest √ and X. T gives hints if needed, e.g. which numbers out of the 3 are in 4 times table and which are not?
3	**PB 1.1, Q1** T: You have 5 minutes to solve this problem. T: Who would like to show their solution? Explain your answers! T: Check your solution, and if necessary, correct it. *22 mins*	Each P has copy of blank logic table, OS 1.18, to work on. Keep to time limit; check P's working and help individuals who are having problems starting. P works on OS 1.18 on OHP. Agreement/disagreement. Praising correct solution.
4	**PB 1.2, Q2 (or Q6 if no problems with Q1)** T: Answer this one in your Ex.B. T: Stop now and we will review answers. (Also review Q6 if stronger Ps have completed this.) *37 mins*	Encourage Ps to work in pairs if they need help; T monitoring work, helping slower Ps. Ps give answers on OHP. Class check each answer. Agreement/feedback/self-correction. Praising.

Y7	UNIT 1: *Logic* Lesson Plan 1	*Logic Puzzles*
Number	***Activity***	***Notes***
5	**PB 1.1, Q4** T: Finally, we have a more difficult problem, where the answer is not obvious at first sight. T gives hints, e.g. Can Charlie be the oldest boy? So, what can we put and where? What else does Clue 1 tell us? *45 mins*	Whole class activity, but first Ps read Q. Table drawn on BB or OHP. Ps work in Ex.B. Discussion; agreement. T and Ps put √ and X in their own tables.
6	**Set homework** PB 1.1, Q3, Q7 and Q10	

Y7	**UNIT 1: *Logic*** Lesson Plan 2	*Two-Way Tables*
Number	***Activity***	***Notes***
1	**Checking homework** T: Check your answers to Q3 and Q7. T: Who got them both correct? Who didn't? What was the problem? T: It is impossible to check all solution to Q10, but we will try one ... Who would like to give their clues? *8 mins*	T has prepared OS or BB with solutions to Q3 and Q7. Encourage Ps to discuss any problems. P reads out their clues, and other Ps say where to put √ or X in logic table. Agreement, correction. Praising.
2	**Activity 1.1** T: Before we make our brains work, we will make our bodies work! T: Ps with *no* sisters or brothers, go to the front; others go to the back. T: Now boys go to the right; girls to the left. *Similar for parts 2 and 3 of Activity.* **For Part 3** T: What is the total number now? Is it equal to the total number of Ps in class? If not, why not? *18 mins*	You need sufficient space for this activity (you could use the four corners of the classroom). When in place, T puts the result on BB or OHP. After each formation, Ps dicuss what is in each part of the formation, and add up total number of Ps in each cell, and the total. Ps give ideas; establish that the categories have to be opposite to include all Ps.
3	**PB 1.2, Q1** T: Read this question carefully and answer in your Ex.B. You have 3 minutes for this! T: We will check answers. *24 mins*	T monitoring work, checking progress. Ps give answers in turn. T writes them on BB. Checking, feed-back, self-correction. Praising.
4	**Revision** T: It's time to see what you have remembered from your numerical work in Primary School. T: (for example) $3+5$ $5+3$ $7+12$ $14+9$ $20+50$ $23+32$ $42+39$ $39+42$ $8-3$ $15-8$ $3-2$ $2-3$ $26-7$ $50-20$ $42-23$ $82-38$ 3×2 … T: Now in Ex.Bs – try to find a quick method: $36+48+64$ $43+132+56$ $237-189$ 3×2 … T: (after 2 minutes): We will review answers. *33 mins*	At speed, around class by name (encourage strugglers with easier tasks). For review of answers, encourage Ps to work on BB or OHP. Discuss methods such as $36+48+64=(36+64)+48$ $=100+48$ $=148$ $237-189=37+(200-189)$ $=37+11=48$

Y7	**UNIT 1: *Logic*** Lesson Plan 2	*Two-Way Tables*
Number	***Activity***	***Notes***
5	**Incomplete tables** T: Now we will see how to complete tables that are incomplete. **PB 1.2, Q5** T: Read the first part of the question. What data do we know apart from that in the table? Does every P have a place in this table? Why? How do we complete the table? What is the total? (436) What do we do now? T: Fine; but how can we answer part (a)? ((b), (c)) *39 mins*	Whole class activity. Ps count in PB and record answer in Ex.B. Let Ps answer in chorus. Ps offer reasons. Ps give numbers to be added; T on BB. P demonstrates on BB $(484 - 436 = 48)$ Class helps with subtraction; Ps put calculation in Ex.B. Discussion; praising. Ps volunteer answers; agreement. Praising.
6	**Filling in logic table** T: Now we can try to fill in a complete table. **PB 1.2, Q6** T: Who can fill in one of the boxes? T: What information do we start with? Why? *45 mins*	Whole class activity. Put empty table on BB or OHP. Ps volunteer and fill in table, giving reasons. Agreement, discussion. Ps copy table into Ex.B. Praising.
7	**Set homework** PB 1.2, Q4 and Q7 (and Q9 for stronger Ps) Also, find out some facts about John Venn, e.g. who he was, when and where he lived, why he is famous.	Encourage use of library and/or internet for information.

Y7	**UNIT 1: *Logic*** Lesson Plan 3	*Sets and Venn Diagrams*
Number	***Activity***	***Notes***
1	**Checking homework** **PB 1.2, Q4** T: Who was successful? Who was not? What was your mistake? **Similar for PB 1.2, Q7, PB 1.2, Q9 (stronger pupils)** T: Who tried this question? T: We will discuss the information about John Venn later in the lesson.	T points to Ps to give answers (and reasons). Praise. Agreement, feedback, self-correction. Praise. P volunteer gives solutions on BB or OHP. Class follows; agreement ment, feedback, self-correction. Praise.
	8 mins	
2	**Illustrating sets** T: This is another aspect of logic. First, though, we must make a large space for everyone to stand in (or all move to the hall!). T: *On BB* Set A = {pupils with brown eyes} T: All Ps in set A come into the circle. T: Who are in the circle? (Ps with brown eyes.) T: Who are outside the circle? (Ps whose eyes are not brown.) **New example:** T: *On BB* Set B = {boys} T: Ps in set B move into the circle. T: Who is in the circle? (boys) T: Who is on the outside? (not boys) **Another example:** Set A = {pupils with brown eyes} Set B = {pupils wearing glasses} T: Who are inside A but not inside B? (Ps with brown eyes but no glasses) T: Who are inside B but not inside A? (Ps with glasses but not brown eyes) T: Who are in both sets? (Ps with brown eyes and glasses) T: Now move to your places.	This is based on Activity 1.3, but here we use it for introducing sets and Venn diagrams. T draws circle around the group (or use rope, etc.). Volunteer P draws similar shape on BB. P puts answer inside circle on BB. Some Ps might say "blue eyes" or "green eyes", but "not brown eyes" is required. P puts answer outside circle on BB and completes with another circle or rectangle, e.g.  Volunteer P draws circle and rectangle on BB and writes in answers. This time T arranges two overlapping circles and outside, e.g.  on floor (and P on BB). Ps move in appropriate position and T checks that they are correct!
	20 mins	

Y7	**UNIT 1: *Logic*** Lesson Plan 3	*Sets and Venn Diagrams*
Number	***Activity***	***Notes***
3	**James Venn** T: What have you found out about James Venn? *26 mins*	Ps write information on BB. Discussion. Praising.
4	**Using Venn diagrams: OS 1.7** (on OHP or drawn on BB) T: Where can we put any of the numbers? *(T could introduce names, i.e. intersection, union, complement)* *32 mins*	Whole class activity. Ps come to OHP/BB to put a number in the appropriate place. Discussion (other numbers?) Praising.
5	**Intersection and union: OS 1.10** T: What are the members of set Y and set X ? Describe the sets X (and Y) in words. T: Now we will complete the sheet. Put (a)? etc. *37 mins*	Whole class activity. Each P has copy of OS 1.10 to work on. P gives answers to class. Ps give answers and complete worksheets. T writes answers on OHP. Agreement. Praising.
6	**PB 1.3, Q2** T: Read the question carefully and answer in your Ex.B. T: Set A ? Set B ? Part (b) T: Also, what is the intersection of A and B? (2, 8) T: What is the complement of the union of A and B? (7, 9) *45 mins*	Individual work; monitored; help given. After a few minutes, start checking. P writes on BB. Checking. Praising. P offer answers; agreement. Praising. Help Ps with the meaning of this, e.g.  Agreement. Praising.
7	**Set homework** PB 1.3, Q3, and Q5 with added questions for stronger Ps: (e) What is the intersection of S and E ? (f) What is the complement of E ? (g) What is the complement of the union of S and E ?	

Y7	UNIT 1: *Logic* Lesson Plan 4	*Sets and Venn Diagrams: Notation*
Number	***Activity***	***Notes***
1	**Checking homework** **PB 1.3, Q3** T: What have you noticed here? (every element in B is also in A) T: Could we use the Venn diagram in PB 1.3, Q2 for this task? What is the intersection of A and B? {4, 8, 12} What is the union? {4, 8, 12, 2, 6, 10} Hence? (you can use the usual notation) **PB 1.3, Q5** (a) E = {2, 4, 6, 8, 10, 12, 14, 16, 18, 20} (b) S = {1, 4, 9, 16} (c) E = {even numbers} and S = {square numbers } (d) Union of E and S = {1, 2, 4, 6, 8, 9, 10, 12, 14, 16, 18, 20} (e) Intersection of E and S = {4, 16} (f) Complement of E = {1, 3, 5, 7, 9, 11, 13, 15, 17, 19} (g) Complement of the union of E and S = {3, 5, 7, 11, 13, 15, 17, 19} *8 mins*	T asks, Ps give answers. Agreement, feedback, self-correction. Praising. T discusses this special case with Ps. T introduces the concept of subset. T prepares OS with solution or on BB, as shown opposite. Feedback, self-correction. Praising.
2	**Simplifying notation** T: Gosh; writing out all these names is exhausting! We need a shorter method. Can anyone suggest what we could do? **OS 1.12** *(big sigh from T!)* T: We will use the notation here to revise my solutions to PB 1.3, Q5. T: What is the empty set? T: Name something that does not exist. T: How about "the pink dogs sitting under my table"? *18 mins*	Try to lead Ps to the concept of notation for intersection, union and complement. Ps help to rewrite solutions on BB (with OS 1.12 on OHP). Discussion, brainstorming (work in pairs to name things that do not exist).
3	**Using set notation OS 1.13** T: Look at this problem. We will answer parts (a) to (e). *23 mins*	Whole class activity. P volunteers to put answers on OHP (and state reasons). Agreement. Praising.

Y7	UNIT 1: *Logic* Lesson Plan 4	*Sets and Venn Diagrams: Notation*
Number	***Activity***	***Notes***
4	**Practising 1** T: Look at PB 1.3, Q4 and add (c) $P \cup Q$ (d) Q' T: Who would like to draw Venn diagram on the BB? T: Who can answer the questions? *29 mins*	Whole class activity. P read tasks from PB. P draws Venn diagram (if P does not use best possible figure, still use it, unless other Ps suggest changing it, but comment on it at the end). Ps give answers and T writes on BB. Agreement. Praising.
5	**Practising 2** T: PB 1.3, Q7, but rewritten as (a) the same (b) $R \cap Q = ?$ (c) $R \cup Q = ?$ (d) $Q' = ?$ (e) $(R \cup Q)' = ?$ (f) $Q' \cap R = ?$ T: We will check answers. Draw Q to I in Venn diagram on BB. *39 mins*	Individual work. Use prepared BB or OH slides or on sheet of paper. Ps answer in Ex.B. Ps draw one shape each in Venn diagram on BB or OHP. Parts (b) to (d) should be OK, but stronger pupils to do parts (e) and (f) and explain answers. Agreement, feedback, self-correction. Praising.
6	**Logic problems OS 1.16** T: Here is a more difficult problem. T: Can we start by writing 13 and 19 into H and F ? (no) Why not? What *can* we start with? *45 mins*	Whole class activity. Interactive discussion along the lines of the solution given on p19/20 in PB 7A. T leads Ps to find out how many more is $7 + 13 + 19$ than the total. Praising.
7	**Set homework** PB 1.4, Q2 (a) to (e) and PB 1.5, Q6	

Y7	UNIT 1: *Logic* Lesson Plan 5	*Solving Logic Problems with Venn Diagrams*
Number	***Activity***	***Notes***
1	**Check homework** **PB 1.4, Q2 (a) to (e)** T: Do you agree with the answers? **PB 1.5, Q6** T: What is the final answer? (3) T: Who was successful? *6 mins*	(Note that if you have missed out Lesson Plan 5, you need to refer to the start of Lesson Plan 5 for correct review.) T has already asked P to write up answers as soon as P arrives. Checking, discussion. Agreement, feedback, self-correction. Praising. T asks P who was not successful to draw Venn diagram on BB and explain their solution. Other Ps help to correct solution. Self-correction. Praising.
2	**Practice** Tasks (given out by T): 1. MT 1.2, Q1 2. Extra Exercises 1.1, Q3 3. MT 1.2, Q2 4. MT 1.2 Q3 with (c) what is the intersection of B and complement of A ? (d) use set notation to describe these regions of the Venn diagram. 5. PB 1.5, Q4 6. PB 1.4, Q4 (b), (e) and (f) *36 mins*	Individual work for the remainder of the lesson. T to complete worksheet as shown opposite. Ps work in Ex.B at their own pace. If they finish one task, they move on to the next one. T monitors progress and helps when needed.
3	**Checking answers** T: Who can list set A? ($A = \{ 2, 4, 6, 8, 10 \}$) T: Is that correct? Who agrees? T: What is the intersection of A and B ? (6) T: How can we mark this region on the Venn diagram? *45 mins*	T has OH slides prepared with answers and used when needed, e.g. M 1.2, Q3 Interactively, particularly tasks 5 and 6, which some Ps will not have reached. T uncovers solutions on OHP as they are dealt with.
4	**Set homework** PB 1.1, Q5 PB 1.2, Q10 PB 1.3, Q6 and list sets $O,\ M,\ O \cap M,\ M',\ (O \cup M)',\ O' \cap M$	

Y7	**UNIT 1: *Logic*** Lesson Plan 6	*Recap*
Number	***Activity***	***Notes***
1	**Check homework** **PB 1.1, Q5** **PB 1.2, Q10** **PB 1.3, Q6** For each task, T: Who was successful? T: Who was not? T: What were the problems? *10 mins*	T prepares OH slide with answers on it. At start, T puts slide on and Ps check answers in their Ex.Bs. T shows answers question by question. T concentrates on any misconceptions.
2	**Test: RT 1.2** (answers given in but pupils keep a copy) *45 mins*	T gives out copies of RT 1.2, and Ps work on copies or in special test book. Stronger Ps, who finish early, can continue with extra tasks (e.g. activity 1.5).
3	**Set homework** Study copy of answers for RT 1.2 and try to find mistakes. Stronger Ps continue with extra work.	

Y7	***Logic*** *Revision* Lesson Plan 7	*UNIT 1*
Number	***Activity***	***Notes***
1	**Revision** T and Ps go over test questions. e.g. **Question 1** T: Who did *not* get the correct answer? Who found their mistake at home? T: OK, come to BB and explain where your mistake was *(T draws logic table on BB).* T: First clue was: "Ben's yo-yo was not green." What did you do? P: *This was clear; I put X in Ben's row in the third column (P does this on BB).* T: OK! The second clue is: "Tom's yo-yo is not red or green." What did you do now? P: *I was confused. I thought it meant:* *"Tom's yo-yo is not red but green."* *and so I put a X in the first column of Tom's row and a √ in the third row.* T: What did you do next? P: *As there was no contradiction, I completed the table, answered the question but did not notice my fault.* T: And what is the correct solution? etc.	Between lessons 6 and 7, T must mark the test, and bring corrected test papers to give back to Ps. T chooses P who has discovered their mistake at home so that they can explain how they noticed it. This P writes on BB, explaining mistake and correcting it. If no such Ps, T asks one of the Ps who got it wrong to work at BB and, with help, correct their mistake. If every P was successful, T praises the class, and goes over the test quickly. P gives correct solution on BB. In this way, Ps find the solution to each question, learn from mistakes (their own and others) and revise Unit 1; covering • how to solve logic problems • how to use 2-way tables • when to use sets • how to use sets to solve problems.

UNIT 1 Logic Mental Tests

M 1.1 Standard Route *(no calculator)*

1. Tom is 4 years older than Mark. Mark is 10 years old.
   How old is Tom? (14)

2. Two children in a family are aged 10 and 12. Alan is older than Kate.
   How old is Alan? (12)

3. In a swimming race, Jane finished before Kim; Pam finished before Jane.
   (a) Who finished first? (Pam)
   (b) Who finished last? (Kim)

4. Sue is 1 year older than Rachel and 2 years younger than Jane.
   Jane is 9 years old.
   (a) How old is Sue? (7)
   (b) How old is Rachel? (6)

5. In a class of 30 boys and girls, there are 6 pupils who are left-handed
   4 of whom are girls. There are 10 right-handed boys.
   How many:
   (a) boys are left-handed, (2)
   (b) boys are there in total, (12)
   (c) girls are there in total? (18)

6. From the whole numbers { 1, 2, 3, . . . , 10 }, the set A is defined as the set of even numbers, and B is defined as the set of number divisible by 3.
   What number (or numbers) is common to both sets? (6)

UNIT 1 Logic Mental Tests

M 1.2 Academic Route *(no calculator)*

1. Sue is 1 year older than Rachel and 2 years younger than Jane.
   Jane is 9 years old.
   (a) How old is Sue? (7)
   (b) How old is Rachel? (6)

2. In a class of 30 boys and girls, there are 6 pupils who are left-handed 4 of whom are girls. There are 10 right-handed boys.
   How many:
   (a) boys are left-handed, (2)
   (b) boys are there in total, (12)
   (c) girls are there in total, (18)
   (d) girls are right-handed? (14)

3. From the whole numbers { 1, 2, 3, . . . , 10 }, the set A is defined as the set of even numbers, and B is defined as the set of number divisible by 3.
   (a) What is the intersection of A and B? (6)
   (b) What numbers are not in the union of A and B? { 1, 5, 7 }

4. From the whole numbers { 1, 2, 3, . . . , 20 }, the set A is defined as the set of numbers divisible by 3, and B is defined as the set of numbers divisible by 5.
   (a) What is the intersection of A and B? { 15 }
   (b) What is the intersection of B and the complement of A? { 5, 10, 20 }

UNIT 1 Logic Mental Tests

M 1.3 Express Route *(no calculator)*

1. In a class of 30 boys and girls, there are 6 pupils who are left-handed 4 of whom are girls. There are 10 right-handed boys.
   How many:
   (a) boys are left-handed, (2)
   (b) boys are there in total, (12)
   (c) girls are there in total, (18)
   (d) girls are right-handed? (14)

2. From the whole numbers { 1, 2, 3, . . . , 10 }, the set A is defined as the set of even numbers, and B is defined as the set of number divisible by 3.
   (a) What is the intersection of A and B? (6)
   (b) What numbers are not in the union of A and B? { 1, 5, 7 }

3. From the whole numbers { 1, 2, 3, . . . , 20 }, the set A is defined as the set of numbers divisible by 3, and B is defined as the set of numbers divisible by 5.
   (a) What is the intersection of A and B? { 15 }
   (b) What is the intersection of B and the complement of A? { 5, 10, 15, 20 }

4. From the whole numbers { 1, 2, 3, . . . , 15 }, the set A is defined as the set of numbers with two digits, and B is defined as the set of numbers divisible by 3 or 4.
   (a) What is the complement of the union of A and B? { 1, 2, 5, 7 }
   (b) What is the intersection of A with the complement of B? { 10, 11, 13, 14 }

UNIT 1 *Logic* Overhead Slides

Overhead Slides

OS 1.1 3×3 *Logic Puzzle 1*

Rana, Toni and Millie are sisters. You need to deduce which sister is 9 years old, which one is 12 and which one is 14.

You have two clues:

Clue 1 : *Toni's age is not in the 4-times table.*

Clue 2 : *Millie's age can be divided exactly by the number of days in a week.*

Use the logic table to solve this problem.

OS 1.2 3×3 *Logic Puzzle 2*

Rachel, Emma and Hannah are sisters.

Their ages are 2 years, 7 years and 10 years.

Clue 1 Emma is older than Hannah.

Clue 2 Emma's age is a prime number.

Use the logic grid below to solve the problem

OS 1.3 4×4 *Logic Puzzle*

In Bakers Row there are 4 houses, each numbered 1, 2, 3 or 4.

The following people live in Bakers Row, one in each house:

Ted, Alice, Ernie and Gita

Use these clues to find out who lives in which house, using the logic table below.

Clue 1 The number of Ted's house is an *even* number.

Clue 2 The number of Ernie's house is an *odd* number.

Clue 3 The number of Alice's house is greater than the number of Ted's house.

Clue 4 The number of Gita's house is less than the number of Ernie's house.

OS 1.4 *Two Way Tables 1*

Emma collected information about the cats and dogs that children in her class have. She filled in the table below, but missed out one number.

	Has a dog	*Does not have a dog*
Has a cat	8	4
Does not have a cat	12	

(a) If there are 30 children in Emma's class, what is the missing number?

(b) How many children own at least one of these pets?

(c) Do more children own cats rather than dogs?

(d) Could it be true that some of the children do not have any pets?

OS 1.5 *Two Way Tables 2*

The table below gives information about the children in a class.

	Left-handed	*Right-handed*
Boys	3	14
Girls	2	13

(a) How many right-handed girls are there in the class?

(b) How many left-handed boys are there in the class?

(c) How many girls are there in the class?

(d) How many of the children are left-handed?

(e) How many children there are in the class?

OS 1.6 *Constructing Two Way Tables*

In Ben's class there are 12 girls and 18 boys.

There are 6 children who bring packed lunches and the rest eat school lunches.

Ben and Adam are the only boys who bring packed lunches.

(a) How many children are there in the class?

(b) How many girls eat school lunches?

	Boys	*Girls*	
Packed lunch			
School lunch			

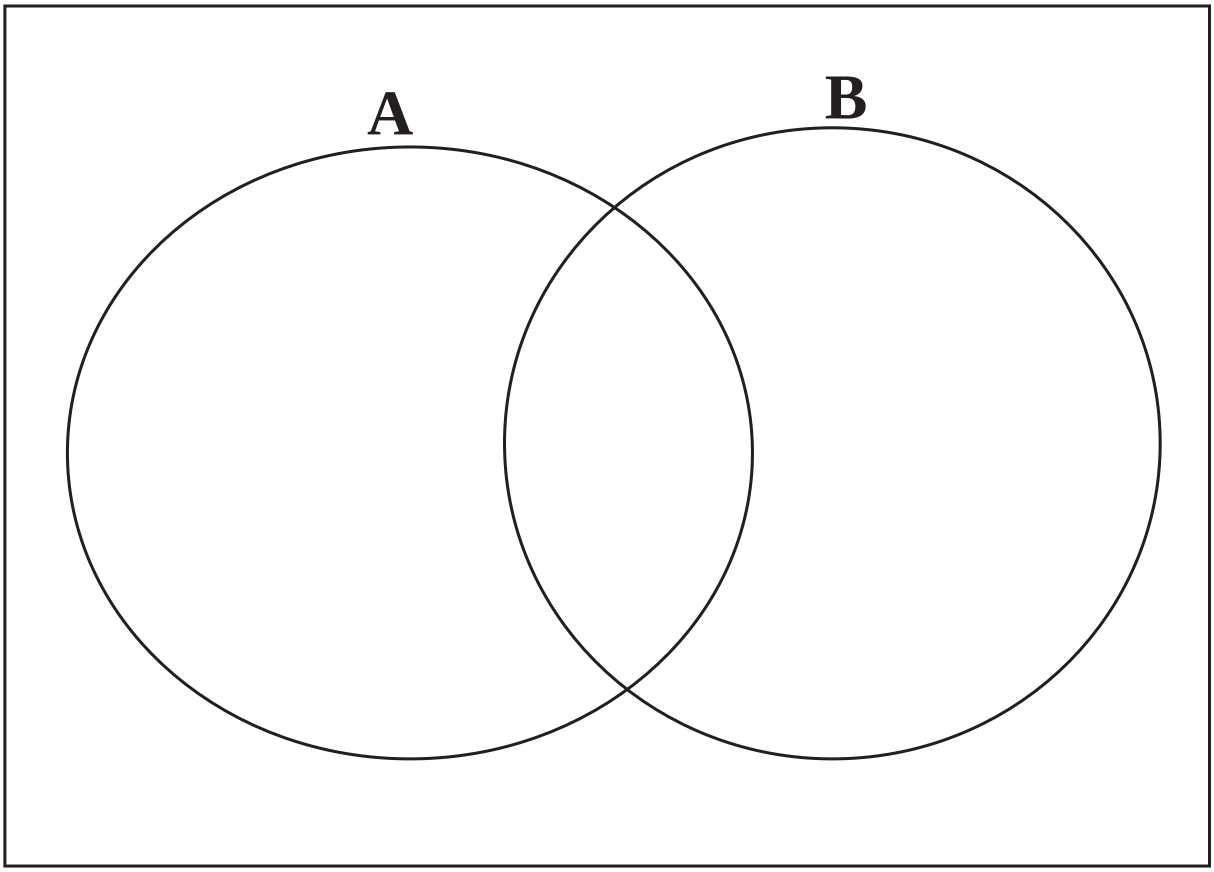
OS 1.7 *Illustrating Sets*

The sets A and B consist of numbers taken from the whole numbers 0, 1, 2, 3, . . . , 9, so that

Set A = { 4, 7, 9 }

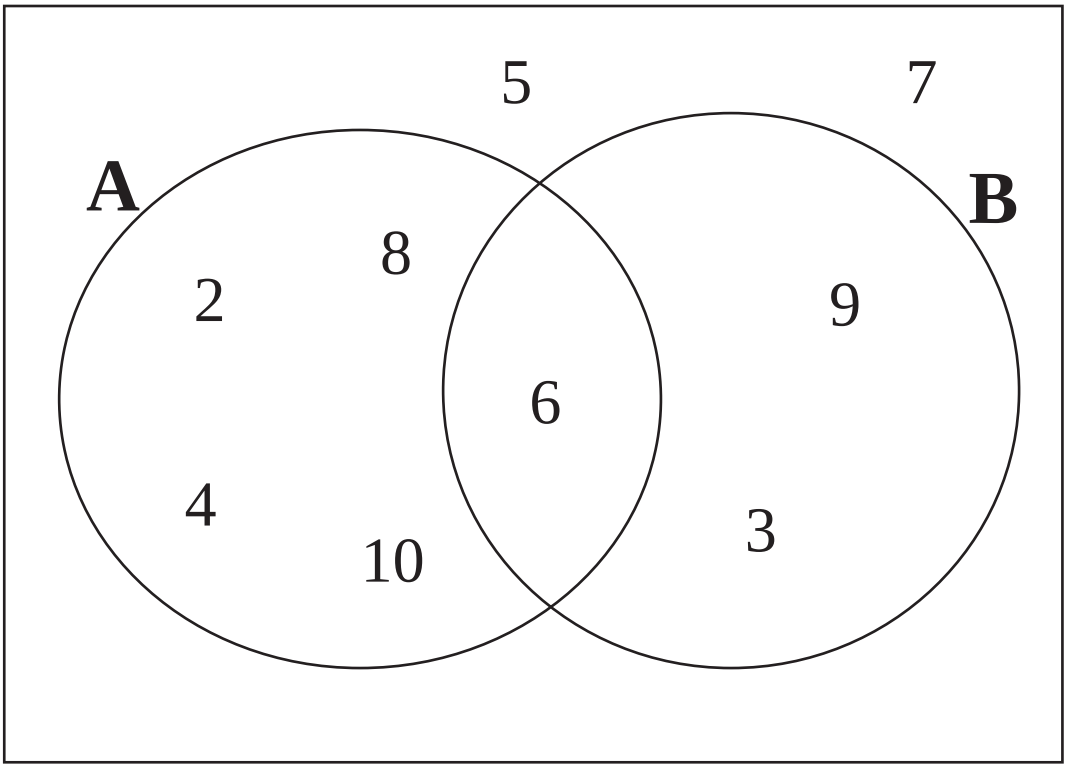
Set B = { 1, 2, 3, 4, 5 }

Illustrate these sets in a Venn diagram.



OS 1.8 *Identifying Sets*

The whole numbers from 1 to 10 are placed in a Venn diagram.



(a) Write down the members of the sets.

A = { . . . . }

B = { . . . . }

(b) Describe the sets A and B in words.

OS 1.9 *Identifying and Illustrating Sets*

Set A contains the whole numbers greater than 6 but less than 12.

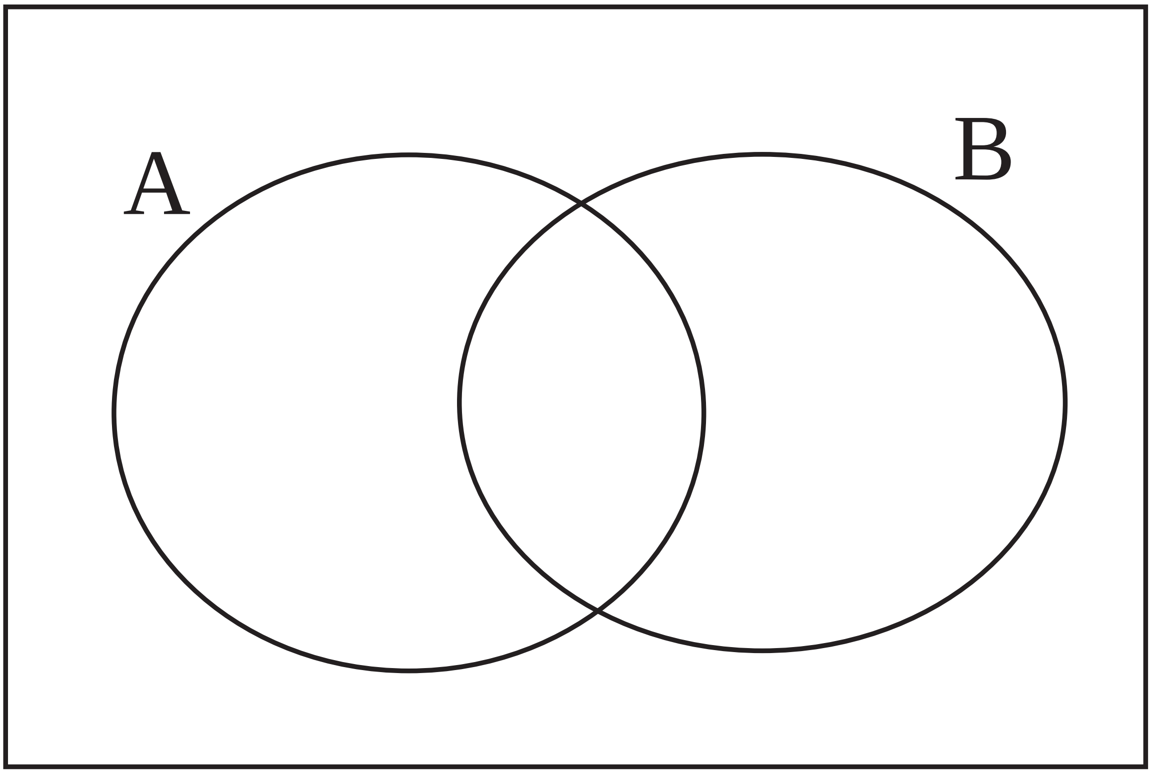
Set B contains the whole numbers greater than 2 but less than 10.

(a) List set A and set B.

A = { . . . . }

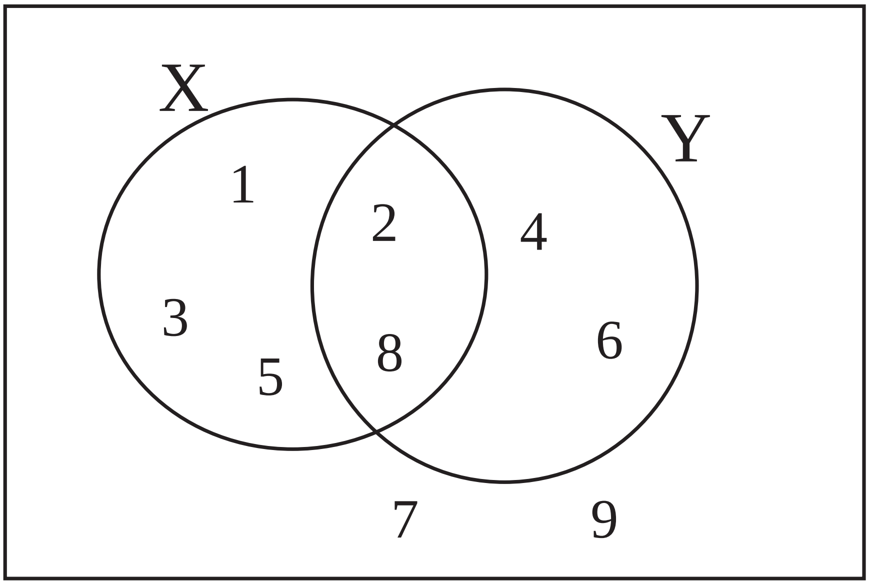
B = { . . . . }

(b) Illustrate the sets A and B on the Venn diagram below, including all the whole numbers from 1 to 15.



OS 1.10 *Intersection and Union*

The sets X and Y are shown in this Venn diagram.



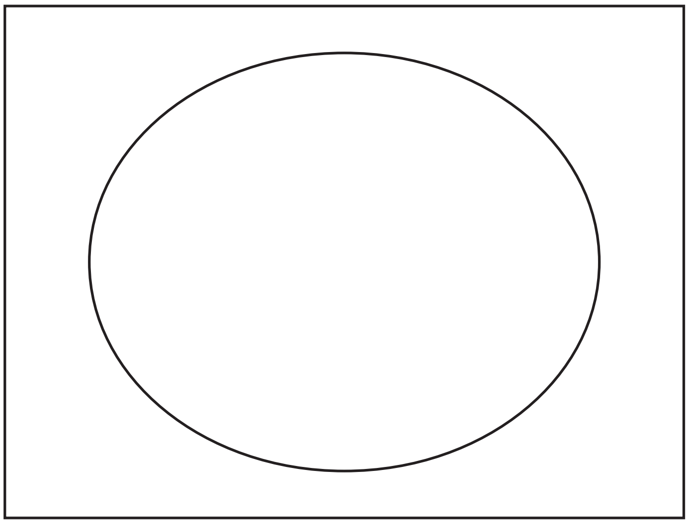
Find:

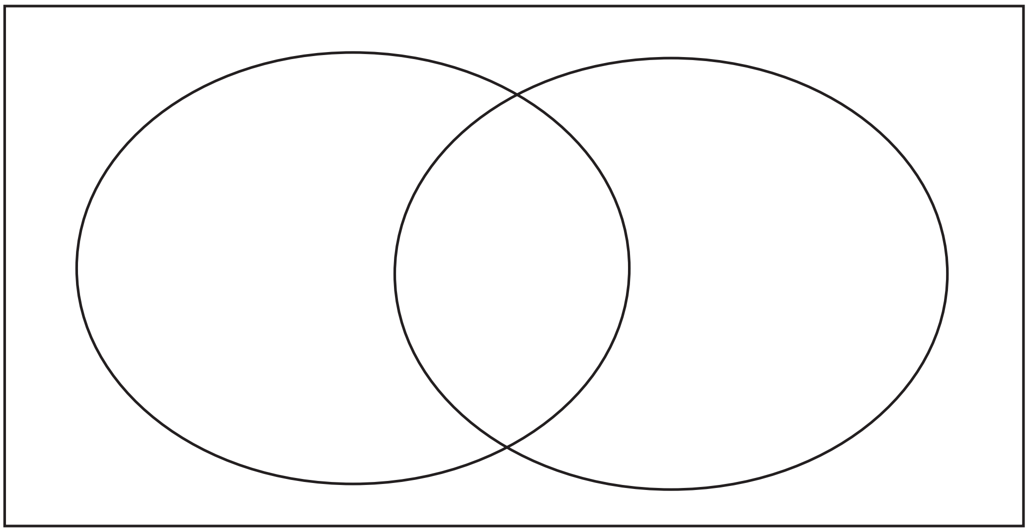
(a) the intersection of X and Y : { . . .. }

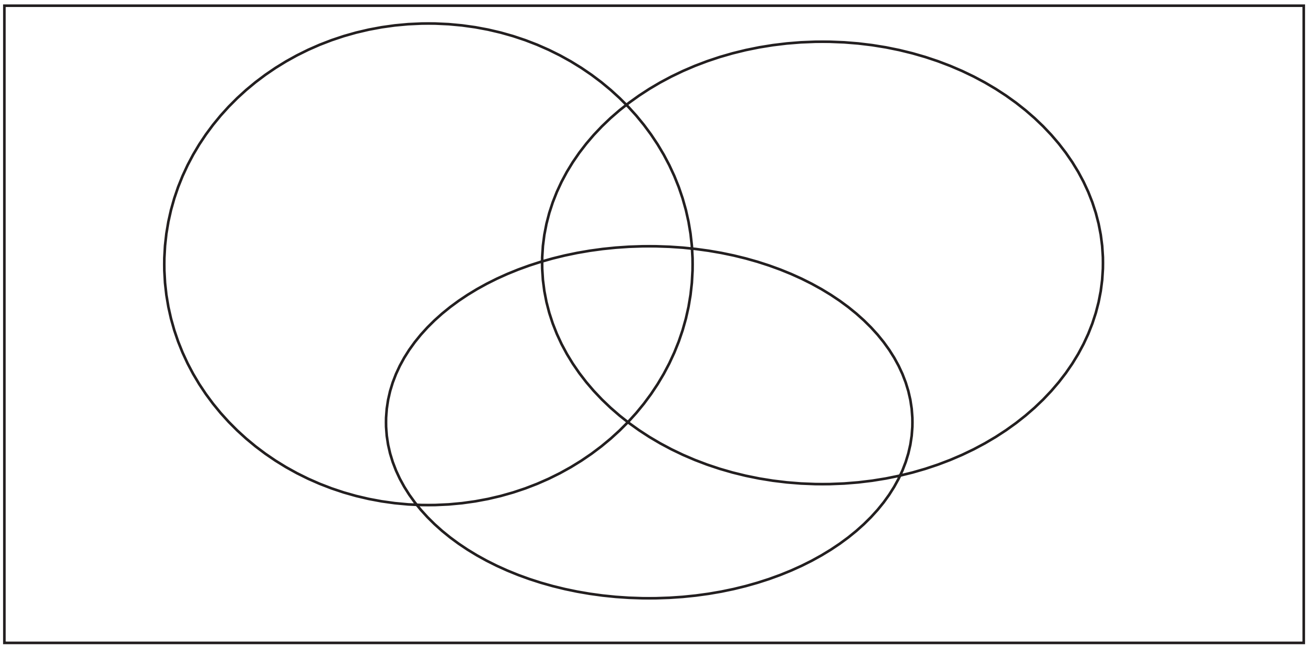
(b) the union of X and Y ; { . . . . }

(c) the complement of X : { . . . . }

OS 1.11 *Sets and Venn Diagrams*

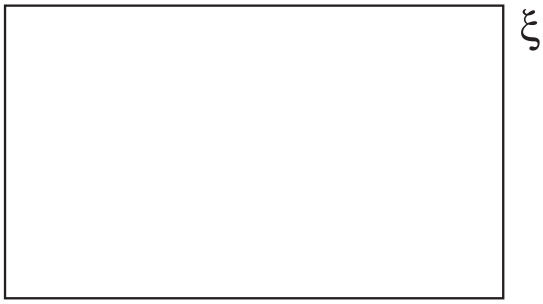




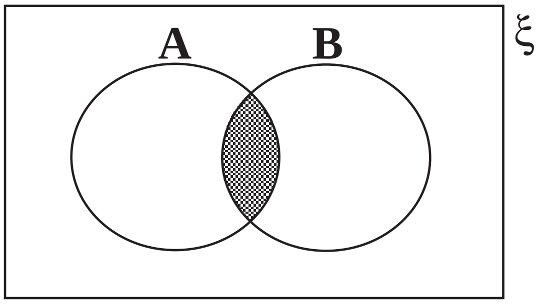


OS 1.12 *Definitions*

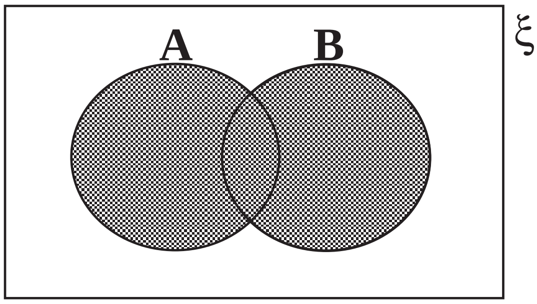
ξ : *universal set*



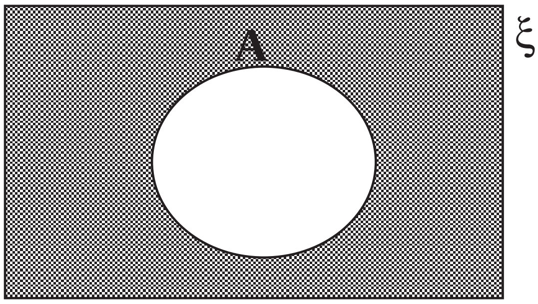
A ∩ B : the *intersection* of A and B



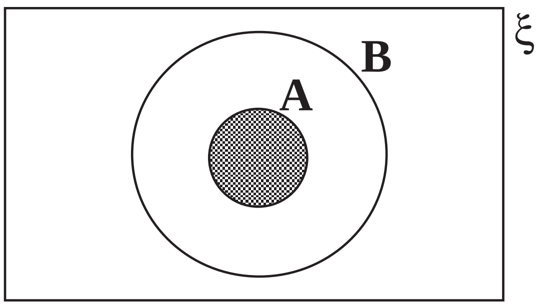
A ∪ B : the *union* of A and B



A' : the *complement* of A and B

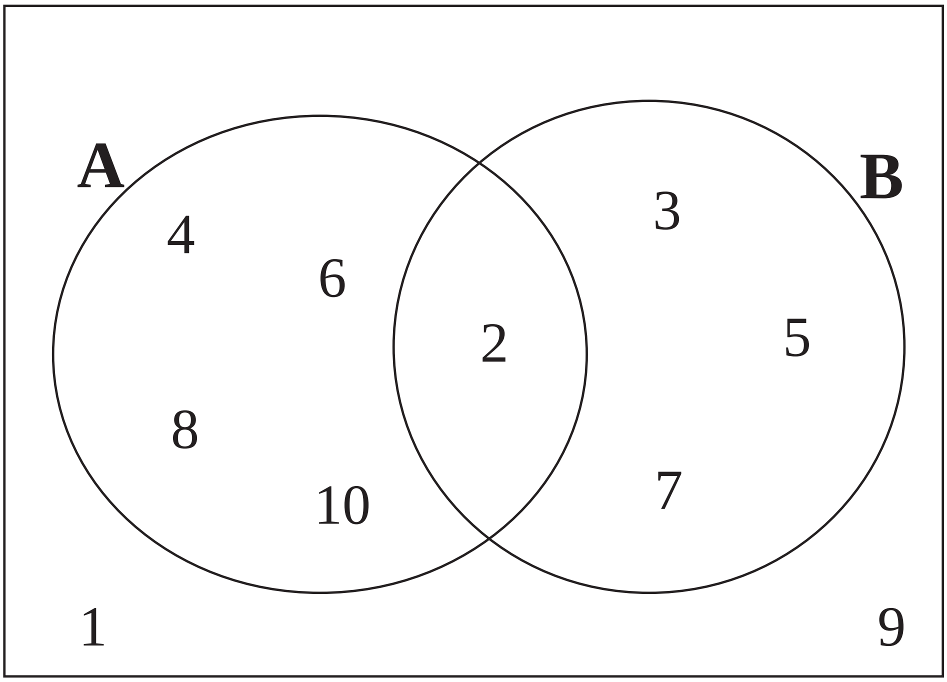


A ⊂ B : A is a *subset* of B



∅ : empty set

OS 1.13 *Using Set Notation*



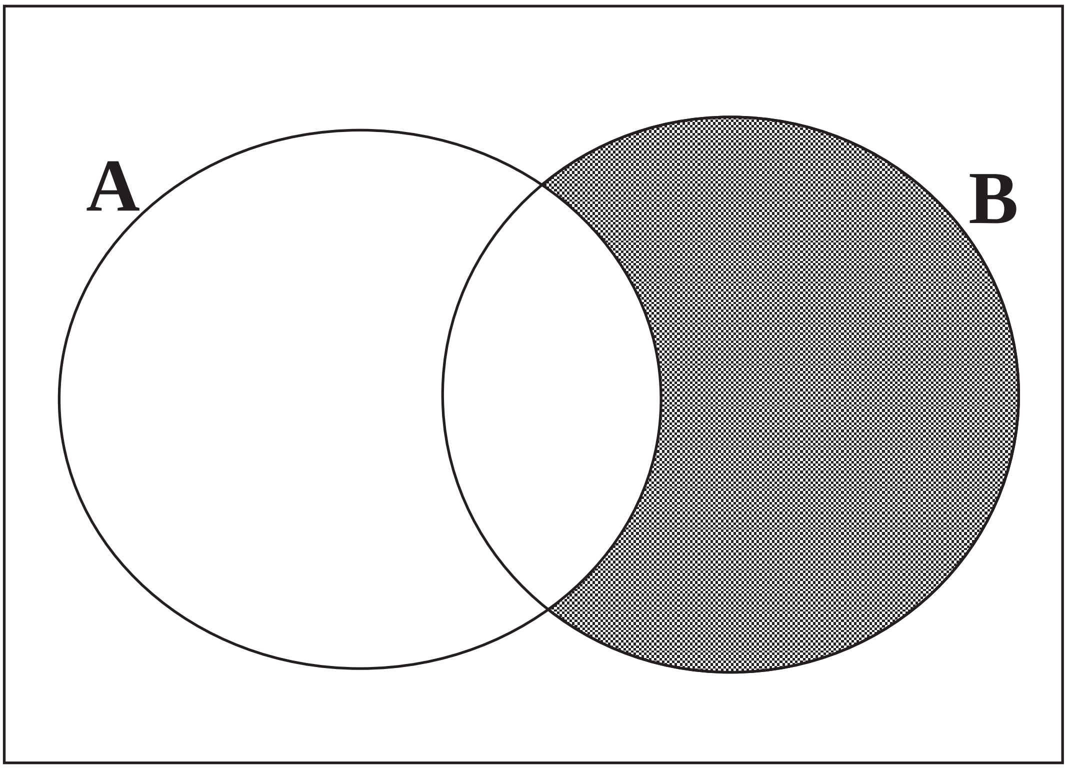
1. Describe in words, set A and set B.

2. Find
   (a) $A = \{ \ldots\ldots\ldots\ldots\ldots\ldots \}$
   (b) $\xi = \{ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \}$
   (c) $A \cap B = \{ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \}$
   (d) $A \cup B = \{ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \}$
   (e) $A' = \{ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \}$
   (f) $A \cap A' = \{ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \}$
   (g) $(A \cap B)' = \{ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \}$
   (h) $A \cap B' = \{ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \}$
   (i) $A \cup B' = \{ \ldots\ldots\ldots\ldots\ldots\ldots\ldots \}$

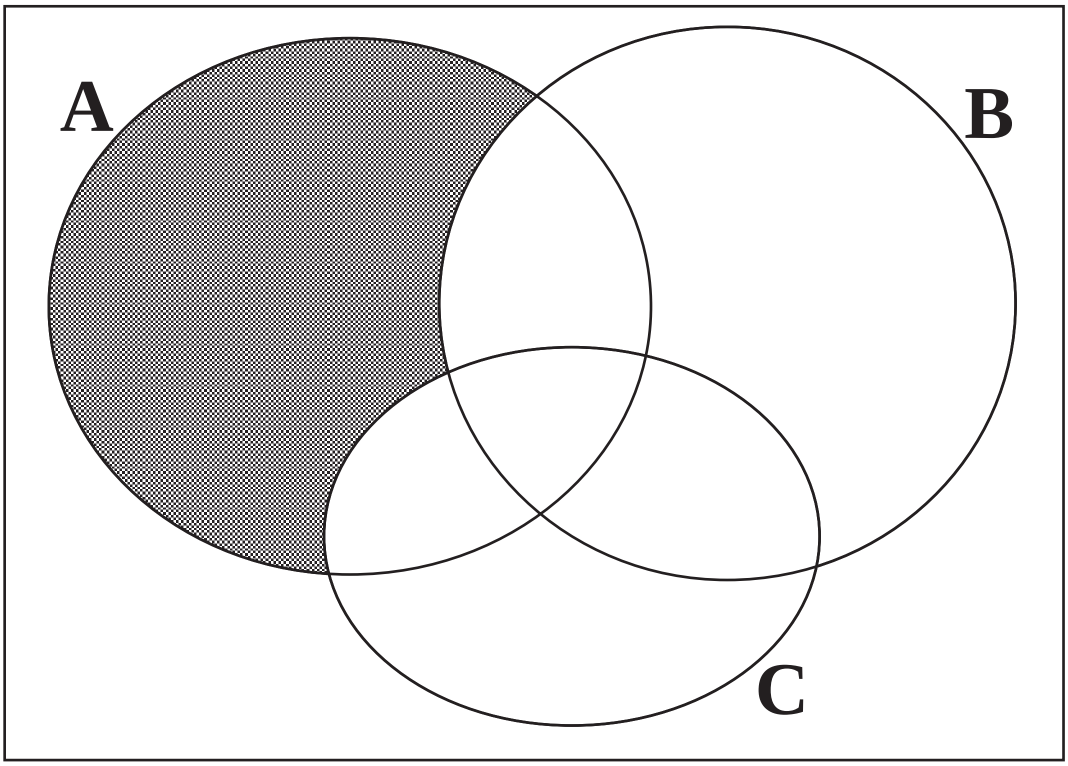
OS 1.14 *Describing Sets 1*

Use set notation to describe the shaded regions of these diagrams.

(a)



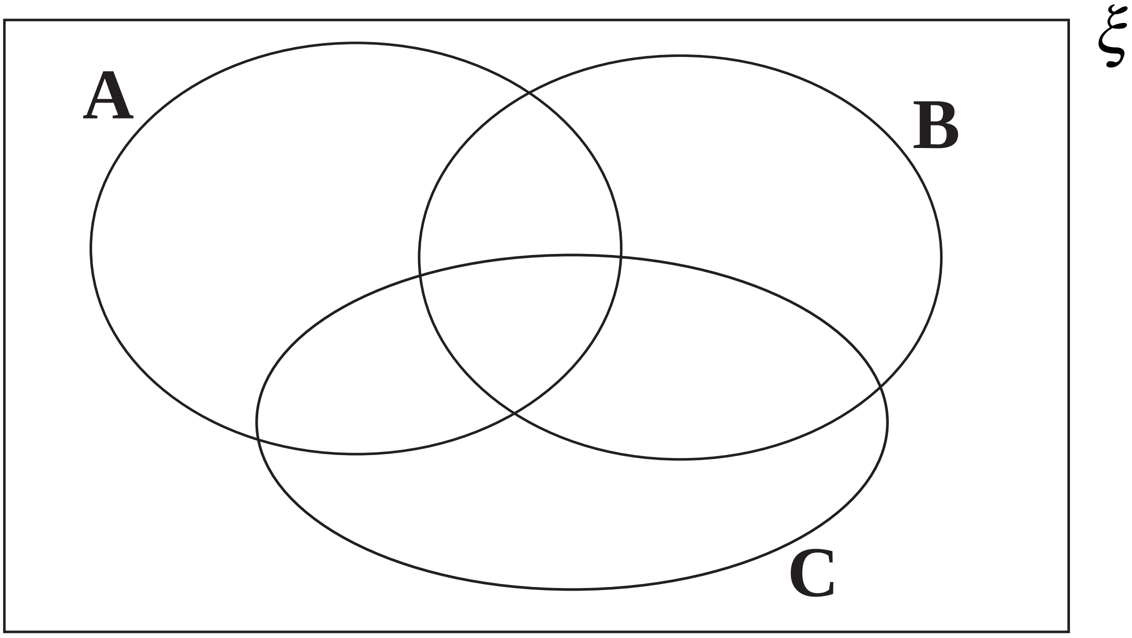
(b)



OS 1.15 *Describing Sets 2*

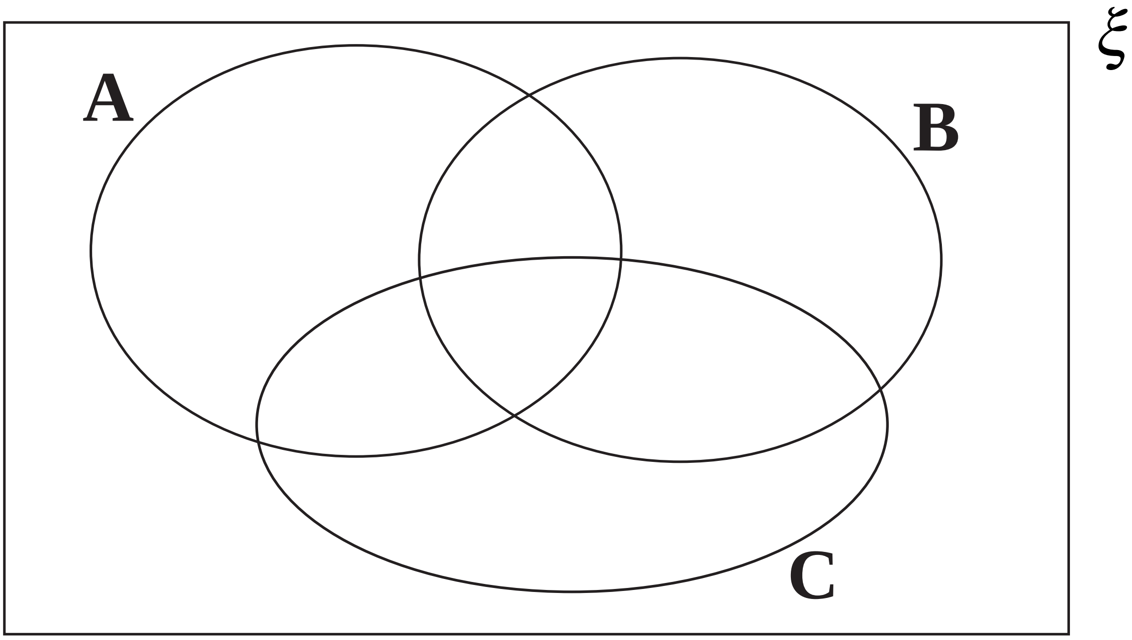
(a) On this diagram, shade the region that represents

$$(A \cup B) \cap C'$$



(b) On this diagram, shade the region that represents

$$A \cap B \cap C'$$

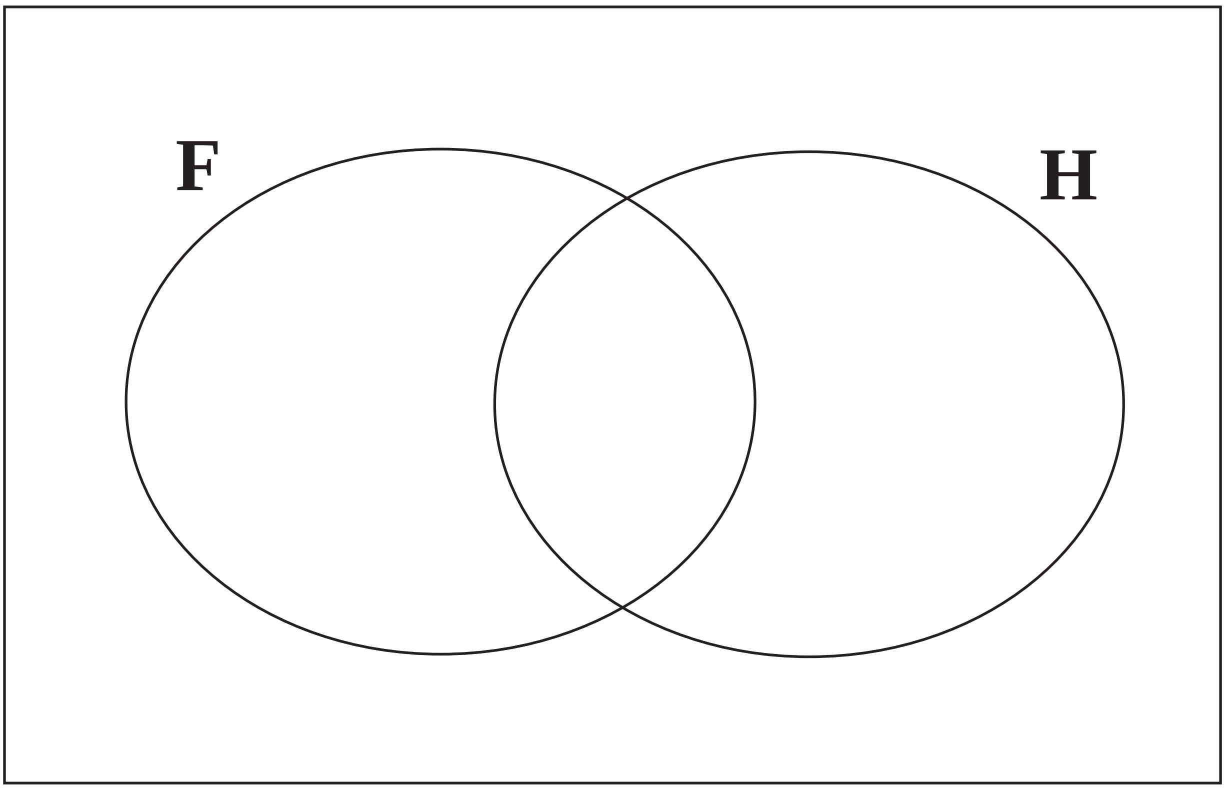


OS 1.16 *Logic Problems and Venn Diagrams*

In a class there are

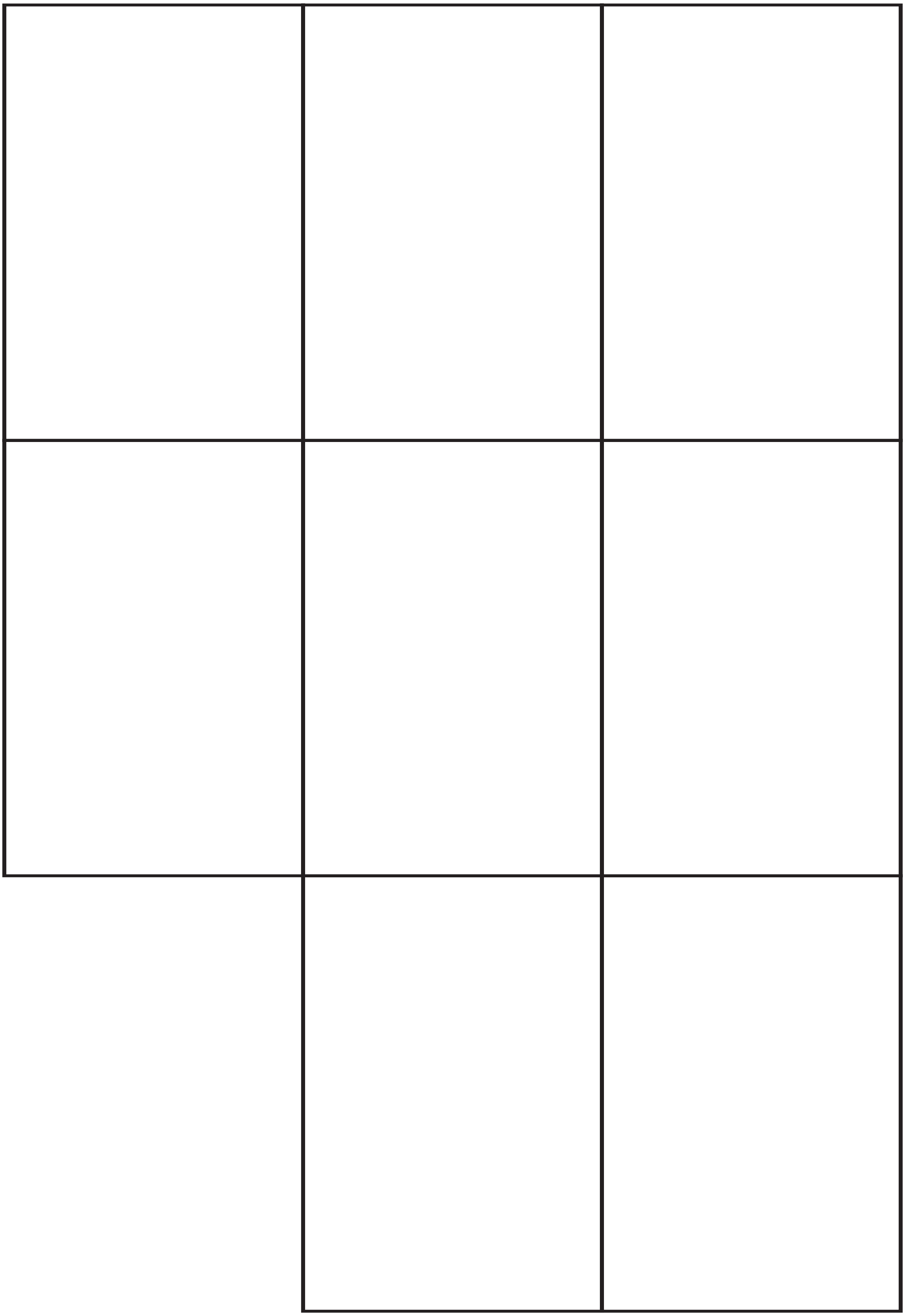
- 8 children who play football and hockey
- 7 children who do not play football or hockey
- 13 children who play hockey
- 19 children who play football.

Illustrate these facts on a Venn diagram, and find how many children there are in the class.

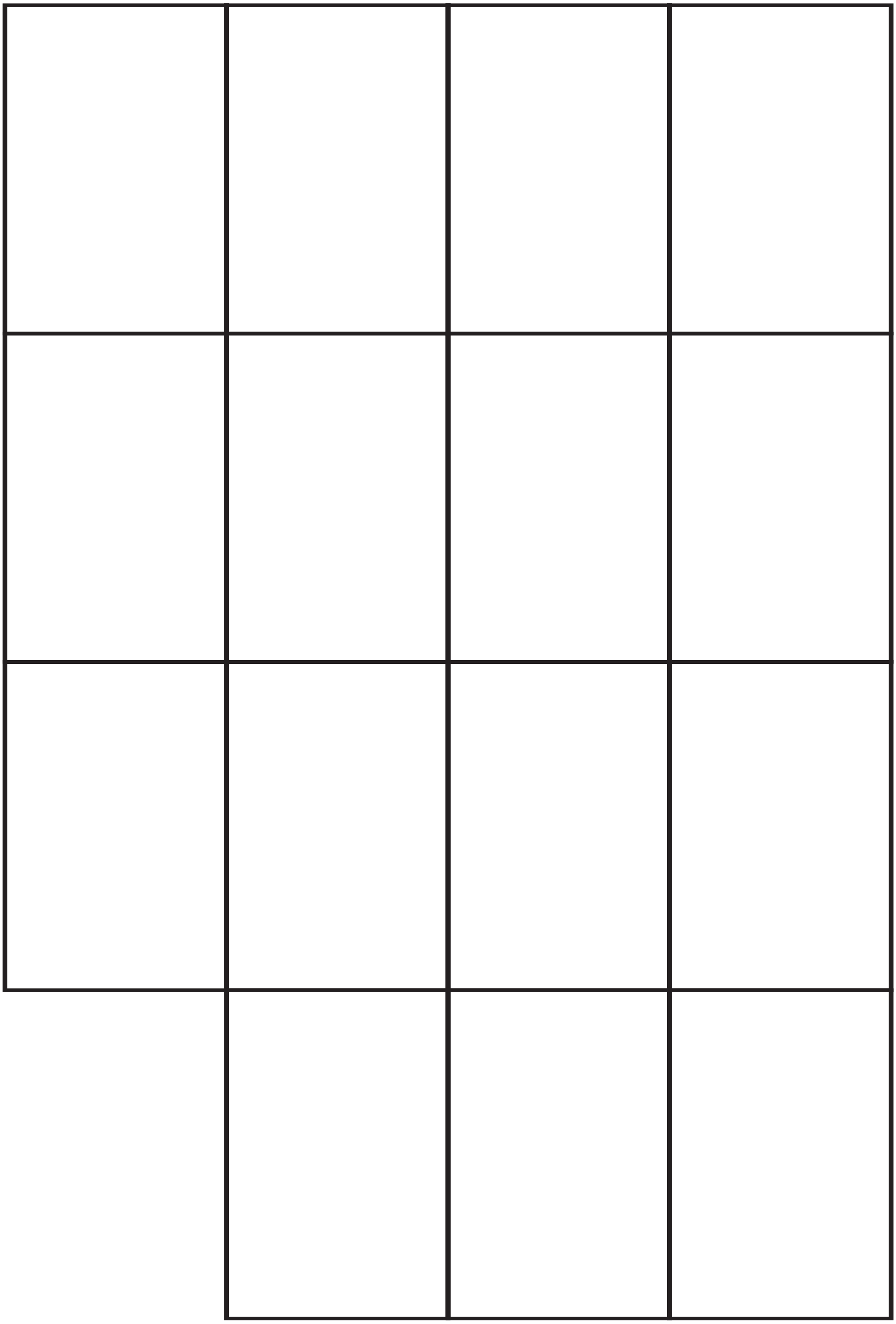


Total number of children in class =

OS 1.17 2×2 *Logic Table*



OS 1.18 3×3 *Logic Table*



Practice Book *UNIT 1 Logic* Answers

1.1 Logic Puzzles

1.

	Goldfish	*Dog*	*Budgie*
Jane	✗	✗	✓
Bill	✓	✗	✗
Kelly	✗	✓	✗

Jane : *Budgie*
Bill : *Goldfish*
Kelly : *Dog*

2.

	Badminton	*Tennis*	*Football*
Karen	✗	✗	✓
John	✗	✓	✗
Jenny	✓	✗	✗

Karen : *Football*
John : *Tennis*
Jenny : *Badminton*

3.

	Maths	*PE*	*Art*
Daniel	✓	✗	✗
Sarah	✗	✓	✗
Jane	✗	✗	✓

Daniel : *Maths*
Sarah : *PE*
Jane : *Art*

4.

	8 *yrs*	12 *yrs*	16 *yrs*
John	✓	✗	✗
Alan	✗	✗	✓
Charlie	✗	✓	✗

John : *8 years*
Alan : *16 years*
Charlie : *12 years*

5. Chris : *Baked potato, cheese and beans*
Adam : *Chips, mushroom pizza and salad*

6.

	Red	*Blue*	*White*	*Black*
Amanda	✗	✓	✗	✗
Jo	✗	✗	✗	✓
Alex	✗	✗	✓	✗
Zarah	✓	✗	✗	✗

Amanda : *Blue*
Jo : *Black*
Alex : *White*
Zarah : Red

1.1 Answers

7.

	Bill	*John*	*Fred*	*Jim*
Mrs Brown	✗	✗	✓	✗
Mrs Green	✗	✓	✗	✗
Mrs Black	✓	✗	✗	✗
Mrs White	✗	✗	✗	✓

Mrs Brown : *Fred*
Mrs Green : *John*
Mrs Black : *Bill*
Mrs White : *Jim*

8. Ist : *Leah*
2nd : *Nadida*
3rd : *Alice*
4th : *Anna*

9.

	6 years	*8 years*	*11 years*	*14 years*
Ali	✗	✓	✗	✗
Mohammed	✗	✗	✗	✓
Dipak	✗	✗	✓	✗
Nesima	✓	✗	✗	✗

10. *Question 10 requires pupils to write clues for a given logic table, rather than to solve a problem, given clues.*

This is a set of *possible* clues: there are many others.

- Ben kicks a ball into a net
- Abbie does not play a team game
- Helen uses a stick

1.2 Two Way Tables

1. (a) 40 (b) 42 (c) 20 (d) 70
(e) Manchester United; more happy fans
2. (a) 5 (b) 10 (c) 3 (d) 33
3. (a) 74 (b) 179 (c) 60 (d) 288 (e) 534
4. (a) 6 (b) 11 (c) BMX (or 12-speed bike)
5. (a) $484 - (40 + 36 + 55 + 161 + 144) = 484 - 436$
$= 48$

(b) 103 (c) 305 (d) 249 boys, 235 girls; more boys

1.2 Answers

6. (a)

	Less than 4 kg	*4 kg or more*
Boys	64	26
Girls	76	14

(b) 76

7.

	Blue Peter	*Grange Hill*	*Newsround*
Year 7	8	13	1
Year 8	12	5	5

Blue Peter was the most popular programme.

8. (a) 40

(b) You do not know how many had, for example, blue eyes and blond hair.

(c)

	Blue eyes	*Not blue eyes*
Blond hair	12	4
Not blond hair	6	18

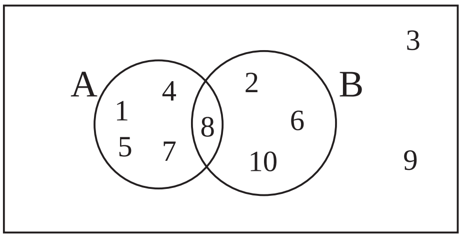
(d) 18

9. 7 cars are not blue and not hatchbacks.

10. 12 boys played hockey.

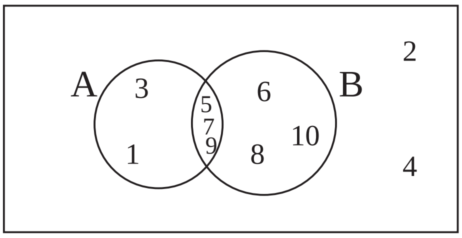
Section 1.3 Sets and Venn Diagrams

1. (a)



(b) { 8 }

2.



(b) { 1, 3, 5, 6, 7, 8, 9, 10 }

1.3 Answers

3. (a) A = { 2, 4, 6, 8, 10, 12 }

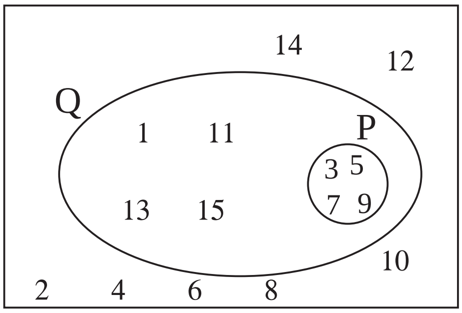
   (b) B = { 4, 8, 12 }

   (c) A = even numbers up to 12

   B = multiples of 4, 4 × table, up to 12

   (d) { 1, 3, 5, 7, 9, 11 }

4. (a)



   (b) { 3, 5, 7, 9 }

5. (a) E = { 2, 4, 6, 8, 10, 12, 14, 16, 18, 20 }

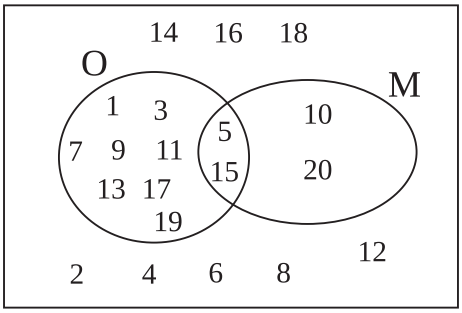
   (b) S = { 1, 4, 9, 16 }

   (c) E = even numbers up to 20

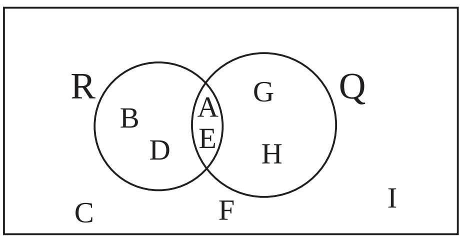
   S = square numbers up to 20

   (d) { 1, 2, 4, 6, 8, 9, 10, 12, 14, 16, 18, 20 }

6.



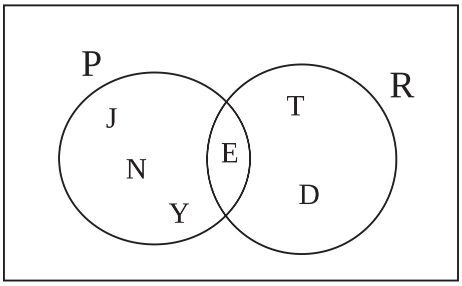
7. (a)



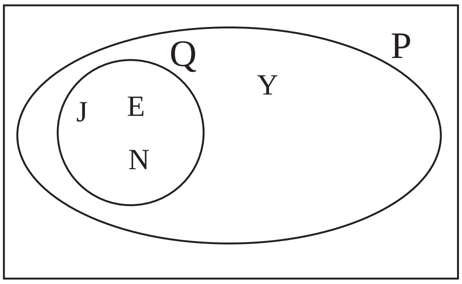
   (b) { A, E } (c) { B, D } (d) { C, F, I }

1.3 Answers

8. (a)



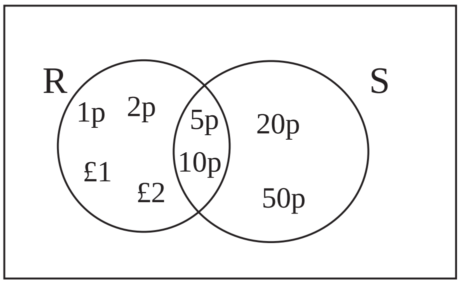
(b)



(c) Union = {D, E, J, N, T, Y }

(d) Intersection = { E }

9.



10. (a) C (b) B (c) B (d) A

1.4 Set Notation

1. (a) $A \cap B = \{ 6 \}$
   (b) $A \cup B = \{ 2, 3, 4, 6, 8, 9 \}$
   (c) $A' = \{ 1, 3, 5, 7, 9, 10 \}$
   (d) $B' = \{ 1, 2, 4, 5, 7, 8, 10 \}$
   (e) $A' \cap B' = \{ 1, 5, 7, 10 \}$
   (f) $A' \cup B' = \{ 1, 2, 3, 4, 5, 7, 8, 9, 10 \}$

2. (a) $A \cap B = \{ 21 \}$
   (b) $(A \cap B)' = \{ 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 \}$
   (c) $A \cup B = \{ 12, 14, 15, 18, 21 \}$
   (d) $A' = \{ 10, 11, 12, 13, 15, 16, 17, 18, 19, 20 \}$
   (e) $B' = \{ 10, 11, 13, 14, 16, 17, 19, 20 \}$
   (f) $A' \cap B' = \{ 10, 11, 13, 16, 17, 19, 20 \}$
   (g) $A' \cap B = \{ 12, 15, 18 \}$

1.4 Answers

3. (a) $A \cap B = \{ 1, 10 \}$

(b) $A \cap C = \{ 3, 6 \}$

(c) $B \cap C = \varnothing$

(d) $A \cup B = \{ 1, 3, 5, 6, 10 \}$

(e) $A \cup C = \{ 1, 3, 6, 9, 10, 12 \}$

(f) $C' = \{ 1, 2, 4, 5, 7, 8, 10, 11 \}$

(g) $A \cap C' = \{ 1, 10 \}$

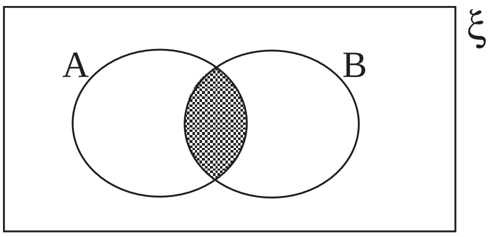
(h) $B' = \{ 2, 3, 4, 6, 7, 8, 9, 11, 12 \}$

(i) $B' \cup C' = \{ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 \}$

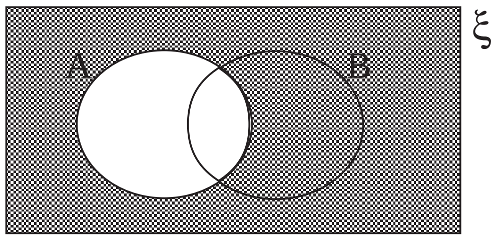
(j) $A \cap B \cap C = \varnothing$

(k) $A \cup B \cup C = \{ 1, 3, 5, 6, 9, 10, 12 \}$

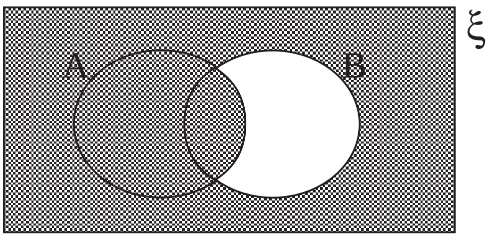
4. (a)



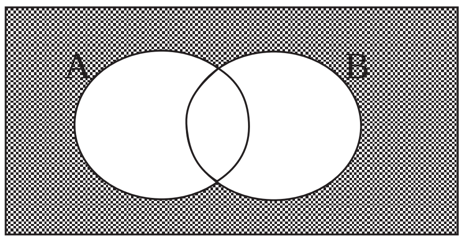
(b)



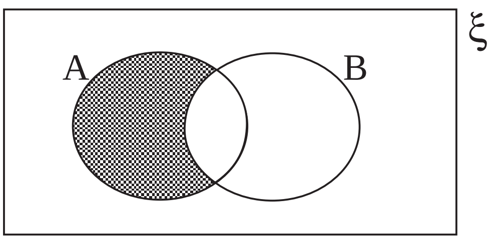
(c)



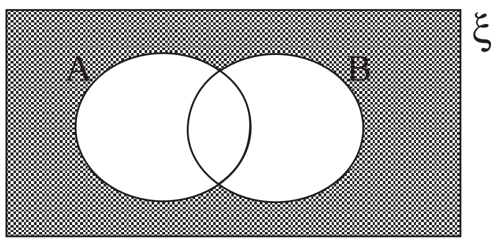
(d)



(e)



(f)



5. (a) $A \cup B$ (b) D' (c) $A \cup B$

(d) $P \cap Q'$ (e) J (f) $(K \cap L)'$ or $K' \cup L'$

6. (a) True (b) False (c) True

(d) False (e) True (f) False

(g) True

1.4 Answers

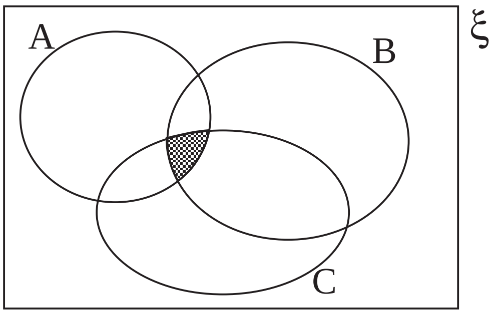
7. (a) True (b) False $A \subset C$

(c) True (d) False $A \cap C = \{ a, c, e \}$

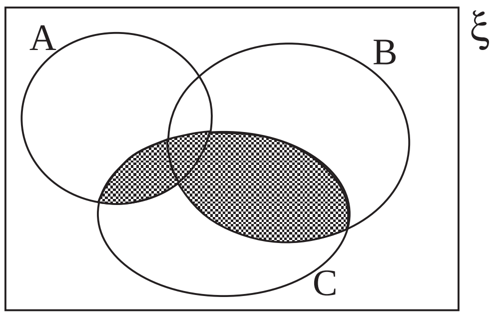
(e) True (f) True

(g) False $A \cap B' = A$

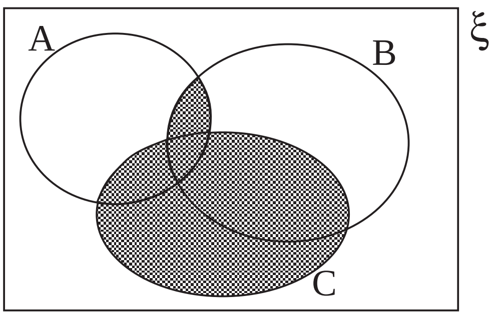
8. (a)



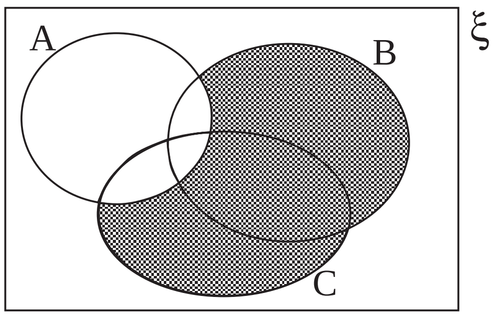
(b)



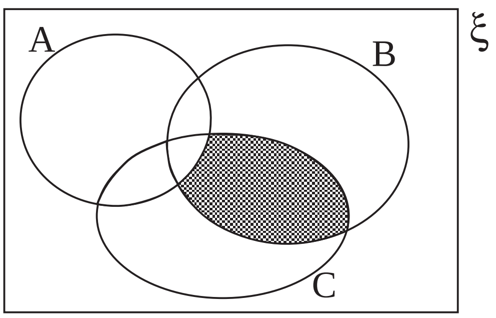
(c)



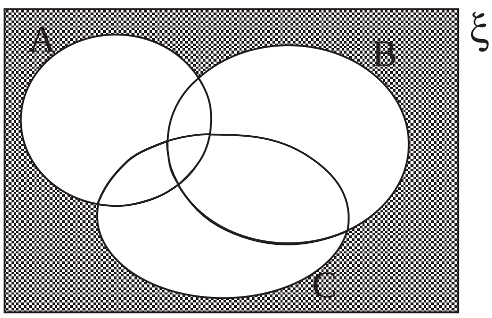
(d)



(e)



(f)

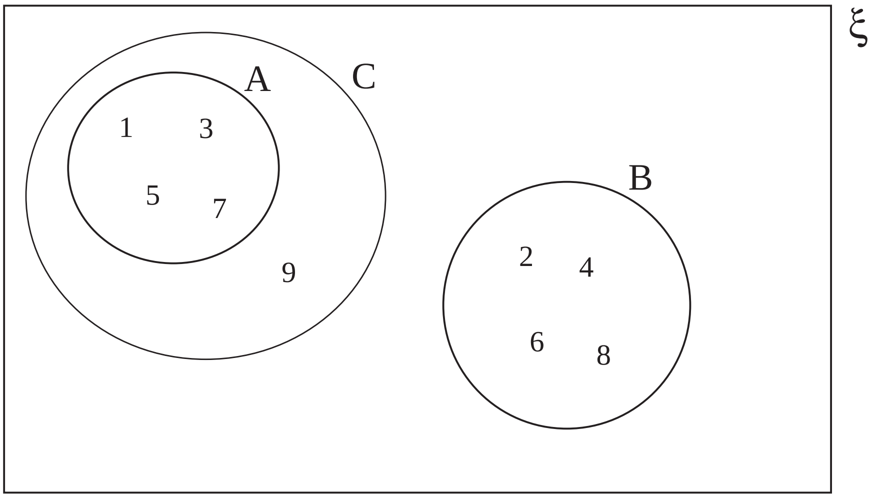


9. (a) $(A \cup B)' \cap C$ (b) $A \cup B \cup C$

(c) $B \cap A' \cap C'$ (d) $A \cap B$

(e) $A \cup B \cup C$ (f) $(A \cap C) \cap B'$

1.4 Answers

10. 

(a) $A \cap B = \varnothing$

(b) $C' = \{2, 4, 6, 8\}$
$= B$

(c) $A \cap C = \{1, 3, 5, 7\}$
$= A$

(d) $B \cap C = \varnothing$

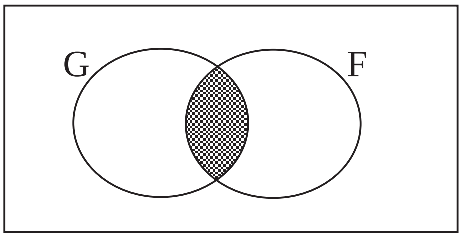
(e) $A \cup B = \{1, 2, 3, 4, 5, 6, 7, 8\}$

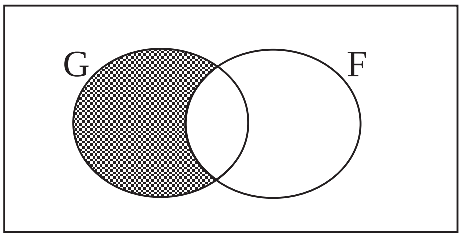
(f) $(A \cup B)' = \{9\}$

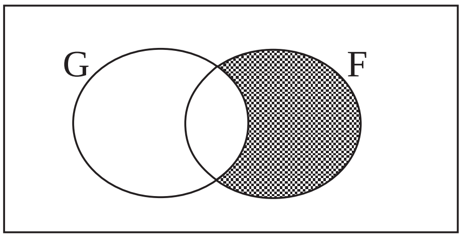
(g) $(A \cup B) \cap C = \{1, 3, 5, 7\}$

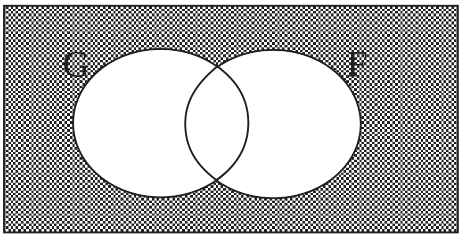
(h) $(A \cup B) \cap C' = \{2, 4, 6, 8\}$

1.5 Logic Problems and Venn Diagrams

1. 1 member of the family plays only football.
2. 2 portions of chips have only salt.
3. (a) 

(b) 

(c) 

(d) 

4. 8 pupils like pancakes and maple syrup.
5. (a) 18 cars (b) 12 cars (c) 16 cars

1.5 Answers

6. 3 people wear glasses and hold a newspaper.

7. 2 blue pens do not work.

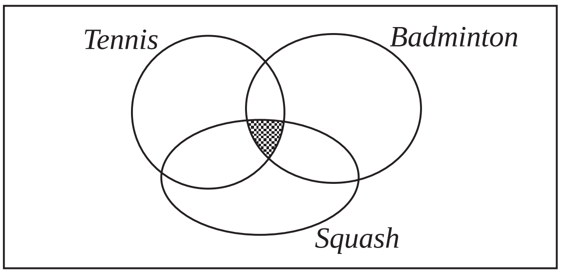
8. (a) 14 are eating fish and chips.

   (b) 3 are eating fish without chips.

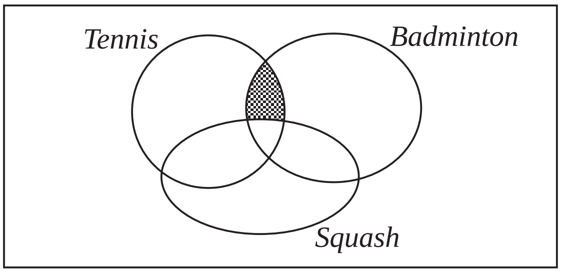
   (c) 12 are eating only chips.

Questions 9, 10 and 11 involve situations that will require Venn diagrams or situations involving 3 sets.

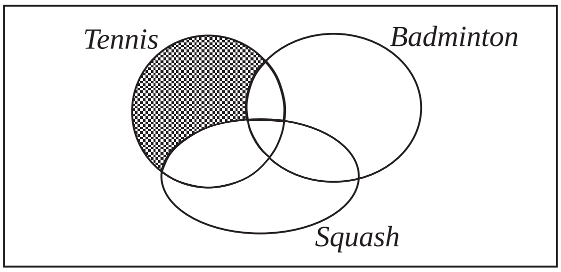
9. (a)



   (b)



   (c)



10. (a) 10

    (b) Art : 15
    Chess : 19
    Drama : 20

11. 17 pupils eat school dinners.

UNIT 1 *Logic* **Revision Test 1** (Standard)

1. Tom, Jarid and Joe own one pet each. They own a goldfish, a dog and a cat.

(a) Copy this logic table.

	Tom	*Jarid*	*Joe*
Goldfish			
Dog			
Cat			

(b) Use these clues to complete the table.

Clue 1: Tom's pet has no legs.

Clue 2: Jarid owns a cat.

(c) Write down who owns which pet.

(6 marks)

2. Adam, Naomi and Ian buy different coloured yo-yos. One yo-yo is red, one is yellow and the other is green.

(a) Copy the logic table.

	Adam	*Naomi*	*Ian*
Red			
Yellow			
Green			

(a) Use these clues to complete the table.

Adam's yo-yo is not red.

Naomi's yo-yo is not yellow.

Naomi's yo-yo is not red.

(c) Write down who has which colour yo-yo.

(6 marks)

Revision Test 1 (Standard)

3. This table gives information on the children in a Year 7 class.

	Age 11	*Age 12*
Boys	10	3
Girls	8	9

Answer these questions:

(a) How many girls are age 12?

(b) How many boys are age 11?

(c) How many girls are age 11?

(d) How many boys are age 12?

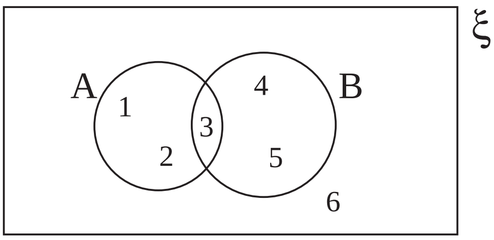
(e) How many children are there in the class?

(f) How many boys are there in the class?

(g) How many girls are there in the class?

(11 marks)

4. Use this Venn diagram to answer the questions below.



(a) Which numbers are in the set A?

(b) Which numbers are in the set B?

(c) Which number is in set A *and* set B?

(d) Which number is *not* in set A and *not* in set B?

(e) Which numbers are in set A but not in set B?

(7 marks)

(30 MARKS)

UNIT 1 *Logic* **Revision Test 2** (Academic)

1. Ben, Tom and Adam each buy different coloured yo-yos.
One yo-yo is red, one is yellow and the other is green.

(a) Use these clues to complete this logic table.

Clue 1: Ben's yo-yo is not green.

Clue 2: Tom's yo-yo is not red or green.

	Red	*Yellow*	*Green*
Ben			
Adam			
Tom			

(b) State the colour of the yo-yo each boy buys.

(6 marks)

2. In a survey, people were asked if they owned a car and if they owned a bicycle. The results are given in the table below.

	Car	*No car*
Bicycle	28	5
No bicycle	30	4

(a) How many people owned a car and a bicycle?

(b) How many people owned a car but not a bicycle?

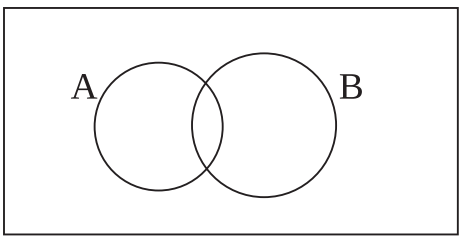
(c) How many people each owned a car?

(d) How many people each owned a bicycle?

(e) How many people took part in the survey?

(8 marks)

3. (a) Copy and complete this Venn diagram.



A = { 4, 7, 8, 9 }

B = { 1, 2, 3, 4 }

Include all whole numbers from 1 to 9.

(b) What is the intersection of A and B?

(c) What is the union of A and B?

(d) What is the complement of A?

(9 marks)

Revision Test 2 (Academic)

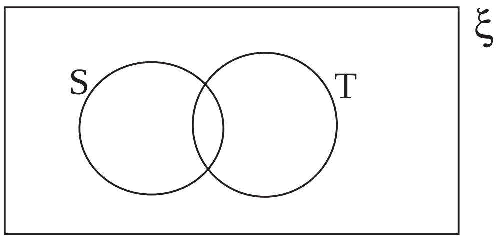
4. In a class of 29 children, each child plays at least one sport.
20 children play football and 18 play cricket.

How many children play cricket *and* football?

(3 marks)

5. The set S represents the number of members of a squash club.
The set T represents the number of members of a tennis club.

Make 2 copies of this Venn diagram.



(a) On one diagram, shade the part that represents the people who are members of both clubs.

(b) On the other diagram, shade the part that represents the people who belong to the squash club, but not to the tennis club.

(4 marks)

(30 MARKS)

UNIT 1 *Logic* **Revision Test 3** (Express)

1. Sarah, Jenny, Rachel and Emma each order a drink.
One of them has cola, one has orange, one has limeade and the other has water.

(a) Use these clues to complete the logic table.

Clue 1: Sarah does not like cola.

Clue 2: Jenny only likes orange.

Clue 3: Emma only likes orange and limeade.

	Cola	*Orange*	*Limeade*	*Water*
Sarah				
Jenny				
Rachel				
Emma				

(b) State clearly who has which drink.

(6 marks)

2. A headteacher collected information about 200 of her pupils.

	Left-handed	*Right-handed*
Wears glasses	8	39
Does not wear glasses	2	

(a) How many of the right-handed pupils wear glasses?

(b) How many of the pupils wear glasses?

(c) How many of the pupils are left-handed?

(d) How many pupils who are right-handed do not wear glasses?

(8 marks)

3. The whole numbers from 1 to 12 are to be included in a Venn diagram.

A = { 2, 4, 6, 8, 10, 12 }

B = { 3, 6, 9, 12 }

(a) Draw a Venn diagram to show the sets A and B.

(b) What is the union of A and B?

(c) What is the intersection of A and B?

(d) What is the complement of B?

(9 marks)

Revision Test 3 (Express)

4. In a class of 32 children there are 8 children who belong to no club at all, 16 who belong to the music club and 5 who belong to both the music club and the chess club.

   How many children belong only to the chess club?

   (3 marks)

5. Draw a Venn diagram for each pair of sets described below.

   (a) Set R contains all those people who own red cars.
   Set C contains all those people who own cars.

   (b) Set B contains all the boys in a school.
   Set G contains all the girls in a school.

   (4 marks)

(30 MARKS)

Revision Test 1 (Standard) Answers

1. (a) and (b)

	Tom	*Jarid*	*Joe*
Goldfish	✓	✗	✗
Dog	✗	✗	✓
Cat	✗	✓	✗

M1 M1 A1 A1

(c) *Tom* : Goldfish
Jarid : Cat
Joe : Dog B1 B1 *(6 marks)*

2. (a) and (b)

	Adam	*Naomi*	*Ian*
Red	✗	✗	✓
Yellow	✓	✗	✗
Green	✗	✓	✗

M1 M1 A1 A1

(c) *Adam* : Yellow
Naomi : Green
Ian : Red B1 B1 *(6 marks)*

3. (a) 9 B1
(b) 10 B1
(c) 8 B1
(d) 3 B1
(e) $10 + 3 + 8 + 9 = 30$ M1 M1 A1
(f) $10 + 3 = 13$ M1 A1
(g) $8 + 9 = 17$ M1 A1
(11 marks)

4. (a) 1, 2, 3 B1 B1
(b) 3, 4, 5 B1 B1
(c) 3 B1
(d) 6 B1
(e) 1, 2 B1
(7 marks)

(TOTAL MARKS 30)

Revision Test 2 (Academic) Answers

1. (a)

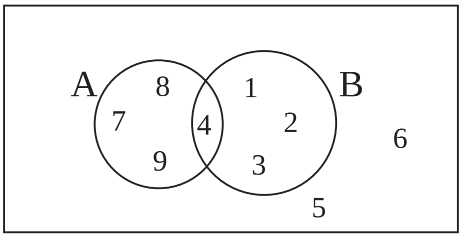
	Red	*Yellow*	*Green*
Ben	✓	×	×
Adam	×	×	✓
Tom	×	✓	×

M1 M1 A1 A1

(b) Ben : *Red*
Adam : *Green*
Tom : *Yellow* B1 B1 *(6 marks)*

2. (a) 28 B1
(b) 30 B1
(c) $28 + 30 = 58$ M1 A1
(d) $28 + 5 = 33$ M1 A1
(e) $28 + 5 + 30 + 4 = 67$ M1 A1 *(8 marks)*

3. (a)

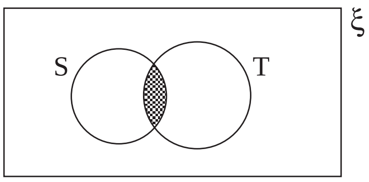


B1 B1 B1

(b) { 4 } M1 A1
(c) { 1, 2, 3, 4, 7, 8, 9 } M1 A1
(d) { 1, 2, 3, 5, 6 } M1 A1 *(9 marks)*

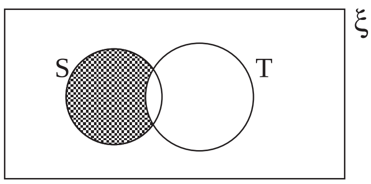
4. $20 + 18 - 29 = 9$ children who play football and cricket M1 M1 A1 *(3 marks)*

5. (a)



B1 B1

(b)



B1 B1 *(4 marks)*

(TOTAL MARKS 30)

Revision Test 3 (Express) Answers

1. (a)

	Cola	*Orange*	*Limeade*	*Water*
Sarah	✗	✗	✗	✓
Jenny	✗	✓	✗	✗
Rachel	✓	✗	✗	✗
Emma	✗	✗	✓	✗

M1 M1 A1 A1

(b) Sarah : *Water*
Jenny : *Orange*
Rachel : *Cola*
Emma : *Limeade* B1 B1 *(6 marks)*

2. (a) 39 B1

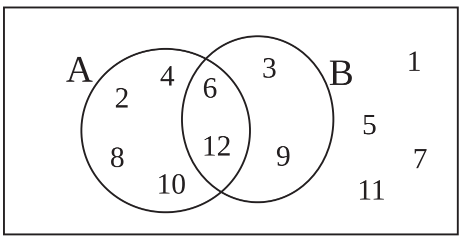
(b) $8 + 39 = 47$ M1 A1

(c) $8 + 2 = 10$ M1 A1

(d) $200 - (39 + 8 + 2) = 200 - 49$ M1

$= 151$ M1 A1 *(8 marks)*

3. (a)



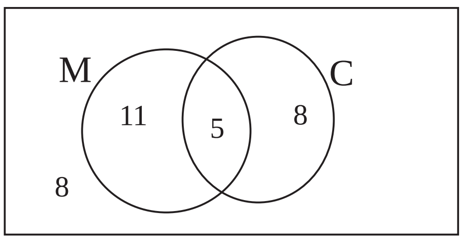
B1 B1 B1

(b) { 2, 3, 4, 6, 8, 9, 10, 12 } M1 A1

(c) { 6, 12 } M1 A1

(d) { 1, 2, 4, 5, 7, 8, 10, 11 } M1 A1 *(9 marks)*

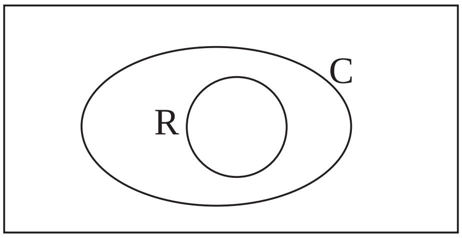
4.



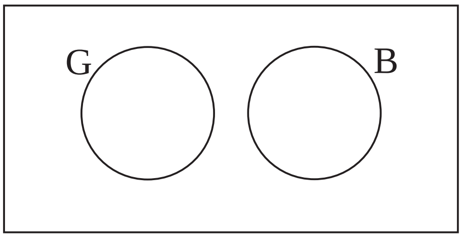
$32 - (8 + 11 + 5) = 8$
13 children belong only to the chess club. M1 M1 A1 *(3 marks)*

Answers

Revision Test 3 (Express)

5. (a) 

B1 B1

(b) 

B1 B1 *(4 marks)*

(TOTAL MARKS 30)

UNIT 1 *Logic* Teaching Notes

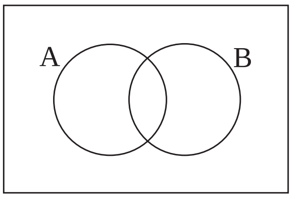
Historical Background and Introduction

This first unit of the course gives an introduction to mathematical logic, which underpins all mathematical study. It is important to stress the exactness of this type of analysis, and to emphasise that the logical arguments given to find answers are the fundamental aspects of mathematics.

Historically, mathematical logic developed from the first serious attempts at mathematical analysis, but the modern-day emphasis on set theory owes much to the European mathematicians of the 19th and even the 20th centuries.

Foremost of these was the Englishman, *George Boole* (1815-1864), who was the instigator of Boolean Algebra (which has been of such fundamental importance to developments in modern-day computer technology), and the Russian, *Georg Cartor* (1845-1915), who founded set theory.

Of particular interest in this unit, is the use of Venn diagrams. These are named after *John Venn* (1834-1923). He was an English mathematician who worked at the University of Cambridge and had a particular interest in logic. A very simple Venn diagram for dealing with two subsets is:



Venn did not actually invent the diagrams which now bear his name. In the previous 300 years, several logicians had dabbled with the idea of using geometrical drawings to illustrate their logic; included among these were *Leibniz* (circles and ellipses) and *Euler* (circles). What Venn did was to survey all that had gone before and, by incorporating the work done by Boole, build a complete and comprehensible system that was much more accessible to all. The diagrams are deservedly named after him.

Venn also realised the limitation imposed by using circles. Three circles can show all the possible eight combinations of three subsets but with four subsets, circles cannot cope (sixteen combinations have to be shown). Venn proposed using ellipses in that case.

It is of interest to note that the mathematician *Charles Dodgson* (1832-1898), who was also a logician, proposed using rectangles rather than circles, and that neatly takes care of the case for four subsets. Dodgson, of course, is better known as Lewis Carroll, the author of 'Alice in Wonderland', and Venn diagrams which use rectangles are called Carroll diagrams.

The early work on set theory, thought to provide a firm and vigorous foundation for mathematical study, was questioned by the English philosopher, *Bertrand Russell* (1872-1970). For nearly a century he lived a varied and turbulent life, achieving fame as a philosopher, writer, educator and peace campaigner as well as being a Member of the House of Lords and a one-time inmate of Brixton jail (during World War 1). He was awarded a Nobel Prize, had four marriages and countless affairs but still managed to be influential with a remarkable number of 'top people', ranging from H G Wells and T S Eliot to Lenin, Trotsky, Mao Tse-t'ung (although Russell was a lifelong critic of communism) and Peter Sellers and Winston Churchill!

He will probably be remembered principally for his paradox, an example of which follows:

> *"In a village, the barber states that he will shave everyone who does not shave himself; the question is, does he shave himself?"*

If he does, he should not have done, but if he doesn't, he should have!

UNIT 1 *Logic* Teaching Notes

In set theory, the analogous problem is "Is the set itself a member of the set?" So, for example, if

S = set of teaspoons,

then the set itself is not a teaspoon, so is not a member of itself. But, for the set,

X = set of 'sets that can be described in less than 20 words',

where 'the set of all buffaloes' would be a member of X (just 5 words to describe it) and 'the set of 747 Jumbo Jets' would also be a member, then so would X itself (12 words).

So any set falls into one of two categories; either, like S, it is not a member of itself, or, like X , it does contain itself as a member. Russell then considered the set, R, of 'all those sets which are not members of themselves': so R will include the set S above and much else also.

But now comes the question that shook the foundations:

"Is R a member of itself?"

(If 'yes', then to be a member of R, R must meet the membership requirements, namely that it is not a member of itself; so if R is a member of R, then R cannot be a member of R $\Rightarrow$ contradiction; so if 'no', R is not a member of itself, and like the set of teaspoons, meets the membership criteria for R, i.e. if R is not a member of R, then it must become a member $\Rightarrow$ again contradiction!) This is the Russell Paradox, and he was mightily dismayed. He wrote "I felt about the contradiction much as an earnest Catholic must feel about wicked Popes."

This paradox has never really been explained away. Many mathematicians were indifferent to this type of foundation question, the entire matter requiring more thought than it was worth, and even Russell came to believe that the reduction of mathematics to logic was less fundamental that he had, in his youth, thought!

This may all seem irrelevant, but it is important for pupils to appreciate the firm foundation on which *their* mathematics is built. Essentially, any step from A to B in mathematics must be simple and straightforward – if this is not the case, intermediate steps must have been missed out. Unfortunately for many pupils, it seems that either hunch or intuition is used to arrive at the correct answer – but this is not the foundation of mathematics!

This unit provides the starting point for pupils to think deductively, to try to find the logical sequence of operations, and to gain confidence for their future mathematical study.

Routes		**Standard**	**Academic**	**Express**
1.1	Logic Puzzles	✓	✓	✓
1.2	Two Way Tables	✓	✓	✓
1.3	Sets and Venn Diagrams	(✓)	✓	✓
1.4	Set Notation	✕	✕	(✓)
1.5	Logic Problems and Venn Diagrams	✕	✕	✓

UNIT 1 *Logic* Teaching Notes

Language

• rows and columns – be sure that pupils know which is which!	✓	✓	✓
• two way tables	✓	✓	✓
• sets and Venn diagrams	(✓)	✓	✓
• set notation	✗	✗	(✓)

(✓) *denotes extension work for these pupils*

Challenging Questions

The following questions are more challenging than others in the same section:

	Section	*Question No.*	*Page*
Practice Book Y7A	1.1	9, 10	4
" "	1.5	9, 10, 11	21/22
Review Exercise	1.5	4	

UNIT 2 *Arithmetic: Place Value* Activities

Activities

ACTIVITY 2.1 *Rounding*

Here we introduce the concept of rounding and see how it is used in practical contexts.

1. The attendance of the Arsenal v. Manchester United Charity Shield football match (1995) was quoted in newspapers in the following way.

Newspaper	*Number of Spectators*
Times	68 800
Telegraph	68 770
Daily Mail	69 000
Sun	70 000

(a) Can they all be correct if they have given the number correct to a certain number of decimal places?

(b) What are the possible actual attendance figures?

2. The number of people at a pop concert was given as 350 000 to the nearest 50 000. What is the

(a) minimum possible number of people attending;

(b) maximum possible number of people attending?

Extension

The number of complaints received by a train operating company one year was quoted as 5500 (to the nearest 100). The next year it was quoted as 5000 (to the nearest 1000). The train company publicly announced "improved services have led to a real reduction in complaints".

Are they justified in their statement?

ACTIVITY 2.2 *Place Value*

This is best done as a whole class activity with individual pupils taking each (large) digit card and moving themselves into the appropriate places - with the help of the class (and the teacher).

1. Using the digits

$\boxed{1}$ $\boxed{3}$ $\boxed{6}$ $\boxed{7}$ $\boxed{9}$

only once each time, find

(a) the largest number that can be made

(b) the smallest number that can be made

when you use (i) 3 cards (ii) 4 cards (iii) all 5 cards.

2. Repeat the first problem using the digits;

$\boxed{0}$ $\boxed{4}$ $\boxed{5}$ $\boxed{5}$ $\boxed{6}$

3. Repeat the problem again now using the digits;

$\boxed{0}$ $\boxed{0}$ $\boxed{2}$ $\boxed{3}$ $\boxed{4}$

ACTIVITY 2.3 *Approximating to Given Number of Decimal Places*

Here we show how numbers given to a certain number of decimal places, are used in context.

1. Four students got the following results from a measurement in a science experiment:

Ben	4.754
Sergier	4.8
Adam	4.75
Chris	4.755

(a) Can they all be correct?

(b) What are the possible values of the measurements if given to an accuracy of 5 decimal places?

2. The height of a pupil was given as 123.4 cm to the nearest mm.

What is the

(a) minimum possible value for the height of the pupil;

(b) maximum possible value for the height of the pupil?

Extension

A student suggested that an easy way to give a number to a given number of decimal places was to do it stage by stage.

For example, to calculate 4.3412 to one decimal place, you work it out in the following way

$$4.2412 \longrightarrow \underset{\text{(to 3.d.p.)}}{4.341} \longrightarrow \underset{\text{(to 2.d.p.)}}{4.34} \longrightarrow \underset{\text{(1 d.p.)}}{4.3}$$

Will this method always give the correct answer?

ACTIVITY 2.4 *Place Value with Decimals*

This is best done as a whole class activity with individual pupils taking each (large) digit card and moving themselves into the appropriate places - with the help of the class (and the teacher).

1. Using the digits

1	3	6	7	9	•

only once each, find

(a) the largest number that can be made

(b) the smallest number that can be made

when you use the decimal point $\boxed{\bullet}$ with

(i) 3 more cards (ii) 4 more cards (iii) 5 more cards

2. Repeat the first problem using the digits

0	4	5	5	6	•

3. Repeat the problem again now using the digits

0	0	2	3	4	•

ACTIVITY 2.5 *Ordering Decimals*

This is best done as a whole class activity with individual pupils taking each (large) digit card and moving themselves into the appropriate places - with the help of the class (and the teacher).

1. Put these numbers in order, with the smallest first

0.5	0.99	0.905	0.59	0.509	0.9

2. Repeat the same procedure with

0.18	0.089	0.101	0.81	0.019	0.809

3. Merge the two sets of numbers together to form one set of numbers, in increasing order.

Extension

Get each member of the class to write a two or three decimal number (starting with 0.   ) on a sheet of A4. Collect all these in and organise the class into groups of equal size, say 7, 8, 9 or 10.

Give out all the numbers (face down) to each pupil, and see how fast each group can get these sets of numbers into the correct increasing order.

ACTIVITIES 2.1 - 2.3 *Notes and Solutions*

Notes and solutions are only given where appropriate.

2.1 This has been written as a teacher led activity to encourage discussion and to bring out the problems concerning rounding.

1. (a) Yes they can, if each is given to the nearest 100, 10, 1000, 10 000 respectively.

   (b) 68 765 to 68 774 are all possible.

2. (a) 325 000 (b) 374 999 (as 375 000 would round up to 380 000)

Extension - The comment is not necessarily justified

Year 1 - actual number of complaints are in the range 5450 to 5549

Year 2 - actual number of complaints are in the range 4500 to 5499

So, for example, Year 1: 5475

Year 2: 5490

are compatible with these ranges and these show an increase!

2.2 Whilst these could be used as an individual (or group) worksheet it gives an opportunity for the class to work together (or if appropriate, in teams). For the whole class approach you will need large digit cards.

1.	(a)	(i)	976	(ii)	9763	(ii)	97631
	(b)	(i)	136	(ii)	1367	(iii)	13679
2.	(a)	(i)	655	(ii)	6554	(iii)	65540
	(b)	(i)	405	(ii)	4055	(iii)	40556

(N.B. you cannot start a whole number with 0)

3.	(a)	(i)	432	(ii)	4320	(iii)	43200
	(b)	(i)	200	(ii)	2003	(iii)	20034

2.3 This is again intended as a teacher led discussion for all questions here.

1. (a) Yes (b) 4.75445 to 4.75454

2. (a) 123.35 (b) 123.44 (actually 123.44999...)

Extension - It does not work; e.g. $4.3476 \xrightarrow[\text{(to 3.d.p.)}]{} 4.348 \xrightarrow[\text{(to 2.d.p.)}]{} 4.35 \xrightarrow[\text{(1 d.p.)}]{} 4.4$

but 4.3475 is closer to 4.3 than 4.4.

ACTIVITIES 2.4 - 2.5 *Notes and Solutions*

2.4 A with A 2.2, this is intended as a whole class very interactive activity. You must be very careful with the 0's (in Q2 and Q3) and suggest that a number like 0.45 cannot be written as .45 and 976. is not allowed for the whole number 976.

1.	(a)	(i)	97.6	(ii)	976.3	(iii)	9763.1	
	(b)	(i)	13.6	(ii)	136.7	(iii)	1367.9	
2.	(a)	(i)	65.5	(ii)	655.4	(iii)	6554.0	(this is allowed!)
	(b)	(i)	0.02	(ii)	0.023	(iii)	0.00234	

2.5 For a whole class activity you will need to prepare the number cards to be used, or alternatively, get pupils to write their own.

1. 0.5, 0.509, 0.59, 0.9, 0.908, 0.99
2. 0.019, 0.089, 0.101, 0.18, 0.809, 0.81
3. 0.019, 0.089, 0.101, 0.18, 0.5, 0.509, 0.59, 0.809, 0.81, 0.9, 0.908, 0.99

UNIT 2 *Arithmetic: Place Value* Lesson Plans **St**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Rounding**	
	Writing and speaking number	OS 2.1
	Introduction to rounding	Activity 2.1, Q1
	Practice	PB 2.1, Q1, Q2 and Q3
	Discuss solutions	
	Extending ideas	Activity 2.1, Q2
	Practice	PB 2.1, Q14
	Set homework	PB 2.1, Q4 and Q13
2.	**Place Value**	
	Discuss homework	
	Inroduction	Activity 2.2
	Practice	PB 2.1, Q11
	Discuss solutions	
	Value of digits	OS 2.3
	Practice	PB 2.1, Q6
	Set homework	PB 2.1, Q9
3.	**Estimation**	
	Mental tests	M 2.1
	Discuss homework	
	Similar problems (if needed)	OS 2.4
	Revision	OS 2.2
	Introduction to decimals	OS 2.5
	Set homework	PB 2.2, Q1 and Q2
4.	**Decimals**	
	Mental test	M 2.2
	Discuss homework	
	Introduction to place value and decimals	Activity 2.4
	Rounding	OS 2.6
	Practice	PB 2.2, Q3 and Q4
	Discuss solutions	
	Set homework	PB 2.2, Q9 and Q10

UNIT 2 *Arithmetic: Place Value* Lesson Plans **St**

Lesson No.	*Suggested Plan*	*References*
5.	**Recap**	
	Discuss homework	
	Revision test	RT 2.1 (Standard)
6.	**Revision**	
	Give back marked tests	
	Go over test questions interactively	
	Revise key topics	

UNIT 2 *Arithmetic: Place Value* Lesson Plans **A**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Rounding and Place Value**	
	Introduction to rounding	Activity 2.1
	Practice	OS 2.2
	Value of digits	Activity 2.2
	Practice	PB 2.1, Q6
	Set homework	PB 2.1, Q4 and Q9
2.	**Estimation**	
	Mental test	M 2.1
	Discuss homework	
	Similar problems (if needed)	OS 2.4
	Introduction to decimals	OS 2.5
	Practice	PB 2.2, Q1 and Q2
	Set homework	PB 2.2, Q3 and Q4
3.	**Decimals and Rounding**	
	Mental test	M 2.3
	Discuss homework	
	Extending ideas	Activity 2.3
	Practice	PB 2.2, Q5
	Discuss solutions	
	Set homework	PB 2.2, Q9
4.	**Decimals and Place Value**	
	Discuss homework	
	Ordering decimals	Activity 2.5
	Place value in decimals	Activity 2.4
	Revision	OS 2.6
	Set homework	PB 2.2, Q10
5.	**Recap**	
	Discuss homework	
	Revision test	RT 2.2 (Academic)

UNIT 2 *Arithmetic: Place Value* Lesson Plans **A**

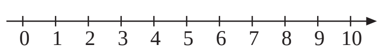
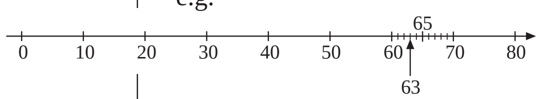
Lesson No.	*Suggested Plan*	*References*
6.	**Revision** Give back marked tests Go over test questions interactively Revise key topics	

UNIT 2 *Arithmetic: Place Value* Lesson Plans **E**

These are based on 45/50 minute lessons.

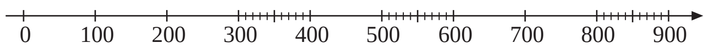
Lesson No.	*Suggested Plan*	*References*
1.	**Place Value and Rounding**	
	Introduction to rounding	OS 2.2
	Value of digits	Activity 2.2
	Practice	PB 2.1, Q6
	Estimation	OS 2.4
	Set homework	PB 2.1, Q4, Q9 and Q13
2.	**Decimals and Place Value**	
	Discuss homework	
	Mental test	M 2.3
	Ordering decimals	Activity 2.5
	Place value in decimals	Activity 2.4
	Revision	OS 2.6
	Set homework	PB 2.2, Q10
3.	**Recap**	
	Discuss homework	
	Revision test	RT 2.3 (Express)
4.	**Revision**	
	Give back marked tests	
	Go over test questions interactively	
	Revise key topics	

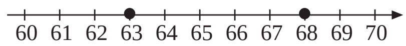
Y7	**UNIT 2** ***Arithmetic: Place Value*** Lesson Plan 1	*Place Value*
Activity		***Notes***
1	**Place value table** T: I'm just a simple man/woman. I only know 10 numbers. T: What happens though if I write some of the numbers close together; for example (on BB) 634 ? T: Hundred? Thirty? What do those words mean? T: I see; so the number under the Hundreds column is 6, but it has a real value of 600. T: What about the number in the Tens column? *(Real value 30)* T: Let's try another number (on BB e.g. 40 361). T: But how can I write it in our table? T: What does the 6 represent now? *(60)* The 3 ? *(300)* T: OK, but who can extend the place value table further? T: Fantastic! Is there a number large enough to fill up the table?	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 written on BB. Ps respond in chorus (six hundred and thirty four). Ps try to explain, and T leads them on to place value table on BB e.g. *Hundreds* ¦ *Tens* ¦ *Units*: 6 ¦ 3 ¦ 4 Ps respond (forty thousand three hundred and sixty one). Ps extend table on BB, writing 'Thousands', 'Tens of thousands' and then 40 361. Ps volunteer and T chooses P to write on BB the next column (extending up to hundreds of millions). Agreement. Praising. One P writes 9-digit numbers in table on BB, others write in Ex.Bs. This P chooses another P to read number out, and they write another 9-digit number, etc. Agreement. Praising.
	12 mins	
2	**PB2.1, Q6** T points to Ps in turn to firstly read out number and then to answer question.	Whole class activity, without writing. First P chooses the next P, etc. Agreement. Praising.
	17 mins	
3	**Number systems** T: Working in our system of numbers, based on 10, it is easy to read and write numbers. But what other systems have been used?	See *Teaching Notes* for other systems. e.g. *Number* | *Word*: 0 sky; 1 moon; 2 eye; 3 fire and read backwards, so that 210 is sky-moon-eye, etc.
(continued)		

Y7	**UNIT 2** ***Arithmetic: Place Value*** Lesson Plan 1	*Place Value*
Activity		***Notes***
3 **(*continued*)**	T: What system did the Romans use? On BB I = 1 V = 5 X = 10 L = 50 C = 100 D = 500 M = 1000 T: In Roman numerals, - how old are you? - what is the number of your house? - what year is it? - when were you born? etc.	Encourage Ps to define symbols; ensure that all are defined and written on BB. Ps write answers (in turn) on BB, with encouragement from T and help if necessary from other Ps. Praising.
	27 mins	
4A	**PB 2.1, Q11 (a), (b), (c)** T: Now we return to *our* number system.	Whole class activity. Discuss answers. Praising.
4B	**PB 2.1, Q11 (d)**	Individual work (monitored, helped). Checking (one P writes numbers on BB). Agreement. Feedback. Self-correction. Praising.
4C	T: OK; let's add another zero to the digits. Who can answer the questions now?	T chooses P to answer (choose one who needs help with part (d)). Praising.
	37 mins	
5	**Number line** T: So now we understand place value tables, but how can we illustrate our numbers showing how they relate to one another? *(Number line)* T: What is a number line? How do we construct it? T: How do you illustrate the number 63 on your number line? *(Impossible)* T: Why is it impossible? *(Number too big)* T: Construct a more suitable number line. T: Who would like to show 68? 2? 79? 81?	Whole class activity, recalling the idea of a number line. T draws (or reveals already prepared) number line on BB with 0, 1, ... , 10 as dividing points; Ps copy into Ex.Bs.  e.g.  T on BB, Ps in Ex.Bs. P at BB; agreement, praising.
	45 mins	

Y7	UNIT 2 *Arithmetic: Place Value* Lesson Plan 1	*Place Value*
Activity		***Notes***
6	**Set homework** **A** PB 2.1, Q7 (a), (e), (f), (g), (h), (i) and with the extra question, 'What does the 3 represent in each of these numbers?' **B** PB 2.1, Q8, (a), (c), (e), (f), (g) using place value table in Ex.Bs. **C** PB 2.1, Q9. **D** Construct a suitable number line to illustrate these numbers: 310 570 890 575 817	

Y7 — UNIT 2 *Arithmetic: Place Value*
Lesson Plan 2 — *Rounding and Estimation*

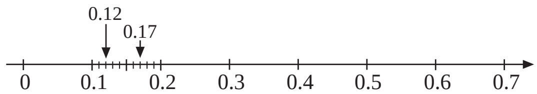
Activity		*Notes*
1	**Mental work** T: Let's start with some simple questions! (i) What is the smallest number with 3 digits? *(100)* (ii) What is the largest number with 3 digits? *(999)* (iii) How many whole numbers are there with 3 digits? *(900)* (iv) How many whole numbers are there with 2 digits? *(90)*	T asks, Ps put hands up or show answers on paper or slates. This question might cause problems as it can be answered in two different ways: 1. There are 99 numbers from 1 to 99 and 999 from 1 to 999, so answer $= 999 - 99 = 900$. 2. There are 899 steps from 100 to 999, so, including the first step, there are 900 numbers. (You can illustrate with easier questions, e.g. how many numbers from 6 to 9?)
Extensions	(v) How many whole numbers are there with 4 digits? *(9000)* (vi) How many whole numbers are there from 12 to 674, including 12 and 674 ? *(663)*	
	8 mins	
2	**Checking homework**	T prepares OHP with answers. Feedback. Self-correction. Praising.
2AB	PB 2.1, Q7 (a), (e), (f), (g), (h), (i) Q8 (a), (c), (e), (f), (g)	
2C	PB 2.1, Q9	Ps read out statements and reasons for true or false; discussion. Praising.
2D	Illustrate numbers 310 570 890 575 817 on a number line.	Whole class discussion about suitable number lines, e.g.  OK for 310, 570, 890
	T: Where on the line is 575? *(Halfway between 570 and 580)* What about 817?	Discussion; T shows approximate place for number.
	18 mins	
3	**Rounding** T: Did anyone watch the Man. Utd. game last night? *(Response!)* T: For those not into football, this was a Champions League match, Man. Utd. against Lille. I'm sure you can tell us the result ... *(Response, maybe at length!)*	T refers to an actual event - it doesn't have to be football!
	T: In my paper it says that there were 65 000 spectators. I couldn't believe it - exactly 65000! Do you believe it?	Ps respond that the information is probably not exact.
	T: So the papers told a lie? *(No, they just gave an estimate.* T: What do you mean by an estimate?	Ps (hopefully) will suggest that the number has been rounded (to the nearest 1000).
(continued)	T: Draw a number line in your Ex.B to illustrate how 63 and 68 round to the nearest 10.	T on BB, Ps in Ex.Bs.

Y7	**UNIT 2** ***Arithmetic: Place Value*** Lesson Plan 2	*Rounding and Estimation*
Activity		***Notes***
3 *(continued)*	T: What does 63 round to? *(60)* Why? *(Nearer to 60 than to 70)* T: What does 68 round to? *(70)* Why? etc. T: What about rounding 310 to the nearest 100 *(300)* and 380, 817, to the nearest 100 *(400, 800)* T: What is 817 rounded to the nearest 10? *(820)* T: What about 575 rounded to the nearest 10? *(580)* *28 mins*	 P writes on number line on BB. T discusses with Ps the convention of rounding '5' up.
4	**PB 2.1, Q1, Q2 or Q3** *33 mins*	Mental work; T points to Ps one at a time. Agreement. Praising.
5	**PB 2.1, Q15** *40 mins*	Individual work, monitored, helped. Checking. Discussion. Agreement. Feedback. Self-correction. Praising. T and Ps discuss what is meant by estimation.
6	**Estimation** T: Give me some examples of situations when you have used estimation. T: Suppose you have £3 in your pocket and you put these items into a shopping basket. As you near the check-out, you begin to wonder if you have enough money. T: How can you quickly see if you have enough money? *(Estimate by rounding to the nearest 10p)* T: Now add them up quickly. Total? *(270p)* T: So what can you conclude? *(Since £3 = 300p, you will have enough money, so you can go to the check-out)* *45 mins*	Give Ps opportunity and encouragement to think of possible practical situations. On OHS, e.g. Choc Bar 29p Crisps 22p Pie 97p Drink 48p Apples 71p P on OHS Choc Bar → 30p Crisps → 20p Pie → 100p Drink → 50p Apples → 70p
7	**Set homework** **A** Write down the prices from the OHS and work out the exact total priceof the items. See if you can find an easy way to add them up. **B** PB 2.1, Q4 **C** PB 2.1, Q13	

Y7	UNIT 2 *Arithmetic: Place Value* Lesson Plan 3	*Place Value and Rounding of Decimals*
Activity		***Notes***
1	**Checking homework**	
1A	T: How much is 29p + 22p + 97p + 48p + 71p ?	Checking P's work.
	T: Who added up in an easy way ($(29+71)+(22+48)+97$ $= 100 + 70 + 97$ $= 170 + 97$ $= 267$)	Discuss P's ideas; they might add 97 by using $100 - 3$, etc.
	T: Who got this right? Who got another answer? Can you work out where you made the mistake?	Self-correction. Praising.
	T: So was the estimation OK?	
1B, C	PB 2.1, Q4 and Q13	Tasks checked by Ps writing solutions on BB. Agreement. Feedback. Self-correction. Praising.
	5 mins	
2	**Decimals in place value table**	Whole class activity.
2A	T: Do you remember the place value table we used?	P draws table on BB with hundreds, tens and units.
	T: What comes next on the left hand side? *(Thousands, tens of thousands, ...)*	Praising.
	T: What is the difference between the real values of the same digit in the tens and units? $\left(\frac{1}{10}\right)$	Help needed to recognise that the opposite of $\times 10$ is $\div 10$ or $\times \frac{1}{10}$.
	T: Is there a tenth part of the units? *(Tenths)*	
	T: And more? *(Hundredths, thousandths)*	T draws extension to RHS of place value table on BB, and Ps in Ex.Bs.
2B	T: Let's see if you can read out a number ... (1.47, 302.4, 0.05, etc.)	

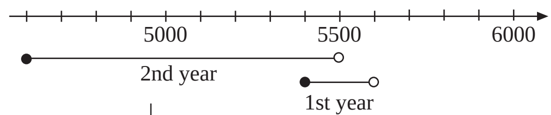
Hundreds	*Tens*	*Units*		*Tenths*	*Hundredths*
		1	•	4	7
3	0	2	•	4	
		0	•	0	5

		Ps read out the numbers. Agreement. Praising
2C	T reads out numbers from OS 2.5 and Ps write them in Ex.Bs using table. 1 4 7 . 2 0 9 2 6 . 0 9 2 5 . 0 0 7 4 7 0 . 0 5	Individual work. Having finished, T puts OS 2.5 onto OHP and Ps check their answers. Feedback (no mistakes? one mistake? ...) Self correction. Praising.
2D	T: What is the value of the 2 in each of our numbers? *(2 tenths in first number, etc.)*	Whole class activity. Ps respond. Agreement. Praising.
	18 mins	

Y7	**UNIT 2** ***Arithmetic: Place Value*** Lesson Plan 3	*Place Value and Rounding of Decimals*
Activity		***Notes***
3A	**Activity 2.5, Q1**	Whole class activity. T chooses Ps to hold up large digit cards in front of class. Other Ps dictate where they are to stand. Agreement or not. Praising.
3B	Extensions to Activity 2.5. T waits for all groups to finish and writes all the decimals on the BB for checking. *28 mins*	Organise as competition between groups. T needs to organise space in classroom for this, and ensure stronger and weaker Ps are in each group. For checking, T points to one of the groups to say the first number. The others agree or not. T writes this number onto OHS at OHP and crosses it out at BB. Another group follows, etc. Praising and giving final result.
3	**Number line for decimals** T: You can also illustrate decimals on a suitable number line. Can you draw one to show 0.12, 0.7, 0.3, 0.17, 0.58, 0.35, 0.125 ? T: Who will show the first number? (etc.) *35 mins*	Whole class activity. Discussion on what form it takes. Agree that it must have 0, 0.1, 0.2 ..., and divide again when needed.  Ps put numbers on number line. Agreement. Praising.
4	**Rounding to given number of decimal places** T: Look at the number line and the numbers 0.53 and 0.58. Which tenth is nearest to each? *(0.5 and 0.6)* T: Round each of the other numbers to the nearest tenth. T: We call this 'Writing the number, correct to 1 decimal place'. T: Now write the last one correct to 2 decimal places. *(0.13)* T: Why do we round 5 up? *(Convention)* *40 mins*	Whole class activity. Use the number line with marked decimals already on BB. T introduces idea of rounding again, to the nearest tenth, etc. 0.12 $\rightarrow$ 0.1 0.17 $\rightarrow$ 0.2 0.35 $\rightarrow$ 0.4 0.125 $\rightarrow$ 0.1

Y7	**UNIT 2** ***Arithmetic: Place Value*** Lesson Plan 3	*Place Value and Rounding of Decimals*
Activity		***Notes***
5	**PB 2.2, Q5** *45 mins*	Individual work. Checking: P reads out solutions giving reasons. Agreement. Feedback. Self-correction. Praising.
6	**Set homework** PB 2.2, Q2, Q3, Q4 and Q6.	

Y7	UNIT 2 *Arithmetic: Place Value* Lesson Plan 4	*Rounding in Practical Contexts*

Activity		*Notes*
1	**Checking homework** *6 mins*	Ps write solutions on BB. Class checks; discussion. Agreement or not. Feedback. Self-correction. Praising.
2	**Activity 2.1, Q1** T introduces problem. e.g. T: What similarities do you notice about the numbers? *(All end in 0)* T: What differences? *(End in two zeros for Times, one for Telegraph, etc.)* T: What do the zeros remind you of? *(Rounding)* T: Why are they different? *(Rounding to different accuracy)* T: What about 68770 ? *(Rounded to nearest 10)* T: So what is the smallest and largest possible number of people? *(68 765 and 68 774)* T: What about the number 68 800 ? *(Nearest 100)* T: What is the possible interval for the number of people? *(68 750 to 68 849)* T: Is it smaller or larger than the previous interval? *(Larger, but contains the previous interval)* *20 mins*	Whole class activity. Data written on BB. T helps Ps realise that the problem is connected with the type of rounding used by each newspaper. T asks questions around the class. If T agrees, praise. If not, change the question or ask another pupil. T should encourage all Ps to contribute; get 4 intervals and choose smallest one.
3	**Misleading rounding: Activity 2.1, Extension** e.g. There is an overlap between the two intervals, and numbers in the second interval that are larger than some in the first, so complaints might have increased. T: That is why you need to read information in documents and newspapers carefully. *30 mins*	Individual work Maybe only stronger Ps will be able to solve it alone, but encourage everyone to try. T monitors stronger Ps and helps others. P who is successful can show solutions on BB (use number line to show intervals). 
4	**Practice** T gives out M 2.3, one to each P. *45 mins*	Whole class activity. T and Ps go over questions interactively. T chooses P; P reads out question and answers it, giving reasons. Each question discussed. Agreement. Praising.

Y7	UNIT 2 *Arithmetic: Place Value* Lesson Plan 4	*Rounding in Practical Contexts*
Activity		***Notes***
5	**Set homework.** M 2.4, Q1 - Q8	
	NB For lessons 5 and 6, see the last two lessons for Unit 1, and follow a similar style. Make sure that there is enough for stronger pupils to do; there are many Extra Exercises and, for example, Activity 2.3, that could be used.	

UNIT 2 Arithmetic: Place Value Mental Tests

M 2.1 Standard Route *(no calculator)*

1.	Write 22 to the nearest 10.	(20)
2.	Write 78 to the nearest 10.	(80)
3.	Write 108 to the nearest 100.	(100)
4.	Write 395 to the nearest 100.	(400)
5.	Write 45 to the nearest 10.	(50
6.	Write down five thousand in figures.	(5000)
7.	Which number is bigger, 0.6 or 0.51?	(0.6)
8.	Write down two thousand five hundred in figures.	(2500)
9.	Write down sixth tenths in figures as a decimal.	(0.6)
10.	What does the 6 represent in 1627?	(6 hundreds or 600)

M 2.2 Standard Route *(no calculator)*

1.	Write 43 to the nearest 10.	(40)
2.	Write 37 to the nearest 10.	(40)
3.	Write 151 to the nearest 100.	(200)
4.	Write 449 to the nearest 100.	(400)
5.	Write 95 to the nearest 10.	(100)
6.	Write down one thousand five hundred in figures.	(1500)
7.	Which number is bigger, 0.59 or 0.7?	(0.7)
8.	Write down three thousand and twenty in figures.	(3020)
9.	Write down one and four tenths in figures as a decimal.	(1.4)
10.	What does the 5 represent in 1254?	(5 tens or 50)

UNIT 2 Arithmetic: Place Value Mental Tests

M 2.3 Academic Route *(no calculator)*

1. Write 26 to the nearest 10. (30)
2. Write 745 to the nearest 100. (700)
3. Which of these numbers is biggest: 0.6 and 0.52? (0.6)
4. To the nearest 10, there were 40 children on a bus.
   What is the smallest possible number of children that were on the bus? (35)
5. What does the 6 represent in 0.6? (6 tenths)
6. Write down 5 million in figures. (5 000 000)
7. Karen says her lounge is 22 m long. Is she likely to be correct? (No)
8. Write 0.321 correct to one decimal place. (0.3)
9. Write these numbers in order of increasing size:
   0.501, 0.321, 0.42. (0.321, 0.42, 0.501)
10. Write down four tenths in figures as a decimal. (0.4)

M 2.4 Express Route *(no calculator)*

1. Write 4672 to the nearest 1000. (5000)
2. Write 4753 to the nearest 100. (4800)
3. Correct to the nearest 1000, there were 38 000 spectators at a football match.

   What was the largest possible number of spectators at the match? (38 499)
4. What does the 7 represent in 0.567? (7 thousandths)
5. Write down three hundred and eight thousand in figures. (308 000)
6. Write down sixty two million in figures. (62 000 000)
7. Write 0.4695 correct to 3 decimal places. (0.470)
8. Write 0.41732 correct to 2 decimal places. (0.42)
9. Write down 48 hundredths in figures as a decimal. (0.48)

10 John estimates that the length of a woodlice is 428 mm. Is he likely to be correct? (No)

UNIT 2 *Arithmetic: Place Value* Teaching Notes

Historical Background and Introduction

This is the first of the six Arithmetic Units in Book 7A. These units aim to consolidate and develop pupils' understanding of place value and arithmetic, as well as providing practice in the basic number operations.

The familiar place value concept used in our number system, and usually referred to as the Hindu - Arabic system, had its origins in India but brought to the West by means of the Arabs. The Babylonians had a place value system, but it was based on 60, whilst the Chinese, from the earliest times, had a system based on 10.

Around the 7th Century, the Indians dropped symbols for numbers higher than 9 and began to use symbols for 1 to 9 in our familiar place value arrangement (with a dot used for the zero). The first reference to this is in fact attributed to a Syberian priest in 662. Others began to use systems in which words stand for numbers, for example

Number	*Word*
0	sky
1	moon
2	eye
3	fire

Thus fire - sky - moon - eye is in fact 2103, the place value beginning on the left with the units.

Whilst the exact sequence of development is not at all clear, certainly by 870, a decimal place value system for integers existed both in India and China.

In this unit, we concentrate on *place value and rounding.* The first section (2.1) deals with the *natural numbers* and the second section (2.2) deals with *decimals.* After this Unit on *place value* the later arithmetic units will deal with *number operations*.

You must be careful not to labour these Arithmetic Units; if your pupils are already confident, just use them for quick and fast-paced revision. As the National Numeracy Strategy in Primary Schools begins to have an effect, it is hoped that these Arithmetic Units will no longer be necessary for any but the mathematically less able pupils.

You will find mental tests in this unit – it is crucial that your pupils can respond instantly to questions of this sort, and you ought to reinforce this aspect throughout the course.

Routes		**Standard**	**Academic**	**Express**
2.1	Place Value and Rounding	✓	✓	✓
2.2	Decimals and Place Value	(✓)	✓	✓
Language				
•	units, tens, hundreds, thousands, millions	✓	✓	✓
•	rounding to nearest 10, 100, 1000	✓	✓	✓
•	tenths, hundredths, thousandths	(✓)	✓	✓

(✓) *denotes extension work for these pupils*

Misconceptions

- To round, say 14 459 to the nearest 1000, you first round to the nearest 10, then 100, then 1000 giving

  $$14\ 489 \longrightarrow 14\ 490 \longrightarrow 14\ 500 \longrightarrow 15\ 000 \text{ (as '5' rounds up)}$$

  giving clearly the incorrect answer that 14 459 to the nearest thousand is 15 000.

- The number 1.329 is greater than 1.4 as it has more decimal places - reference to a number line will clearly show this to be false. Similarly, 1.09 is greater than 1.22, as the final digit 9 is greater than 2 - again reference to a number line shows this to be false.

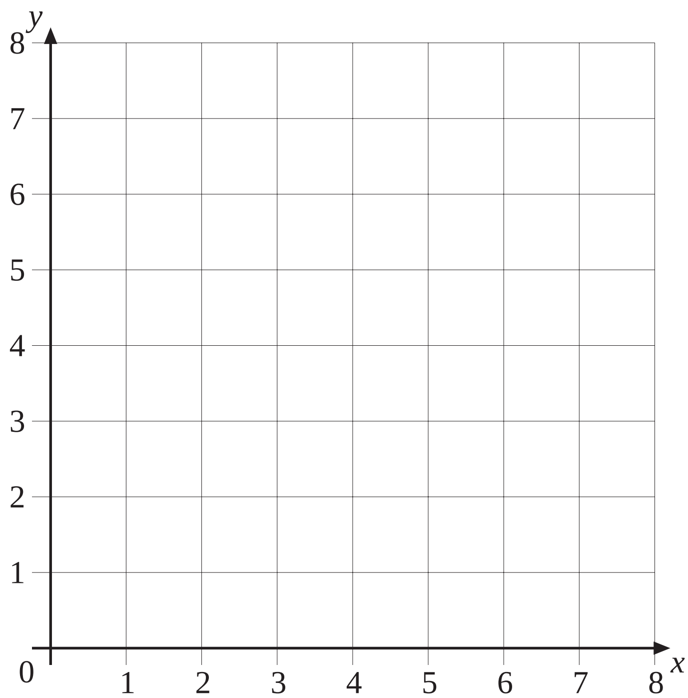
UNIT 3 *Graphs* Activities

Activities

ACTIVITY 3.1 *Scatter Graphs*

This is a whole class or group activity for pupils to collect, illustrate and to make deductions about data.

You will need a grid of the form below, either on the board or OHP.



1. Using the labels:

x = no. of brothers and sisters,

y = no. of aunts and uncles,

for the whole class (or group) input the data for each class member onto the scatter plot.

What trends can be deduced from the data?

2. Repeat problem 1 with the same x but with y = no. of pets.

3. Using a large scatter graph, with

x = birth month (take January = 0, February = 1, etc.)

y = shoe size,

complete the graph for class members. Is there any trend in the data?

* Note – if a data point occurs twice, represent this as ⊙; the third occurrence is shown as ⊚, etc.

ACTIVITY 3.2 *Negative Numbers*

A key use of negative numbers is in sport, and in particular, in determining the position of clubs in the football league tables. In the early part of the season this is especially true, as there are few differences in points obtained (3 for win (W), 1 for draw (D), 0 for lose (L)) as only a small number of matches have been played (P). When teams have equal numbers of points, the order is determined by the highest goal difference.

1. The table below shows the Premiership League table on Friday 28 August 1998.

	Matches				Goals		
Team	P	W	D	L	For	Against	Points
Charlton	2	1	1	0	5	0	4
Leicester City	2	1	1	0	4	2	4
Aston Villa	2	1	1	0	3	1	4
Wimbledon	2	1	1	0	3	1	4
Arsenal	2	1	1	0	2	1	4
Liverpool	2	1	1	0	2	1	4
Leeds United	2	1	1	0	1	0	4
West Ham United	2	1	1	0	1	0	4
Sheffield Wednesday	2	1	0	1	3	1	3
Coventry City	2	1	0	1	2	2	3
Nottingham Forest	2	1	0	1	2	2	3
Manchester United	2	0	2	0	2	2	2
Newcastle United	2	0	2	0	1	1	2
Derby County	2	0	2	0	0	0	2
Chelsea	2	0	1	1	2	3	1
Blackburn Rovers	2	0	1	1	0	1	1
Middlesbrough	2	0	1	1	1	3	1
Everton	2	0	1	1	0	2	1
Tottenham Hotspur	2	0	0	2	1	6	0
Southampton	2	0	0	2	1	7	0

Find the goal difference, i.e. goals for and goals against, to check that the teams are in the correct order.

2. The results of matches played at the weekend 29/30 August are given below.

Arsenal	0	Charlton	0
Blackburn Rovers	1	Leicester City	0
Coventry City	0	West Ham United	0
Everton	0	Tottenham Hotspur	1
Middlesbrough	1	Derby County	1
Sheffield Wednesday	0	Aston Villa	1
Southampton	1	Nottingham Forest	2
Wimbledon	1	Leeds United	1
Newcastle United	1	Liverpool	4

What was the order of the teams in the league after these matches had been played?

Extension Find out when, in recent years, goal difference has decided a league title, promotion or relegation.

ACTIVITY 3.3 *Conversion Graphs*

Many travel agents and banks will change money from one currency to another, They will also charge commission, either as a fee or as a percentage of the amount of money you are changing. Here are two examples for changing pounds (£) to dollars ($).

EasyChange

Rate: £1 buys $1.50

Commission: £4 per transaction

Better Exchange

Rate: £1 buys $1.60

Commission: 10%

1. If you have £100 to change, how much commission will you pay with *EasyChange*?

   How much money will you have left to change?

   How many dollars will you get?

2. If you have £100 to change, how much commission will you pay with *Better Exchange*?

   How much money will you have left to change?

   How many dollars will you get?

3. Repeat problems 1 and 2 for changing (a) £20 and (b) £200, to dollars.

   What conclusion can you reach to help you decide which of these two companies to use for changing your money?

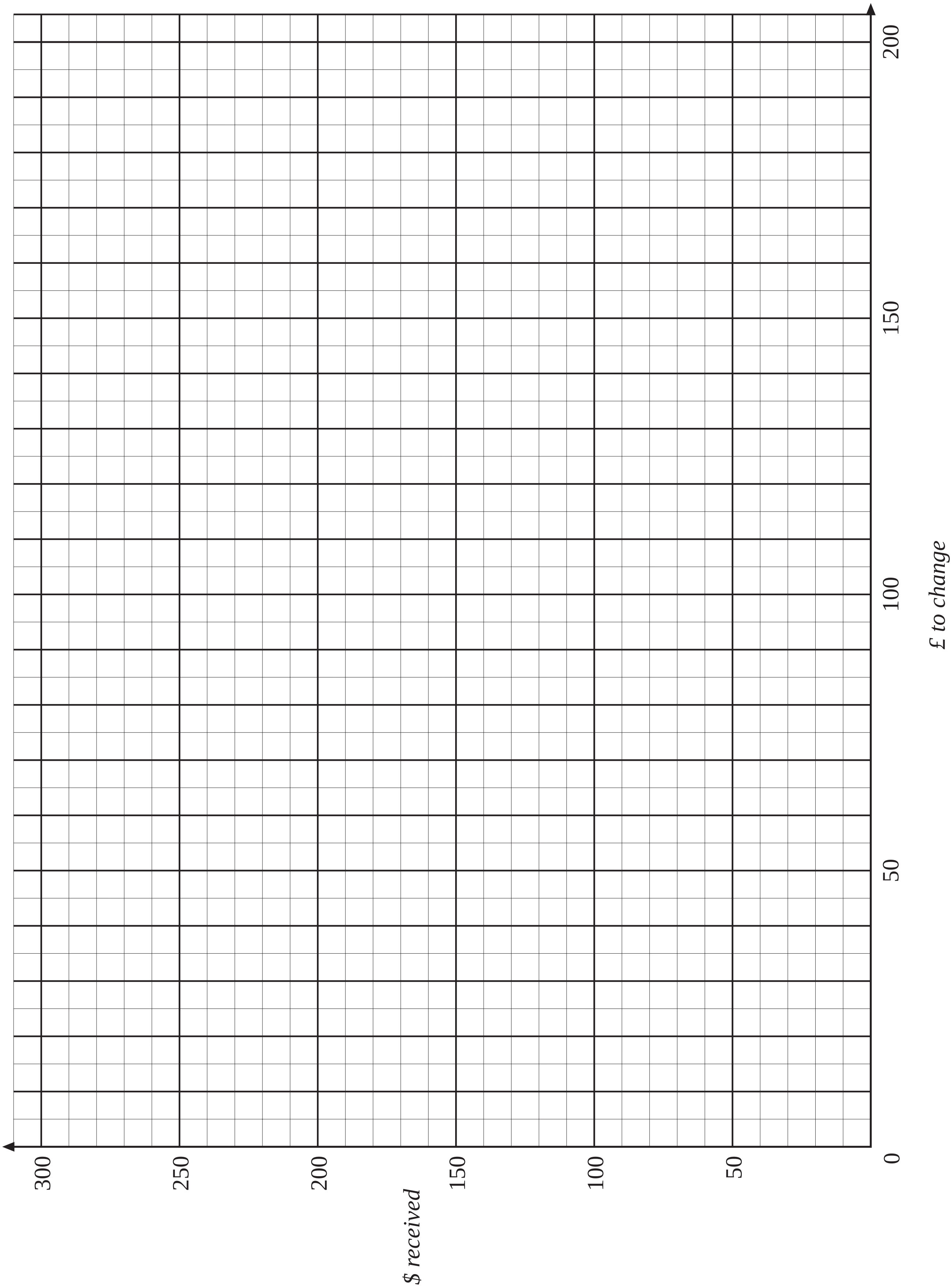
You can easily see what is happening if you draw conversion graphs for each company on the same graph.

4. (a) Draw the conversion graph for *EasyChange*. First plot the three data points found in problems 1 and 3. Use a copy of the grid given. Draw a straight line through these points (it should also go through $x = 4$, $y = 0$).

   (b) On the same graph, draw the conversion graph for *Better Exchange*. First plot the three data points found in problems 2 and 3. Draw a straight line through these points (it should also go through the origin, $x = y = 0$).

   (c) Where do the lines intersect? From your graph, estimate the best outcome when changing (i) £50, (ii) £150.

ACTIVITY 3.3 *Conversion Graph*



ACTIVITIES 3.1 - 3.2 *Notes and Solutions*

Notes and solutions are only given where appropriate.

3.1 This is a whole class activity which aims to involve all pupils in plotting 'their' point, and also provides an opportunity to begin a discussion on correlation.

3.2 This will be of particular interest to keen football fans (there are similar applications in cricket and rugby); the aim here is to show how negative numbers do have meaning beyond the usual 'temperature' examples.

	Matches				Goals			
Team	P	W	D	L	For	Against	Goal Diff.	Points
Liverpool	3	2	1	0	6	2	+4	7
Aston Villa	3	2	1	0	4	1	+3	7
Nottingham Forest	3	2	0	1	4	3	+1	6
Charlton	3	1	2	0	5	0	+5	5
Wimbledon	3	1	2	0	4	2	+2	5
Arsenal	3	1	2	0	2	1	+1	5
Leeds	3	1	2	0	2	1	+1	5
West Ham United	3	1	2	0	1	0	+1	5
Leicester City	3	1	1	1	4	3	+1	4
Coventry City	3	1	1	1	2	2	0	4
Blackburn Rovers	3	1	1	1	1	1	0	4
Sheffield Wednesday	3	1	0	2	3	2	+1	3
Derby County	3	1	0	2	1	1	0	3
Tottenham Hotspur	3	1	0	2	2	6	– 4	3
Manchester United	2	0	2	0	2	2	0	2
Middlesbrough	3	0	2	1	2	4	– 2	2
Newcastle United	3	0	2	1	2	5	– 3	2
Chelsea	2	0	1	1	2	3	– 1	1
Everton	3	0	1	2	0	3	– 3	1
Southampton	3	0	0	3	2	9	– 7	0

ACTIVITY 3.3 *Notes and Solutions*

Notes and solutions are only given where appropriate.

3.3 1. £4 ; £96 ; $144

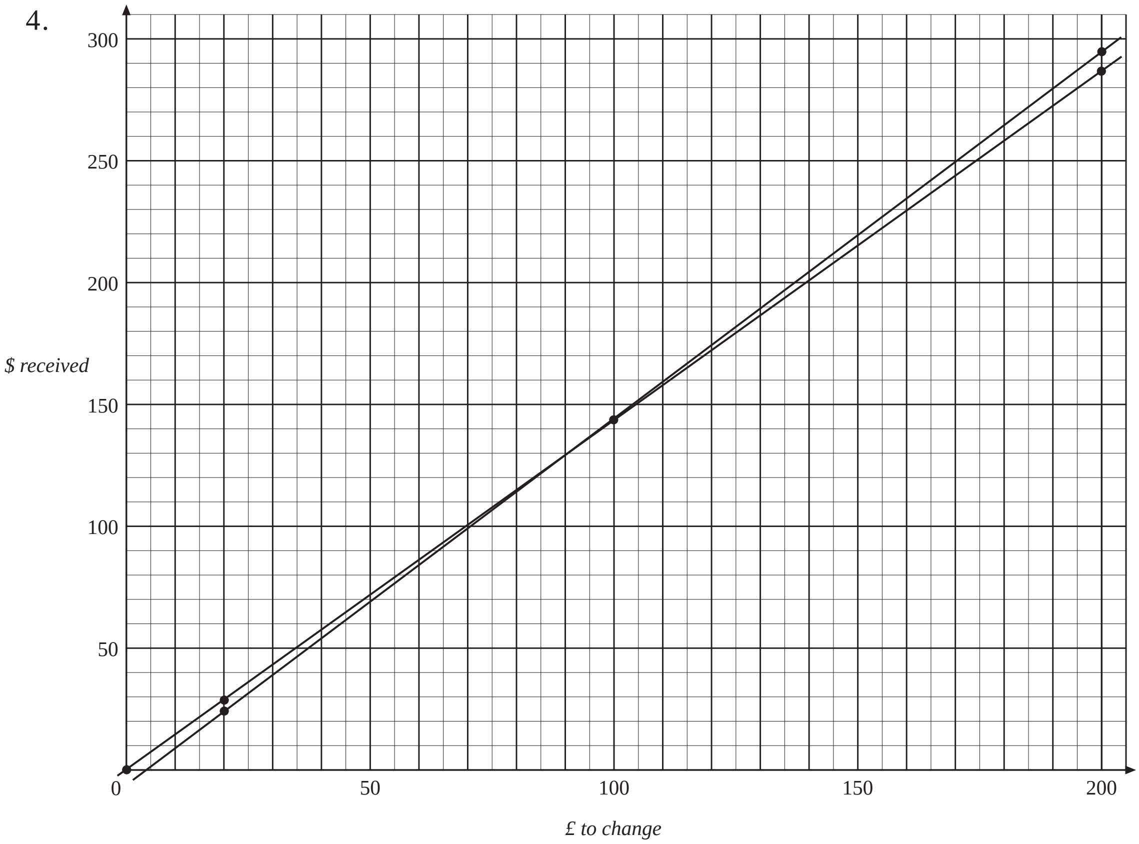
2. £10 ; £90 ; $144

3. (a) £4 ; £16 ; $24 and £2 ; £18 ; $28.8

(b) £4 ; £196 : $294 and £20 ; £180 ; $288

For amounts of less than £100 to change, use *Better Exchange*; for amounts more than £100, use *EasyChange*.

3.3 4.



(c) (i) $72 (ii) $219

UNIT 3 *Graphs* Lesson Plans **St**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Scatter Graphs**	
	Introduction	OS 3.1
	Exercises	PB 3.1, Q1 and Q2
	Review answers	PB 2.1, Q1, Q2 and Q3
	Activity	Activity 3.1
	Set homework	PB 3.1, Q4
2.	**Plotting Points**	
	Discuss homework	
	Continue Activity	Activity 3.1
	Worked Example	OS 3.3
	Exercises	PB 3.2, Q1 and Q3
	Review answers	
	Set homework	PB 3.2, Q7
3.	**Coordinate Grids**	
	Discuss homework	
	Identifying points	OS 3.4
	Exercises	PB3.2, Q6
	Review answers	
	Introduce Negative Numbers	OS 3.6
	Set homework	PB 3.3, Q1
4.	**Negative Numbers**	
	Discuss homework	
	Further example	OS 3.5
	Exercises	PB 3.3, Q2 and Q3
	Review answers	
	Set homework	Activity 3.2

UNIT 3 *Graphs* Lesson Plans St

Lesson No.	*Suggested Plan*	*References*
5.	**Coordinates**	
	Discuss homework	
	Introduction	OS 3.7
	Exercises	PB 3.4, Q1
	Review answers	
	Exercises	PB 3.4, Q2
	Review answers	
	Mental Test	M 3.1
	Set homework	PB 3.4, Q3 and Q5
6.	**Revision**	
	Discuss Homework	
	Revision Test	R 3.1
7.	**Recap**	
	Return marked tests	
	Recap topics	

UNIT 3 *Graphs* Lesson Plans **A**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Scatter Graphs**	
	Introduction	OS 3.1
	Exercises	PB 3.1, Q1 and Q2
	Review answers	PB 2.1, Q1, Q2 and Q3
	Activity	Activity 3.1
	Set homework	PB 3.1, Q4
2.	**Plotting Points**	
	Discuss homework	
	Continue Activity	Activity 3.1
	Worked Example	OS 3.3
	Exercises	PB 3.2, Q1 and Q3
	Review answers	
	Set homework	PB 3.2, Q7
3.	**Coordinate Grids**	
	Discuss homework	
	Identifying points	OS 3.4
	Exercises	PB3.2, Q6
	Review answers	
	Introduce Negative Numbers	OS 3.6
	Set homework	PB 3.3, Q1
4.	**Negative Numbers**	
	Discuss homework	
	Further example	OS 3.5
	Exercises	PB 3.3, Q2 and Q3
	Review answers	
	Set homework	Activity 3.2

UNIT 3 *Graphs* Lesson Plans **A**

Lesson No.	*Suggested Plan*	*References*
5.	**Coordinates**	
	Discuss homework	
	Introduction	OS 3.7
	Exercises	PB 3.4, Q1
	Review answers	
	Exercises	PB 3.4, Q2
	Review answers	
	Mental Test	M 3.1
	Set homework	PB 3.4, Q3 and Q5
6.	**Plotting Polygons**	
	Discuss homework	
	Recap names of polygons	OS 3.9
	Finding vertices	OS 3.10
	Exercises	PB 3.5, Q1 and Q2
	Review answers	
	Mental Test	M 3.2
	Set homework	PB 3.5, Q3 and Q5
7.	**Revision**	
	Discuss homework	
	Revision Test	R 3.2
8.	**Recap**	
	Return marked tests	
	Recap topics	

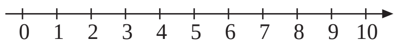
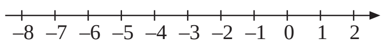
UNIT 3 *Graphs* Lesson Plans **E**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Coordinates**	
	Exercises	PB 3.4, Q1
	Review answers	
	Exercises	PB 3.4, Q2
	Review answers	
	Mental Test	M 3.1
	Set homework	PB 3.4, Q3 and Q5
2.	**Plotting Polygons**	
	Discuss homework	
	Recap names of polygons	OS 3.9
	Finding vertices	OS 3.10
	Exercises	PB 3.4, Q1 and Q2
	Review answers	
	Mental Test	M 3.2
	Set homework	PB 3.4, Q3 and Q5
3.	**Conversion Graphs 1**	
	Discuss homework	
	Introduction	OS 3.11
	Exercises	PB 3.5, Q1
	Review answers	
	Exercises	PB 3.5, Q5
	Review answers	
	Set homework	PB3.5, Q2
4.	**Conversion Graphs 2**	
	Discuss homework	
	More complex conversions	Activity 3.3
	Exercises	PB 3.5, Q6
	Review answers	
	Mental Test	M 3.3
	Set homework	PB 3.5, Q7

UNIT 3 *Graphs* Lesson Plans **E**

Lesson No.	*Suggested Plan*	*References*
5.	**Revision**	
	Discuss homework	PB 3.4, Q1
	Revision Test	R 3.3
6.	**Recap**	
	Return marked tests	
	Recap topics	

Y7	**UNIT 3 *Graphs*** Lesson Plan 1	*Negative Numbers*
Activity		***Notes***
1	**Place value table**	
	T: What sleepy weather! I'd rather be lazing around at home. What about you!	Mental work with whole class.
	T: So we had better make a positive start with some brain work to wake us up.	T chooses Ps with or without hands up. As many Ps as possible involved, at speed.
1A	T: 3 + 8, 21 + 7, 30 + 50, 9 − 4, 27 − 12, 60 − 20, 33 + 47, 28 + 19 + 72	1A prepares for 1B and 1B for 2C.
1B	T: What number is (a) 4 more than 8 (b) 13 more than 19 (c) 5 less than 22 (d) 11 less than 11 ?	Agreement. Praising.
	T: What is your favourite number?	Relaxing question at end.
	5 mins	
2A	**Extending the number line**	
	T: Can you remember how we illustrate numbers? *(Number line)*	Whole class activity. Before introducing negative numbers, T gets Ps to review the illustration of whole numbers and decimals.
	T: Who can draw a simple number line on the BB?	Ps volunteer, T chooses one (slower one if possible) to come to BB and draw 
	T: I can only see whole numbers; what about decimals? Where are they?	T asks Ps to illustrate on BB.
	T: Who can show us where the number 3.2 is?	Ps point to approximate position on number line.
	T: Can you round it to the nearest unit? *(3)*	T asks Ps to show 2 or 3 more decimals, and the number they round to, on the number line.
2B	T: What do you think is on the left hand side of 0 ? *(Negative numbers)*	
	T: Who can extend my number line to the left?	P comes to BB and marks –1, –2, etc. 
	T: So, as on the RHS, the numbers –1, –2, ..., increase. *(No)*	Ps should protest..
	T: Don't tell me –2 is larger than –3 ? *(Yes)*	Ps agree that it *is* larger.
	T: OK; but by how much? *(1)* Why? $(-3+1=-2)$	Discussion. Praising. T asks Ps to draw extended number line in Ex.Bs.
(continued)		

Y7	**UNIT 3** ***Graphs*** Lesson Plan 1	*Negative Numbers*
Activity *(continued)*		***Notes***
2C	**OS 3.6** T (to P): Read out the first question for us, please. T: What is the answer? etc. If mistake made: T: Who agrees? Who doesn't? T (to P with mistake): Come to the BB and move along the number line with your finger. How any steps? In what direction? etc. *17 mins*	Whole class activity; task appears on OHP. Every P listens to question and then uses number line in Ex.B to find answer. T points to P to answer. Agreement, feedback, praising, and on to next question.
3	**Temperature OS 3.5** T: Where do you meet negative numbers in real life? *(Answers might include temperature)* T: We'll look at negative numbers in the context of temperature. T gives out copies of OS 3.5 to each P. *17 mins*	Individual work. Ps work on copy of OS 3.5. T monitors, helps, suggests to slower Ps that they count along the thermometer. Checking: T asks, P answers, giving reasons. Agreement. Feedback. Self-correction. Praising.
4	**Number sequences** T: Consider the number sequence ?, -2, -5, -8, …, … (a) What are the next 3 numbers? *(–11, –14, –17)* (b) What is the rule? *(–3 to get next term)* (c) What number comes before –2? *(1)* (d) What is the tenth number? (–26) T: How did you find the answer to (d)? *(Counted on, term by term)* T: But we didn't need to find the 8th or 9th term! What happens if I ask you for the 100th term? *33 mins*	Whole class activity. T writes sequence on BB. Ps volunteer to answer; stronger Ps will find it easier, but give time for others to work out answers. Ask Ps the reasons for their answers, in particular for (d). Discussion to see if anyone has a quicker way. Tell them that we will find a quicker way when they reach Unit 7.

Y7 UNIT 3 *Graphs* Lesson Plan 1 *Negative Numbers*

Activity		Notes

5

Water gauge

T: Do you know what a water gauge is? *(Suggestions)*

T: Along rivers, at certain points, water gauges are placed to measure the water level. Has anyone seen one?

T: The gauge has a zero point marked on it, and dividing points to measure the water level, in centimetres. It's like a vertical ruler, but with negative numbers on it.

T on prepared OHS,

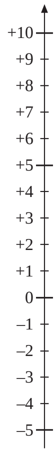
(a) On Monday 3 October, early in the morning, the water level was –13 cm. It increased by 5 cm every day for a week. What was the water level at the end of this time? *(+22 cm)*

(b) On the morning of 28 October, the water gauge showed +8 cm. The level decreased by 6 cm every day until the morning of 3 November. What was the water level now? *(–28 cm)*

Notes:

This task connects the mathematics with a practical context.

On BB:



Individual work, monitored, helped.

Ps work in Ex.Bs.

Review answers and methods.

(Make sure that Ps know how many days there are in October.)

40 mins

6

Illustrating with a Venn diagram

T reads out from OHP:

ζ is { –4, – 3, – 2, – 1, 0, 1, 2 }

A is { negative numbers }

B is {positive numbers }

(a) Draw Venn diagrams to illustrate the sets, and put in the numbers.

(b) $A \cap B = ?$ *(Empty set)*

(c) $A \cup B = ?$ { –4, –3, –2, –1, 1, 2 }

(d) $(A \cup B)' = ?$ { 0 }

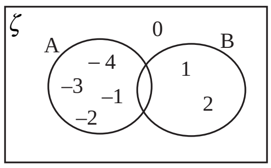
Notes:

This task connects with Unit 1, and clarifies the definition of zero.

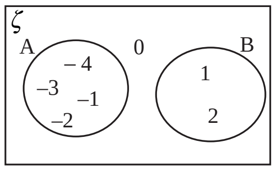
Whole class activity.

Task appears on OHP.

Ps volunteer to put numbers in Venn diagrams and answer questions; T chooses.



or



Discussion of the correct place for zero (clarified in (d)).

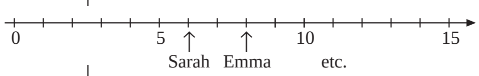
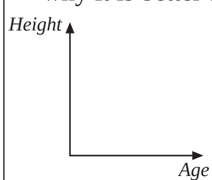
45 mins

7

Set homework

PB 3.3, Q2

Activity 3.2, Q1

Y7	**UNIT 3 *Graphs*** Lesson Plan 2	*Scatter Graphs and Coordinates*
Activity		***Notes***
1	**Checking homework**	
1A	**PB 3.3, Q2**	T points to Ps to answer. Others agree or not. If there is a problem, T draws number line on BB and calls P to it, ensuring that they count step by step. Praising. Self-correction.
1B	**Activity 3.2, Q1**	Checking on OHP. T shows completed sheet of results, with good differences (ranging from +5 to –6). Feedback. Self correction. Praising.
	T asks extra questions to make Ps think, e.g. T: Can you say what were the actual results for the two matches played by (a) Derby County *(0 - 0 and 0 - 0)* (b) Newcastle United *(1 - 1 and 0 - 0)* (c) Manchester United *(Can't say)* (d) Leeds United *(1 - 0 and 0 - 0)*	Discussion. Agreement. Praising.
	8 mins	
2	**OS 3.1** T: How do we illustrate numbers? *(Number line)* T: Can you illustrate *any* data on a number line? T: For example, the data for the ages of these 5 children is to be shown on a number line: Sarah is 6 years old Emma is 8 years old Rebecca is 13 years old Xanthia is 6 years old Samantha is 13 years old	Whole class activity. Ps illustrate on number line. 
	T: OK, but I have some more data: Sarah is 150 cm tall Xanthia is 120 cm tall Emma is 150 cm tall Samantha is 140 cm tall Rebecca is 170 cm tall T: How can I illustrate this? *(Another number line)* T: But how can I show both sets of data together? *(Use two axes)* T: This is called a scatter graph. T shows OS 3.1 and checks that data is correct.	T aims to get Ps to understand why it is better to use two coordinate axes, i.e. two number lines, at right angles to each other.  At pace, answers to questions on OS 3.1. Agreement. Praising.
	18 mins	

Y7	**UNIT 3 *Graphs*** Lesson Plan 2	*Scatter Graphs and Coordinates*
Activity		***Notes***
3	**PB 3.1, Q2** T: Could Ben use the data to support his argument for more pocket money? How? T: What is the connection between the two factors on the graph? *(Increasing pocket money as you get older)* *26 mins*	Individual work; monitored, helped, with detailed checking on OHP or BB, giving reasoning. T calls Ps to OHP to say what information we have about each child and how we can read if from the graph. Reasoning needed for (i).
4 **4A**	**Coordinates** **Identifying pupils** T: I met the mother of someone in this class earlier today and she asked me to give her child these sweets. T: But I didn't know whose mother it was. We talked a bit and it came to light that her child has BROWN hair .... and BROWN eyes .... and that the numbers 3 and 4 belong to this child. *(?)* T: What do these numbers mean? T: Do you want a clue? *(Yes!!)* T: Location! T: Does the order matter? *(Yes)* T: Can you give *your* coordinates in this way?	Whole class activity. T leads Ps into using coordinates to identify their position in class. T chooses P, and notes hair colour and eye colour (and position). Many Ps still a possibility. Still some left. Discussion as to what they could mean. Eventually class realises that the numbers refer to the positions of their seats in the classroom, i.e. column 3 and row 4, so P is identified. T asks most Ps to give their coordinates.
4B	**OS 3.3** T gives one copy to each P. *40 mins*	Whole class activity. Task on OHP. Ps volunteer answers. T chooses and P says coordinates; class checks. For plotting points (H, L) T calls out Ps to OHP to plot points. Agreement. Praising.
5	**PB 3.2, Q2** *45 mins*	Individual work; monitored, helped. Checking with discussion, different Ps giving coordinates of each place. Agreement. Feedback. Self-correction. Praising.

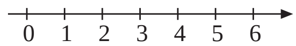
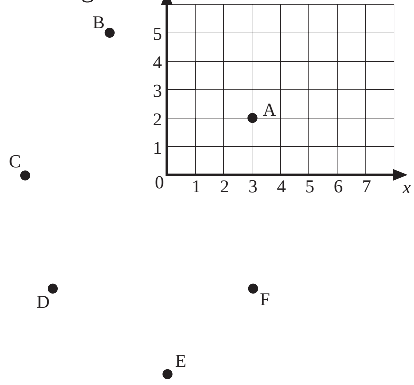
Y7	UNIT 3 *Graphs* Lesson Plan 2	*Scatter Graphs and Coordinates*
Activity		***Notes***
6	**Set homework** PB 3.1, Q4 (a) - (d), plus the question: "Is there any evidence from the graph to show that Ps good at maths are also good at science?" PB 3.2, Q1, but first, "Copy the grid and the triangle into your Ex.B."	Ps write extra question in their Ex.Bs, and copy grid and triangle as instructed.

18 mins

Y7	**UNIT 3 *Graphs*** Lesson Plan 3	*Plotting Points*
Activity		***Notes***
1	**Checking homework** PB 3.1, Q4 (a) - (d) PB 3.2, Q1 *5 mins*	Checking answers in words; T asks, Ps answer. Agreement. Feedback. Self-correction. Praising. (T revises how to read graphs in the checking.)
2	**PB 3.2, Q5** T: We did some plotting of points on the last lesson, but now we really concentrate on it. *15 mins*	Whole class activity. T puts prepared grid on OHP or BB. Ps copy grid into Ex.Bs. T asks Ps to plot points on OS. Each point plotted by different P, including slower ones. Ps watch. Agreement, and Ps plot the correct points in Ex.Bs.
3	**OS 3.4** Instructions Group A : Write a set of instructions for drawing the left eye. Group B : Write a set of instructions for drawing the right eye. Group C : Write a set of instructions for drawing the mouth. Group D : Write a set of instructions for drawing the outside of the head. T: Group E's instructions are to join the points in the order given, first by Group A, then Group B, etc. *30 mins*	Group activity, led, monitored and, if necessary, helped by T. T divides Ps into 5 groups (each of these should contain stronger and slower Ps). Groups A, B, C and D are given OS 3.4 and sheet (opposite) of instructions. Group E are given an OS showing a numbered grid (prepared previously by T). Groups are kept separate and cannot see the other groups' work. T keeps control, and ensures each group in turn gives instructions to group E. Group E work on OS, but it is not shown to class until all instructions have been carried out. When completed, Group E's grid is shown on OHP. Everyone checks; discussion. Praise.

Y7	**UNIT 3** ***Graphs*** Lesson Plan 3	*Plotting Points*
Activity		***Notes***
4	**PB 3.1, Q4** (2nd part)	Whole class activity. T copies set of axes onto BB, and Ps into Ex.Bs. T chooses Ps to come to BB and plot points. T can ask questions like (a) - (f) again with new data.
	37 mins	
5	**PB 3.1, Q5** T: Is there any evidence that the two judges were well trained? *(Some)*	Individual work; monitored, helped. Slow Ps may have a problem, e.g. how to name and label the axes; T monitors and helps. After most Ps have finished, T stops Ps and put on OS showing solutions. Self-correction. Feedback. Praising.
	45 mins	
6	**Set homework** PB 3.2, Q6 PB 3.1, Q6	

Y7 UNIT 3 *Graphs* Lesson Plan 4 *Plotting Polygons*

Activity		*Notes*
1	**Checking homework** PB 3.2, Q6 PB 3.1, Q6	Both tasks can be checked on OHP with T using prepared slides, or T quickly checks Ps' graphs by walking round class. Self-correction. Feedback. Praising.
	4 mins	
2	**Negative numbers** (again)	Mental work with everyone contributing.
2A	T: Can you remember how to work with negative numbers? *(Yes)* T: OK; here's a brain teaser for you. Sarah, (e.g.), choose two numbers between –10 and 10 and say if you want to add or subtract them; choose the next P to answer and then say whether the answer given is correct. T: Now it's Peter's turn to choose two numbers between –10 and 10 and say if they are to be added or subtracted. Who will you choose to answer this, Peter? Is she correct? Continue for several more turns, at a good pace.	e.g. Sarah: "3 – 5.... , Peter!" Peter: " – 2" Sarah: "Correct." e.g. Peter: "– 8 + 10.... , Lucy!" Lucy: " + 2 ", etc. T praises Ps.
2B	T: Can you still remember negative numbers? *(Yes!)* T: Where is the number – 5? – 2 ? etc.	Whole class activity. T draws positive end of number line on BB.  T chooses P to extend number line on BB and Ps put on values.
2C	T: Can you still remember negative numbers? *(Yes!!)* T: So what can I do if I want to tell somebody the place of points A, B, C, D, E or F ? *(Need coordinates)* T: But they are not all on the grid! *(Extend the axes both ways)* T shows complete version of OS 3.7 and gets Ps to read out coordinates and plot points G to L.	Whole class activity. T copies only positive quadrant of OS 3.7 onto top right quarter of BB before the lesson, with all points plotted, approximately. e.g. 
	20 mins	

Y7	**UNIT 3** ***Graphs*** Lesson Plan 4	*Plotting Polygons*
Activity		***Notes***
3	**PB 3.4, Q2** T: Who got all the points correct? Who had one mistake ? two ? three ? more? T: Is there anyone whose points were all correct, but who could not join them up to make the 8-pointed star?	Individual work, monitored, helped. For checking, T puts diagram and marked points (without joining) on OS on OHP. Self-correction. Feedback. T chooses successful P to join up points on OS.
	28 mins	
4 **4A**	**Plotting polygons** T: Have you ever studied the 8-pointed star? *(No)* T: It is a well-known polygon. What kind of polygon have we studied? T: What is a *regular* polygon? *(All sides equal)*	T gets Ps to remember triangle, square, rectangle, etc. and shows table on p47 of PB Y7A.
4B	**(a) OS 3.10** **(b) PB 3.5, Q3 (b)** **(c) PB 3.5, Q6**	T asks Ps to come to OHP to complete the square on OS 3.10. Agreement. Ps read out coordinates of the missing point. Praising. Ps do (b) and (c) in Ex.Bs. Monitoring, helping. T draws on BB if there is a problem. Discussion. Agreement. Praising.
	37 mins	
5	**PB 3.5, Q2 (a), Q4 (c), Q7**	Individual work, monitored, helped. For Q2 and Q4, Ps have to draw a grid in their Ex.Bs, so slower Ps may fall behind. For these, it is not necessary to finish Q7. When most of the Ps are ready, T can stop work and start checking. T asks Ps to give coordinates of missing points. Agreement. Feedback. If many Ps have a problem, then T will need to draw grid onto BB and call Ps to plot the points done first. If only one or two have problems, T can help individually. Self-correction. Praising.
	45 mins	

Y7	**UNIT 3** ***Graphs*** Lesson Plan 4	*Plotting Polygons*
Activity		***Notes***
6	**Set homework** PB 3.4, Q5 PB 3.5, Q4 (b) PB 3.5, Q5 (a), (b)	

Y7	**UNIT 3 *Graphs*** Lesson Plan 5	*Conversion Graphs*
Activity		***Notes***
1	**Checking homework** PB 3.4, Q5 PB 3.5, Q4 (b) PB 3.5, Q5 (a), (b) T: Who got one square? Two? Three? Four or more *(joke)* ? *(More could be found by going outside the plane of the grid.)* *6 mins*	Ps open Ex.Bs at homework and T checks path of tennis ball by walking among them; if there is a problem, T stops and shows mistake. Praising. Check coordinates; if agreement, no problems; otherwise, discussion needed, with grid drawn on BB. Self-correction. Praising. T sketches grid and asks Ps to give coordinates of extra points. Agreement. Feedback. Self-correction.
2	**PB 3.6, Q1** e.g. T: How can you convert pounds sterling into French francs *without* using this graph? How are the currencies related? *(Multiply by 50)* T: So, do we need the graph? *(No, it's easier to multiply)* T: Maybe we will not have this problems much longer if we join the European monetary union. *12 mins*	Whole class activity. T reminds Ps of scatter graphs. T points to Ps to answer (mainly slower ones), using the graph in their PB. Agreement. Praising. Discussion. Discussion!
3	**Speed conversion** OS 3.11 T: I hope that wider integration with Europe won't affect our cars. What do you think I mean by this? *(Steering wheel on RHS)* T: Yes; what else? (Speed in mph) T: In continental Europe, how do they measure speed? *(km/h)* T: How can we convert the speeds? T: Let's see if we can use this conversion graph. What does 30 mph correspond to? *(About 48 km/h)* How did you get your answer? T: Do we have to use this graph? *(No)* T: What is the multiplier? *(It will be a decimal)* T: OK; we will just use the graph and find approximate answers. *20 mins*	Whole class activity. Ps may answer in chorus. Task appears on OHP, and each P gets a copy of the sheet. P describes process using graph. At speed, Ps give answers. Checking. Praising.

Y7	UNIT 3 *Graphs* Lesson Plan 5	*Conversion Graphs*
Activity		***Notes***
4	**PB 3.6, Q5 (a) - (c)** T: This is a bit more complicated, but you will be able to cope. We will find approximate answers, but take care to be as accurate as possible.	Individual work, monitored, helped. T (walking amongst Ps) checks that Ps have correctly copied grid and the two points. T checks answers: T asks P and others have to decide if they accept the answer. Self- correction. Praising.
	30 mins	
5	**Revision: M 3.1**	
5A	T: Let's check what we have learnt in this lesson.	M 3.1 appears on OHP; questions dealt with one-by-one. For Q1, Q6 and Q7, coordinate grid on OHP or BB needed. P points to one or comes out and reads coordinates.
5B	T: Extra question: "A, B and D are corners of a square. What are the coordinates of the fourth corner?"	(In Q2 and Q5, replace 'with' by 'say'.)
5C	**PB 3.1, Q3**	Ps read this task from PBs. T asks questions and Ps answer as above. T notes which topics need review and practice.
	45 mins	
6	**Set homework** M 3.2 (sheet for each P) PB 3.1, Q6	

UNIT 3 Graphs Mental Tests

M 3.1 Standard Route *(no calculator)*

(Pupils will need a copy of coordinate grid, A)

1. What are the coordinates of the points: (i) A, (4, 2)
   (ii) B, (0, 5)
   (iii) C ? (6, 6)

2. Write these numbers in order, smallest first:
   – 5, 7, 0, – 7, 3, – 1 (– 7, – 5, – 1, 0, 3, 7)

3. What is the temperature 5 °C cooler than −2 °C? (−7 °C)

4. What is the temperature 7 °C warmer than −3 °C ? (4 °C)

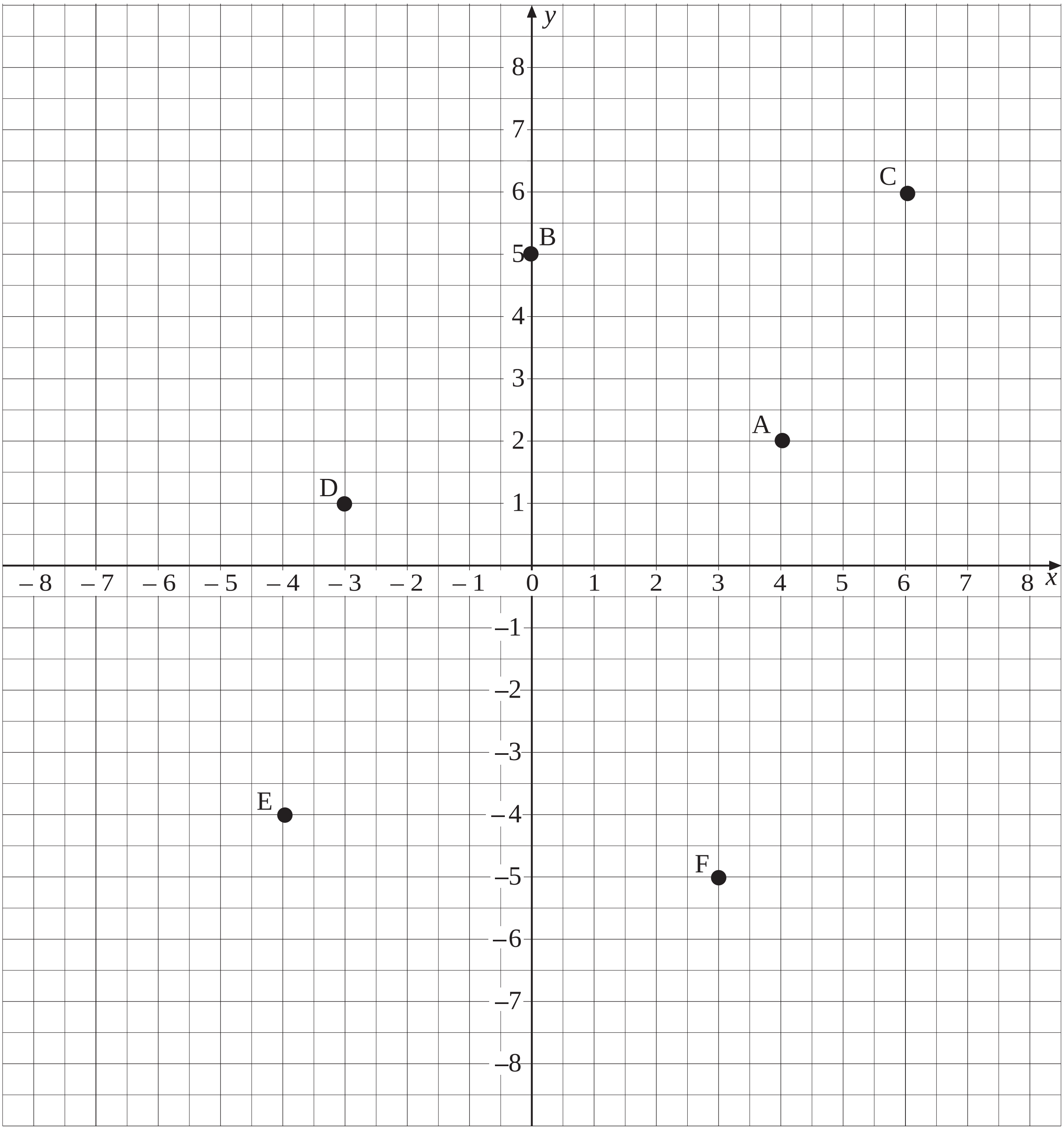
5. Write down *one* integer that satisfies
   $-4 <$ number < -1 (– 2 or – 3)

6. What are the coordinates of the points: (i) D, (– 3, 1)
   (ii) E, (– 4, – 4)
   (iii) F ? (3, – 5)

UNIT 3 Graphs Mental Tests

M 3.1 Standard Route

Coordinate Grid A



UNIT 3 Graphs Mental Tests

M 3.2 Standard Route *(no calculator)*

(Pupils will need a copy of coordinate grid, B)

1. Write these numbers in order, smallest first:
   0, – 4, – 7, 2, 5, – 1 (– 7, – 4, – 1, 0, 2, 5)

2. What is the temperature 4 °C colder than −5 °C? (−9 °C)

3. Write down all integers that satisfy
   $-7 <$ number < -4 (– 6 and – 5)

4. What are the coordinates of the points:
   (i) A, (2, 5)
   (ii) B, (4, 0)
   (iii) C, (– 2, – 4)
   (iv) D ? (0, – 7)

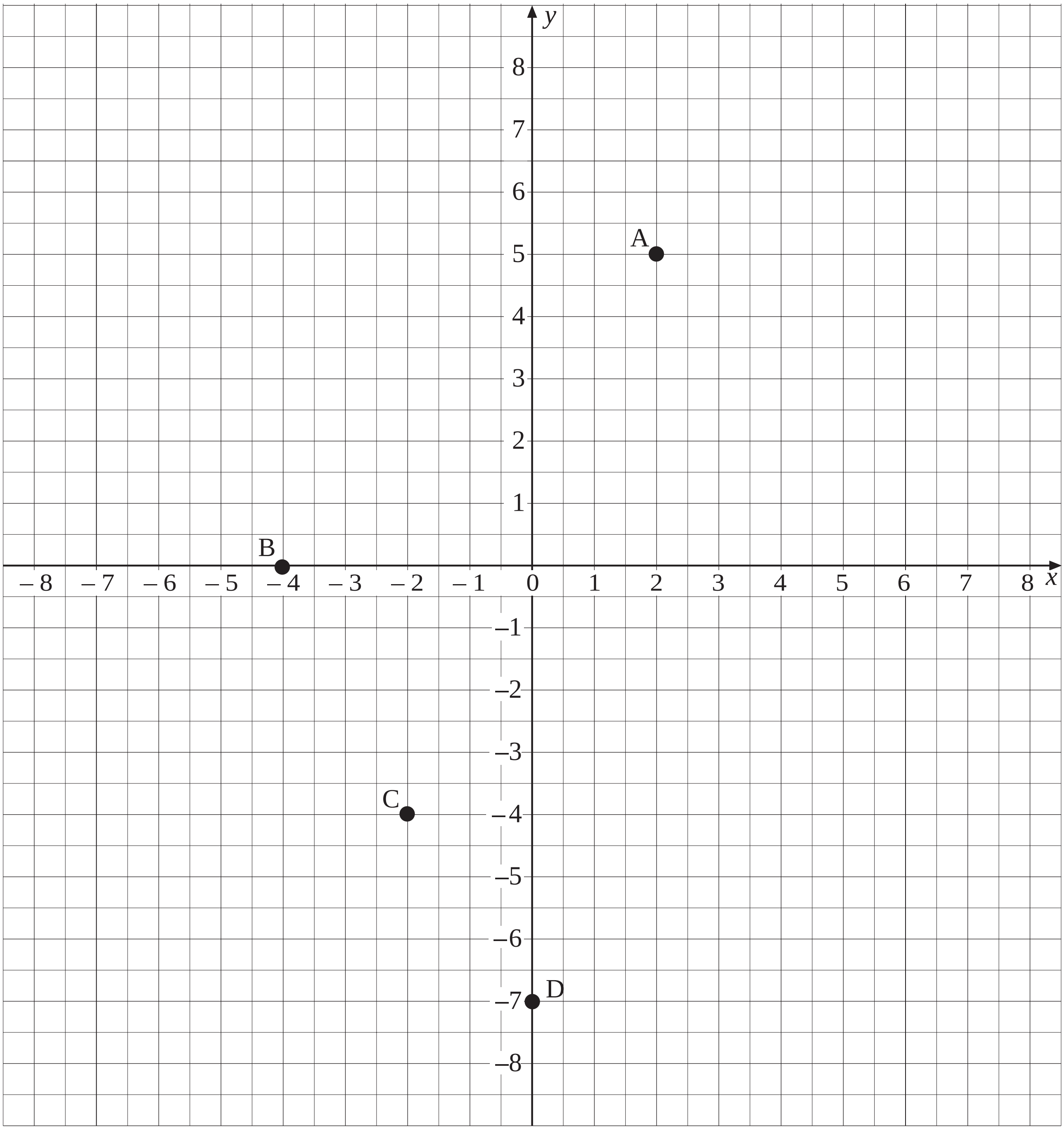
5. Three corners of a rectangle are at (0, 0), (5, 0), (5, 2).
   What are the coordinates of the fourth corner? (0, 2)

6. Three corners of a square are (0, – 2), (3, 0), (1, 3)
   What are the coordinates of the fourth corner? (– 2, 1)

UNIT 3 Graphs Mental Tests

M 3.2 Academic Route

Coordinate Grid B



UNIT 3 Graphs Mental Tests

M 3.3 Express Route *(no calculator)*

(Pupils will need a copy of coordinate grid, C)

1. What are the coordinates of the points: (i) A, (0, 7)
   (ii) B, (– 2, 1)
   (iii) C, (– 3, – 5)
   (iv) D ? (5, – 3)

2. Three corners of a rectangle are at (– 2, – 3), (4, – 3) and (4, 2)
   What are the coordinates of the fourth corner? (– 2, 2)

3. A square has corners at points with coordinates (2, 3), (0, – 1) and (3, 0).
   What are the coordinates of the fourth corner? (– 1, 2)

4. A square has corners at points with coordinates (– 2, – 2) and (– 2, – 5).

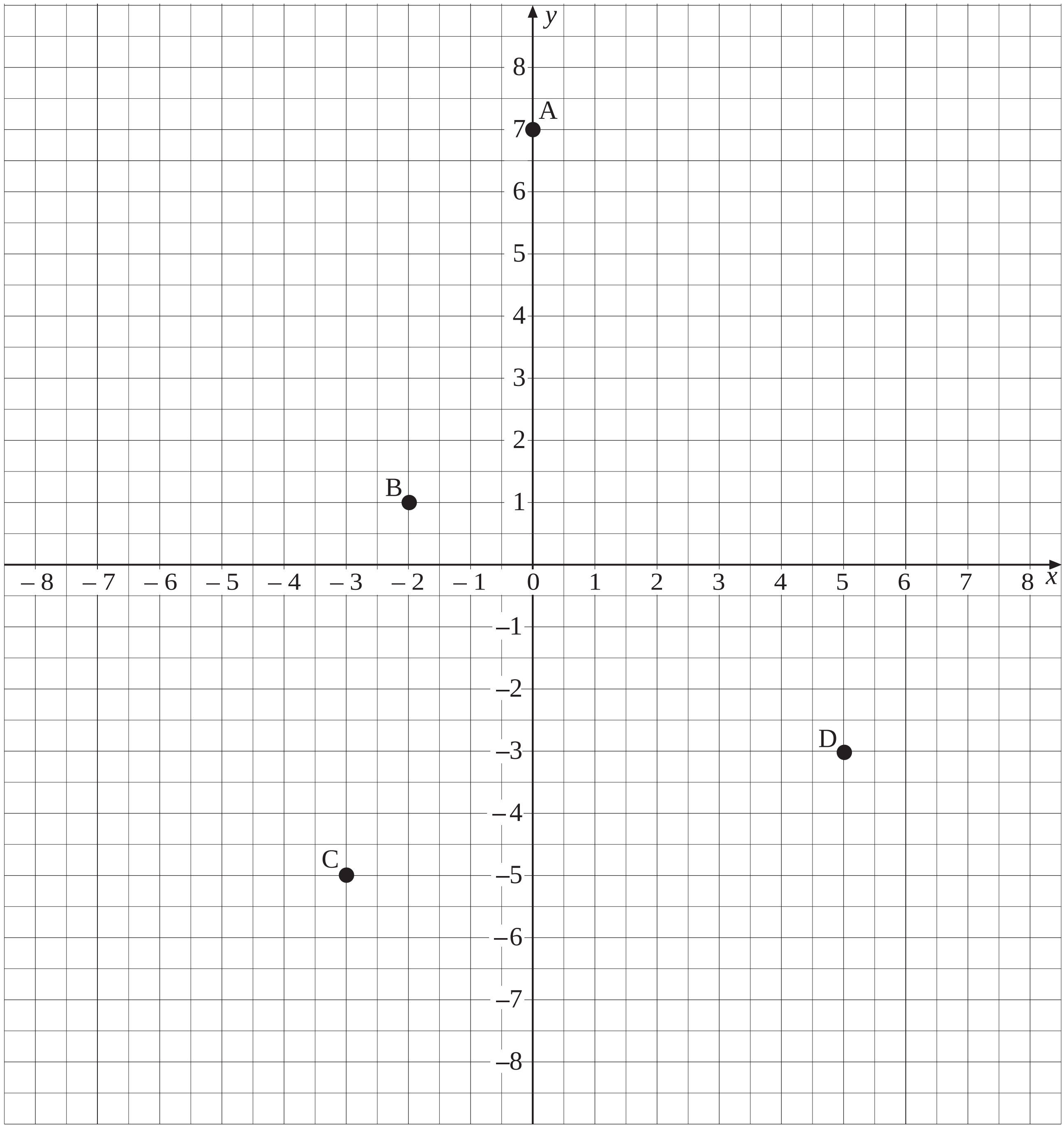
   What are the possible pairs of coordinates of the other two points? (– 5, – 5) and (– 5, – 2)

   or (1, – 5) and (1, – 2)

UNIT 3 Graphs Mental Tests

M 3.3 Express Route

Coordinate Grid C



UNIT 3 *Graphs* Teaching Notes

Historical Background and Introduction

The key concept here is that of drawing graphs to represent formulae (or functions) and hence depends on the formation of cartesian axes. These were first introduced by the French philosopher, *René Descartes* (1596-1650), from which the name 'cartesian' is derived (see internet address

http://www-groups-dcs.st-and.ac.uk:80/~history/

for details of his life and work).

The link between algebra and geometry (often called analytic geometry) seems quite natural now, but it is surprising to note how recently it came into being. The subject appeared in the 17th Century with *Pierre Fermat* and *René Descartes* as its principal developers. In fact, *Descartes* gained the glory as he quickly published his work, whereas *Fermat* delayed publication.

Prior to this time, geometry had been studied for many centuries, so that the properties of particular curves (e.g. circle, parabola, elipse etc.) had been well understood. Algebraic notation and analysis, particularly related to the solving of equations had also been progressing. What *Fermat* and *Descartes* did was to take an algebraic equation and plot corresponding points (and hence its graph) on a rectangular grid so combining geometry and algebra together.

Descartes published his main treatise in 1637, but he made it tough going for the readers - even the great Newton had dificulty in following the arguments! In fact *Descartes* wrote to the reader

> "I shall not stop to explain this in more detail, because I should deprive you of the pleasure of mastering it yourself"

and he continued

> "I have omitted a number of things that might have made it clearer, but I did this intentionally, and would not have it otherwise".

(Note this is not the MEP teaching philosophy!)

Fortunately, others at the time were able to revise the ideas and put them in an intelligible form and later a revised edtion of his work made its mark.

Nowadays it seems entirely natural to draw graphs of functions given in algebraic terms - indeed it is one of the key components of both GCSE and A Level maths courses. So we owe much to the advances made by both *Descartes* and *Fermat.*

In this unit, we first introduce coordinates in the positive quadrant and scatter graphs are introduced as a useful application. To extend the axes fully, negative numbers are introduced and the final section is centred on another application of graphs, namely that of conversion between units (or currencies).

Routes		**Standard**	**Academic**	**Express**
3.1	Scatter Graphs	✓	✓	–
3.2	Plotting Points	✓	✓	–
3.3	Negative Numbers	✓	✓	–
3.4	Coordinates	✓	✓	✓
3.5	Plotting Polygons	(✓)	✓	✓
3.6	Conversion Graphs	✕	(✓)	✓

Language	**Standard**	**Academic**	**Express**
• scatter graph	✓	✓	–
• coordinate axis, coordinates	✓	✓	✓
• negative numbers	✓	✓	–
• polygon (through to decagon)	(✓)	✓	✓
• conversion graph	✕	(✓)	✓

(✓) *denotes extension work for these pupils*

Challenging Questions

The following questions are more challenging than others in the same section:

	Section	*Question No.*	*Page*
Practice Book Y7A	3.1	1 (h)	30
		2 (i)	32
" "	3.3	6	41
" "	3.5	8	51
		9	51

UNIT 4 *Arithmetic: Addition and Subtraction of Decimals* Lesson Plans **St**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Addition and Subtraction**	
	Introduction – addition	OS 4.1
	Practice	PB 4.1, Q1 and Q2
	Discuss solutions	
	Introduction - subtraction	OS 4.1
	Practice	PB 4.1, Q3
	Discuss solutions	
	Brackets	PB 4.1, Example 1
	Practice	PB 4.1, Q4 or OS 4.4
	Discuss solutions	
	Quick calculations	OS 4.3
	Set homework	PB 4.1, Q5 and Q17
2.	**Addition and Subtraction in Context**	
	Discuss homework	
	Inroduction	PB 4.1, Q8
	Practice	PB 4.1, Q9
	Discuss solutions	
	Practice	PB 4.1, Q10
	Discuss solutions	
	Set homework	PB 4.1, Q12 and Q13
3.	**Decimal Addition and Subtraction**	
	Mental Test	M 4.1
	Discuss homework	
	Decimal calculations: introduction	OS 4.2
	Practice	PB 4.1, Q18 and Q19
	Discuss solutions	
	Set homework	PB 4.1, Q18 and Q19

UNIT 4 *Arithmetic: Addition and Subtraction of Decimals* **St**

Lesson No.	*Suggested Plan*	*References*
4.	**Money Calculations**	
	Mental Test	M 4.2
	Using money in context	PB 4.2, Q1
	Practice – whole class	PB 4.2, Q2, Q3, Q4 and Q5
	Practice	PB 4.2, Q8
	Discuss solutions	
	Using brackets	OS 4.5
	Set homework	PB 4.2, Q7 and Q12
5.	**Recap**	
	Discuss homework	
	Revision Test	RT 4.1 (Standard)
6.	**Revision**	
	Give back marked tests	
	Go over test questions interactively	
	Revise key topics	

UNIT 4 *Arithmetic: Addition and Subtraction of Decimals* A and E

Lesson No.	*Suggested Plan*	*References*
1.	**Addition and Subtraction**	
	Revision	OS 4.1 and PB 4.1, Q1, Q2 and Q3
	Brackets	OS 4.4
	Quick calculations	OS 4.3
	Calculations in context	PB 4.1, Q8
	Practice	PB 4.1, Q9 and Q10
	Discuss solutions	
	Set homework	PB 4.1, Q12, Q13 and Q17
2.	**Decimal Addition and Subtraction**	
	Mental Test	M 4.1
	Discuss homework	
	Decimal calculations: introduction	OS 4.2
	Practice	PB 4.1, Q18 and 19
	Discuss solutions	
	Set homework	PB 4.1, Q18 and Q19
3.	**Money Calculations**	
	Mental Test	M 4.2
	Using money in context	PB 4.2, Q1
	Practice – whole class	PB 4.2, Q2, Q3, Q4 and Q5
	Practice	PB 4.2, Q8
	Discuss solutions	
	Using brackets	OS 4.5
	Set homework	PB 4.2, Q7 and Q12
4.	**Decimal Calculations**	
	Mental Test	M 4.3 or M 4.4
	Practice	PB 4.2, Q10 and Q11
	Discuss solutions	
	Introduction	PB 4.2, Q9
	Set homework	Revision

UNIT 4 *Arithmetic: Addition and Subtraction of Decimals*

A and **E**

Lesson No.	*Suggested Plan*	*References*
5.	**Recap**	
	Revision Test	RT 4.2
	Go over test questions interactively	
	Revise key topics	
6.	**Revision**	
	Give back marked tests	
	Go over test questions interactively	
	Revise key topics	

Y7	UNIT 4 *Addition and Subtraction of Decimals* Lesson Plan 1	*Whole Numbers*
Activity		***Notes***
1	**Revision** T: Let's check whether you can add and subtract. PB 4.1, Q1 and Q3 and also subtractions which have negative answers, e.g. $3-4 \quad (=-1)$ $7-17 \quad (=-10)$ $23-35 \quad (=-12)$ $28-44 \quad (=-16)$ *5 mins*	Mental work. T stirs up Ps with fast tempo. T says the task, Ps calculate and volunteer to answer when they are ready. T points in turn. Agreement. Feedback. Praising.
2	**Laws of addition and subtraction**	Whole class activity.
2A	T: Can you remember any 'laws' of addition and subtraction? *(?)* T: Have a look at these statements. You have to decide which are true and which are false. PB 4.1, Q2 (a) - (d) and $(16+3)+7=16+(3+7)=16+3+7$ and $16-(3+7)=16-3+7$ T: So what is the law illustrated by (a) ? *(You* can *change the order of addition)* T: We say that addition is 'commutative'. T: Is subtraction 'commutative' ? *(No - see (b))* T: What does (c) show? *(You can group the numbers in any way)* T: How does this help? *(Easier to add)*	Statements shown on OHP or BB. Ps volunteer, T chooses, P answers. Reasoning. Agreement. No need to stress this word at this stage, unless Ps are confident. Illustrate through $16+3+7=16+(3+7)=16+10$ $=26$
2B	T: Let's see what happens when we use brackets. Here is a group of statements. Calculate both sides and compare the answers, then decide if each is true or false. (a) $65+(35-3) = 65+35-3$ (b) $65-(35-3) = 65-35-3$ (c) $65-(35-3) = 65-35+3$ (d) $65-(35+3) = 65-35-3$ (e) $65-(35+3) = 65-35+3$ Discuss results; e.g. T: Why do you think (d) is true? *(We are substituting both 35 and 3 for 65)* *15 mins*	Whole class activity. Task appears on OHP. Ps calculate, volunteer, answer and give reasons. Agreement. Feedback. Praising.

<table>
<tr><td>Y7</td><td>UNIT 4 Addition and Subtraction of Decimals Lesson Plan 1</td><td>Whole Numbers</td></tr>
<tr><td>Activity</td><td></td><td>Notes</td></tr>
<tr><td>3</td><td>Efficient calculations
T: We can use these laws to make mental calculations easier.
T: For example,
(a) $39 + 58 + 61 = ?$
$\left(= (39 + 61) + 58 = 100 + 58 = 158\right)$
(b) $132 - 67 - 13 = ?$
$\left(132 - (67 + 13) = 132 - 80 = 52\right)$

T: Now in your Ex.Bs, find the quickest way to calculate these:
(c) $39 + 48 + 12$ — $\left(39+(48+12)\right)$
(d) $56 + 27 + 44$ — $\left((56+44)+27\right)$
(e) $91 - 16 - 74$ — $\left(91-(16+74)\right)$
(f) $118 - 137 + 37$ — $\left(118-(137-37)\right)$

T: e.g.
Who would like to explain their method for (c)?
T: Did anyone else use this method?
T: Did anyone use a different method? What was it?
T: Who got the correct answer?
T: Make sure you have a correct method and answer in your Ex.B.

28 mins</td><td>Whole class activity.

T writes task on BB and asks for volunteers. Ps write out method in BB.
Discussion on quickest way. Agreement. Ps write out example in Ex.Bs.

Individual work.
T writes task on BB or OHP.
Ps work in Ex.Bs. T walks among Ps, monitoring their work and helping slower Ps.
After some minutes, when most Ps are ready, T stops the work.

P comes to BB, with their calculation, saying it clearly and giving reasons.

Discussion. Explanation. Agreement. Feedback.
Praising.</td></tr>
<tr><td>4

Extension</td><td>OS 4.1: Vertical calculations
T: OK - what is 3 583 972 + 986 789 ? (?)
T: How can we calculate this? (Vertical addition)

T: Now can you add 3 583 972 and 986 789 ?
e.g.
$$\begin{array}{r} 3\,583\,972 \\ 986\,789 + \\ \hline 4\,570\,761 \\ \hline {\scriptstyle 1\ 1\ 1\ 1\ \ 1\ 1\ } \end{array}$$
34 mins</td><td>T shows task on OHP.
Q1-3 can be solved by Ps at BB with discussion.
Q4 in Ex.B. as individual work.
Similarly Q5-7 on BB and Q8 in Ex.B.

Ps calculate on BB with help.</td></tr>
<tr><td>5</td><td>Problems in context
T: Listen carefully and try this calculation.
T: There is an empty room with no-one in it. Just before 5 people enter the room, 3 people leave it. How many people are now in the room?

38 mins</td><td>Whole class activity.
T uses the 'funny' example as an activity to get their attention again.
(Problem: How can 3 people leave an empty room?
Answer: They can't, but mathematically they can!)</td></tr>
</table>

Y7	UNIT 4 *Addition and Subtraction of Decimals* Lesson Plan 1	*Whole Numbers*
Activity		***Notes***
6	**PB 4.1, Q9** T: Who can write out a solution to (a) ? P_1: (on BB) $22 - 5 + 12 = 29$ T: Who has the same? Who has another method? P_2: (on BB) $22 + (12 - 5)$ T: Does this method work? Does it give the same answer? *(Yes)* T: Now who can give us a solution to part (b) ? P_3: (on BB) e.g. $22 + 0 + x = 35$ T: Is that correct? What is the mistake? P_4: (on BB) $29 - 0 + x = 35$ $x = 6$ *45 mins*	Individual work for a fixed time interval, followed by discussion with T choosing P to show solution on BB. Agreement. Feedback. Self-correction. Praising. Discussion on how the clever use of brackets can help. Discussion, explaining. Agreement. Feedback. Self-correction. Praising.
7	**Set homework** **PB 4.1, Q5** **Q14** **Q17 (a) - (h)**	Slower Ps could solve early questions for homework and give them to T for marking.

Y7	**UNIT 4** ***Addition and Subtraction of Decimals*** Lesson Plan 2	*Decimals*
Activity		***Notes***
1	**Checking homework**	
1A	**PB 4.1, Q5 (c)** e.g.	T chooses Ps to write out solutions to Q5 and Q14 on BB.
	P_1 (on BB): $5 + 7 - (2 - 1) = 11$	Solutions discussed.
	T: Is this correct? Is there any other way?	
1B	**PB 4.1, Q14** e.g.	
	P_2 (on BB): $216 + 82 - 73 = 225$	
	T: Is this correct? Who got the same answer?	
	T (to P_2): How did you add the numbers?	
	P_2: I added 82 to 216 to give 298 and then subtracted 73.	
	T: Can anyone come to the board and show us another way?	
	P_3 (at BB): $216 + (82 - 73) = 216 + 9 = 225$	
	T: Who used this method? Which is the better method?	Self-correction. Praising.
1C	**PB 4.1, Q17 (a) - (h)**	T chooses Ps in turn, to give answers and methods of calculation.
	8 mins	
2	**Revision**	
	T: A problem for practice. Ready? *(Yes)*	Mental work. T reads out problem slowly. Ps calculate in their heads.
	T: Old MacDonald had a farm, And on that farm he had 37 pigs.	
	T: On Monday, he bought 22 pigs .... OK?	Ps nod their heads to show that they have done the calculation.
	T: Next day the mouse took away 15 pigs ... yes, it was a real BAFM (Big Angry Fighter Mouse).	
	T: Finally, on Wednesday morning, Old MacDonald bought 78 more pigs, but 73 escaped into his neighbour's field that afternoon.	
	T: OK? Ready? How many pigs were on Old MacDonald's farm on Wednesday evening?	This may cause problems for many Ps.
	T: What is your answer? And yours? Any other answers?	T asks Ps who seem to be sure of their answers.
	T: Now let's see who is correct. Who would like to show their calculation on the BB while I read out the story again?	
	P: 1st day $37 + 22 = 59$ 2nd day $59 - 15 = 44$ 3rd day $(44 + 78) - 73 = 49$	T reads the story again, day by day, with P writing each step on BB.
	T: Who got the first step correct? Second step? Third step? Who got it wrong? Where was your problem? Does anyone have an easy was of calculating the third step? $(44 + (78 - 73))$	Ps volunteer answer. Agreement. Praising.
	16 mins	

Y7	UNIT 4 *Addition and Subtraction of Decimals* Lesson Plan 2	*Decimals*

Activity | | ***Notes***

3 — **Rounding: place value**

T: Firstly we'll revise place value, which is based on the power of 10. What do we use? *(Units, tens, hundreds, ...)*

> Whole class activity.
> Quick revision of place value. Ps can answer in chorus.

T: What about decimals? *(Tenths, hundredths, thousandths, ...)*

T: What does 4.386 mean? *(4 units, 3 tenths, 8 hundredths and 6 thousandths)*

> T writes number on BB
> Praising.

T: Who could draw a place value table on the BB to show this number?

> Ps volunteer. T chooses P to draw table on BB; 4.386 written in table.

T: What about 685, 3.4, 10.57, 28.002, 0.501 ?

> T says the numbers and Ps in turn write in numbers, extending place value table where necessary. Agreement. Praising.

40 mins

4A — **Adding and subtracting decimals**

T: Daffy Duck is training Bugs Bunny for the next Olympic Games.

Do you know when these will be held?

> Discussion (2004 : Athens
> 2008 : Beijing)

T: Bugs Bunny is very good at 'Hop, Skip and Jump'. Last week he hopped 445 cm, stepped 39 dm and jumped 6 m 3 cm. What is the total distance he covered?

> T will need to explain dm
> (1 decimetre = 10 cm).

T: We can write these values in a table:

10 m	m	dm	cm
	4	4	5
	3	9	0
	6	0	3
1	4	3	8

> T writes data on BB and Ps discuss units.
> T chooses Ps in turn to enter data.
> T chooses 4th P to add up the numbers.
> Agreement. Praising.

T: His total was 14 m 3 dm 8 cm.

T: So what place value table is needed if we choose 1 cm as the unit? *(Thousands, hundreds, tens, units)*

> Ps may answer in chorus.
> T chooses P to write on BB.

T: And what will the addition look like?

$$\begin{array}{r} 445 \\ 390 \\ +\ 603 \\ \hline 1438 \\ \hline \end{array}$$

> Ps write in Ex.Bs.

T: But what if 1 dm is the unit? *(Hundreds. tens. units, tenths)*

$$\begin{array}{r} 44.5 \\ 39.0 \\ +\ 60.3 \\ \hline 143.8 \\ \hline \end{array}$$

> T chooses another P to write on BB and say what they are doing.
> Ps write in Ex.Bs.

(continued)

Y7	**UNIT 4** ***Addition and Subtraction of Decimals*** Lesson Plan 2	*Decimals*
Activity		***Notes***
4A ***(continued)***	T: And what if 1 m is the unit? *(Tens, units, tenths, hundredths)* $\begin{array}{r} 4.45 \\ 3.90 \\ +\ 6.03 \\ \hline 14.38 \\ \hline \end{array}$	T chooses another P to write on BB and say what they are doing. Agreement. Praising. Ps write in Ex.Bs.
4B	T: This week, Bugs Bunny had a total jump of 15 m 20 cm. How much longer was this than his jump last week? e.g. P_1: If the unit is 1 cm, the calculation is $\begin{array}{r} 1520 \\ -\ 1438 \\ \hline 82 \\ \hline \end{array}$ i.e. 82 cm P_2: If the unit is 1 m, the calculation is $\begin{array}{r} 15.20 \\ -\ 14.38 \\ \hline 0.82 \\ \hline \end{array}$ i.e. 0.82 m T: So what rule are we using when adding or subtracting decimals? *35 mins*	T leads Ps to choose the unit. After discussion, T clarifies that "We write decimals so that the same place values are in the same column, with the decimal points lining up. After addition/ subtraction, the decimal point in the answer is in the same place."
5 **5A**	**Practice** (a) 36.4 + 17.825 (b) 12.5 − 8.38	T writes (a) and (b) on BB and chooses 2 Ps to calculate answers, saying what they are doing. Ps write in Ex.Bs. Agreement. Praising.
5B	**PB 4.1, Q18 (a), (e), (i), (n)** **PB 4.1, Q19 (a), (c), (i), (k)** *45 mins*	Individual work; monitored, helped. Discussion at BB (Ps write on BB). Agreement. Feedback. Self-correction. Praising. T again stresses how to add and subtract decimals.
6	**Set homework** **PB 4.1, Q18 (c), (h), (j), (k), (m)** **PB 4.1, Q19 (f), (h), (j), (l), (m)**	

Y7	**UNIT 4** ***Addition and Subtraction of Decimals*** Lesson Plan 3	*Dealing With Money*
Activity		***Notes***
1	**Checking homework** e.g. **PB 4.1, Q19 (l)** wrong $\begin{array}{r} 11.40 \\ -\ 3.12 \\ \hline \end{array}$ correct $\begin{array}{r} 11.40 \\ -\ \ 3.12 \\ \hline \end{array}$ e.g. **PB 4.1, Q19 (m)** correct $\begin{array}{r} 0.7 \\ -\ 0.04 \\ \hline \end{array}$ or $\begin{array}{r} 0.70 \\ -\ 0.04 \\ \hline \end{array}$ etc. *4 mins*	T chooses Ps to write answers on BB. Agreement. Feedback. Self-correction. Praising. T checks that Ps are writing out calculations correctly.
2	**Money calculations** T: Today we are going to buy tickets, chips and newspapers whilst practising addition and subtracting of decimals. First, though, let's see if we are ready to go into a shop! T: Can you calculate with decimals? *(Yes)* T: Let's see! Write down what I say. T: I thought of a number, added the sum of 0.2 and 0.7 to it, and got 2.41. What was the number I thought of? $\left(? + (0.2 + 0.7) = 2.41\right)$ T: Who got the answer 1.51 ? Who has a different answer? *12 mins*	This is a warm-up activity, continuing from the previous lesson. Ps write in Ex.Bs. T gives Ps time to solve the problem. T chooses P to write solution on BB. Agreement. Feedback. Self-correction. Praising. T helps slower Ps with calculation, e.g. $0.2 + 0.7 = 0.9$ $? = 2.41 - 0.9$ $? = 1.51$
3A T: *(continued)*	**PB 4.2, Q8 (c)** Find the pasty in the table. How much does it cost? T: What is the question? How can we answer it? T: If we are going to work in £s, what do we have to do first? $(79\text{p} \rightarrow £0.79)$ T: Can anyone tell me how to write out the subtraction on the board?	Whole class activity. Ps read the text in their PBs and then T asks questions. T chooses Ps to answer. T writes on BB what P says: $\begin{array}{r} 1.20 \\ -\,0.79 \\ \hline 0.41 \\ \hline \end{array}$ Ps write in Ex.Bs

Y7	UNIT 4 ***Addition and Subtraction of Decimals*** Lesson Plan 3	*Dealing With Money*
Activity		***Notes***
3A *(continued)*	T: What else do we have to do? *(?)* T: We have to answer the question with a whole sentence, in context. *(John has 41p left)*	Ps write in Ex.Bs.
3B	Who is the hungriest pupil in this class? T: Let's say you have £1.84 in your pocket. T: What will you buy from the items listed in the table? Make sure you have enough money! *(e.g. chips and pie)* T (to the class): What do you think? Does he/she have enough money? P (on BB): $\begin{array}{r} 0.75 \\ +0.92 \\ \hline 1.67 \\ \hline \end{array}$ As £1.67 is less than £1.84, I have enough money. T: How much money do you have left? P (on BB): $\begin{array}{r} 1.84 \\ -1.67 \\ \hline 0.17 \\ \hline \end{array}$ P: 0.17 T: What is that? P: £0.17 T: Answer with a whole sentence please. P: I have 17 pence left. *22 mins*	T chooses P. T gets Ps to estimate if 1.84 is larger than $0.75 + 0.92$. Individual work in Ex.Bs, then T calls on P to say calculation and write it on BB. Agreement. Feedback. Self-correction. Praising. T stresses that Ps must be precise in mathematics. Agreement. Praising.
4	**PB 4.2, Q10** T: Think how to answer part (b). e.g. P_1: We must first convert the data to the same units. P_2: We first answer part (a) and find out how tall it is now. T: Is this the only method? *28 mins*	Whole class activity. Ps read question. T chooses P to plan the method. Discussion on whether it is better to use m or cm. Discuss strategy. Do you *have* to answer part (a) first?
5 **5A** *(continued)*	**PB 4.2, Q7** e.g. P1: $20 - (3.62 + 5.21 + 8.33)$ P2: $\begin{array}{r} 3.62 \\ 5.21 \\ +\ 8.33 \\ \hline 17.16 \\ \hline \end{array}$	Individual work, monitored, helped. When most of the Ps are ready, T stops the work and discusses method. T asks Ps to show their method on BB.

Y7	**UNIT 4** ***Addition and Subtraction of Decimals*** Lesson Plan 3	*Dealing With Money*
Activity		***Notes***
5A *(continued)*	P_3: $\begin{array}{r} 20.00 \\ -\ 17.16 \\ \hline 2.84 \\ \hline \end{array}$	T gets Ps to answer in words. Agreement. Self-correction. Praising.
5B	T: How much would Prakest have left if he had spent 5p less on Monday? *(5p more; £2.89)* T: And if he had spent 3p more on Monday? *(3p less; £2.81)* T: How much would he have left if he had spent £8.35 on Wednesday? *(2p less: £2.82)* *38 mins*	T chooses Ps to give answers. T leads Ps to make general statements about change. Praising.
6	**Problem** T: Carlos and Jon are brothers. One morning, Carlos had £12.60 and Jon had £6.78. Carlos spent 91p on sweets on his way to visit a friend Jon stayed at home and his mother gave him £3.59 pocket money. Carlos spent £3.09 on food in a snack bar. Jon paid £1.59 for a cheeseburger for lunch. Who had the most money that evening and by how much? e.g. P_1: (data for Carlos) $12.60 - 0.91 - 3.09$ $(= 12.60 - (0.91 + 3.09))$ P_2: (data for Jon) $6.78 + 3.59 - 1.59$ $(= 6.78 + (3.59 - 1.59))$ *45 mins*	Whole class activity. T reads out task, and also shows it on OHP. Ps have to identify and order data. After collecting data for Carlos, Ps can find our what happened to his money. T reminds class of the use of brackets to make calculations easier. Comparing answers. Praising.
7	**Set homework** **PB 4.2, Q6** **PB 4.2, Q8 (b)** **PB 4.2, Q12**	

<table>
<tr><td>Y7</td><td>UNIT 4 Addition and Subtraction of Decimals Lesson Plan 4</td><td>Problems in Context</td></tr>
<tr><td>Activity</td><td></td><td>Notes</td></tr>
<tr><td>1
1A

1B</td><td>Checking homework
PB 4.2, Q6 and Q8 (b)

PB 4.2, Q12
e.g.
T: Who would like to write their plan on the BB?
$\left(\left(10 - 2.48\right) + \left(5 - 1.39\right)\right)$
T: Who did it this way?
What was the result? (£11.13)
Who used another method? Did you get the same result?
etc.
5 mins</td><td>Answers checked; details given only if Ps have had problems.

T reviews methods of tackling this problem.</td></tr>
<tr><td>2
2A

2B</td><td>Problems in context
T: Listen carefully to this problem.
A 70-year-old sea captain is shipwrecked on an island in the middle of the Pacific Ocean.
Also on the island are
2 dogs
5 cats
23 horses
100 cows
37 hens
28 rabbits
59 ducks
324 pigs
593 elephants ... etc.
T: How old is the captain?

T: In a school there are 3 classes in both Y7 and Y8.
In one Y7 class there are 28 pupils, in another 29 pupils and in the third, 31 pupils.
In one Y8 class there are 27 pupils, in another 30 pupils and in the third 28 pupils.
How many pupils are there in Y7?
12 mins</td><td>Mental work, but really a lesson on the relevance (or otherwise) of some data. Pupils might react with irritation or despair!!
T reads introduction and then pauses after each type of animal, as if to give Ps time to count up. T gradually speeds up so that Ps do not have time to calculate.
Ps grumble and protest, but T ignores them and continues, saying the question slowly and carefully.
Ps and T can agree that text can contain data which is not needed when answering the question.

Task given on OHP.

T discusses what data is relevant and what can be ignored. Ps choose easiest way of calculating answer.
$28+29+31 = 28+\left(29+31\right)$
$= 28+60 = 88$</td></tr>
<tr><td>3
3A</td><td>Review of topic
M 4.3</td><td>Mental work; T encourages Ps to count in their heads if possible; otherwise use Ex.Bs.
T reads out questions, repeating them if necessary. T chooses Ps to write answers on BB. Other Ps work in Ex.Bs.
Agreement. Self-correction. Praising. Write answers in Ex.Bs.</td></tr>
</table>

Y7	UNIT 4 ***Addition and Subtraction of Decimals*** Lesson Plan 4	*Problems in Context*
Activity		***Notes***
3B	Calculate (the following are shown on BB or OHP): (a) 2.53 + 3.88 (b) 4.29 − 2.51 (c) 0.39 + 11.8 (d) 12.3 − 8.77	Ps review more thoroughly how to add/subtract decimals; Ps come to BB or OHP to write out solutions, saying what they are doing. Others work in Ex.Bs. Agreement. Self-correction. Praising.
3C	OS 4.4A and 17 − 6 − 4 = ? 12 − 5 + 3 = ?	Individual work. Checking, reasoning, agreement, feedback, self-correction. Praising. Ps can compare results and review what they have learned about brackets.
3D	At midday there were 1365 customers in a shopping centre. During the next 20 minutes, 387 of those customers left and 389 others arrived. How many customers were now in the shopping centre? e.g. P_1: $(1365 - 387) + 389 = 1367$ P_2: $1365 + (389 - 387)$ $= 1365 + 2$ $= 1367$	T shows task on OHP and also reads it out. T reminds Ps to find the easiest way of getting the answer. Agreement. Praising.
3E	There were 353 cars in a car park early in the morning. During the afternoon, 359 cars arrived and none left. How many cars are in the car park if, before noon, 356 left and none arrived?	Here, the *mathematical* answer is $(353 - 356) + 359$ $= 353 + (359 - 356)$, $= 356$ but only in maths, not in reality!
	45 mins	
4	**Set homework** **M 4.4**	A copy to be given to each P.

UNIT 4 Arithmetic: Addition and Subtraction of Decimals — Mental Tests

M 4.1 Standard Route *(no calculator)*

1. 7 + 8 (15)
2. 12 + 9 (21)
3. 9 – 4 (5)
4. 26 – 3 (23)
5. 13 – 7 (6)
6. What is the sum of 6, 5 and 12 ? (23)
7. What is the difference between 23 and 47 ? (24)
8. Tom has 27 CDs. Ann has 12 fewer CDs than Tom.
   How many CDs does Ann have? (15)
9. There are two Year 7 classes in the school. One class has 26 pupils and the other 28. How many pupils are in Year 7 in total? (54)
10. There were 17 people on a bus. At one stop, 12 people got off and another 5 got on. How many people are now on the bus? (10)

M 4.2 Standard Route *(no calculator)*

1. 5 + 9 (14)
2. 13 + 8 (21)
3. 8 – 5 (3)
4. 17 – 4 (13)
5. 25 – 8 (17)
6. What is the sum of 7, 5 and 13 ? (25)
7. What is the difference between 32 and 57 ? (25)
8. Jane has 22 videos. Peter has 9 fewer videos.
   How many videos does Peter have? (13)
9. There are two Year 7 classes in the school. One class has 27 pupils and the other 29. How many pupils are in Year 7 in total? (56)
10. There were 24 people on a bus. At one stop, 8 people got off and another 13 got on. How many people are now on the bus? (29)

UNIT 4 Arithmetic: Addition and Subtraction of Decimals — Mental Tests

M 4.3 Academic/Express Route *(no calculator)*

1. There are three Year 7 classes in a school. The number of pupils in each class are 25, 26 and 24. How many pupils are in Year 7? (75)
2. 0.4 + 0.5 (0.9)
3. 1.2 + 0.9 (2.1)
4. 2.61 + 1.72 (4.33)
5. 6.8 – 3.2 (3.6)
6. 3.2 – 1.5 (1.7)
7. You buy a packet of crisps, price 36p, with a £1 coin. How much change do you get? (64p)
8. A ticket for a train journey costs £3.46. How much change do you get when you pay for it with a £10 note? (£6.54)
9. A plank of wood of length 1.85 m is cut from a 4 m length of wood. What length is left over? (2.15 m)
10. A plant grows from 1.23 m to 1.41 m in one month. How many cm has it grown in the month? (18 cm)

M 4.4 Academic/Express Route *(no calculator)*

1. There are three Year 7 classes in a school. The number of pupils in each class are 27, 26 and 23. How many pupils are in Year 7? (76)
2. 0.3 + 0.4 (0.7)
3. 0.8 + 2.5 (3.3)
4. 1.37 + 2.12 (3.49)
5. 5.4 – 3.1 (2.3)
6. 4.6 – 2.8 (1.8)
7. You buy a packet of crisps, price 27p, with a £1 coin. How much change do you get? (73p)
8. A ticket for a train journey costs £4.72. How much change do you get when you pay for it with a £10 note? (£5.28)
9. A plank of wood of length 1.65 m is cut from a 3 m length of wood. What length is left over? (1.35 m)
10. A plant grows from 1.37 m to 1.53 m in one month. How many cm has it grown in the month? (16 cm)

UNIT 4 *Arithmetic: Addition and Subtraction of Decimals* Teaching Notes

Historical Background and Introduction

In this, the second of the six Arithmetic Units in Book 7A, addition and subtraction are revised, using firstly whole numbers and then decimals.

Our current way of writing (and manipulating) decimals is, largely, attributable to the Belgian mathematician, *Simon Stevin* (1548-1620), who moved to Holland and worked for the Dutch government as quartermaster-general of the army. In this role, he organised a school of engineering at the University of Leiden, to meet the growing need of the Dutch nation for trained engineers, surveyors and navigators.

Prior to his work, a notation for decimal fractions had been used, particularly in the Islamic world, but not manipulated in the way with which we are now familiar. Stevin made the significant jump of designing a system in which arithmetic operations (i.e. $+$, $-$, $\times$, $\div$) used with whole numbers, worked in the same way with decimals.

For example, he first wrote 364.3759, as

$$364 \; 0 \; 3 \; 1 \; 7 \; 2 \; 5 \; 3 \; 9 \; 4$$

meaning $364 + \frac{3}{10} + \frac{7}{100} + \frac{5}{1000} + \frac{9}{10\,000}$ or $364\frac{3759}{10\,000}$. He made the point that no fractions were used in his notation, and his article went on to show how all the basic operations can be performed.

It should also be noted that, in a second major article, Stevin made the point that firstly 'unity' is a number (previously it was not regarded as a number, rather a generator of numbers), as are decimal squares, square roots, etc.

In principle, he defined what we now refer to as the set of 'real numbers'.

As was the case with Unit 2, much of this work should be revision; do not labour the work if your class is competent – just have one or two revision lessons, using the mental tests and the appropriate revision test.

Routes	**Standard**	**Academic**	**Express**
4.1 Addition and Subtraction	✓	✓	✓
4.2 Dealing with Money	✓	✓	✓
Language			
• sum	✓	✓	✓
• difference	✓	✓	✓
• brackets	✓	✓	✓

Misconceptions

- Brackets often cause problems – they *do* matter and, in some cases, their use will produce a different answer,

  e.g. $7-(4+1) = 7-5 = 2$

  whilst $7-4+1 = 3+1 = 4$

Challenging Questions

The following questions are more challenging than others in the same section:

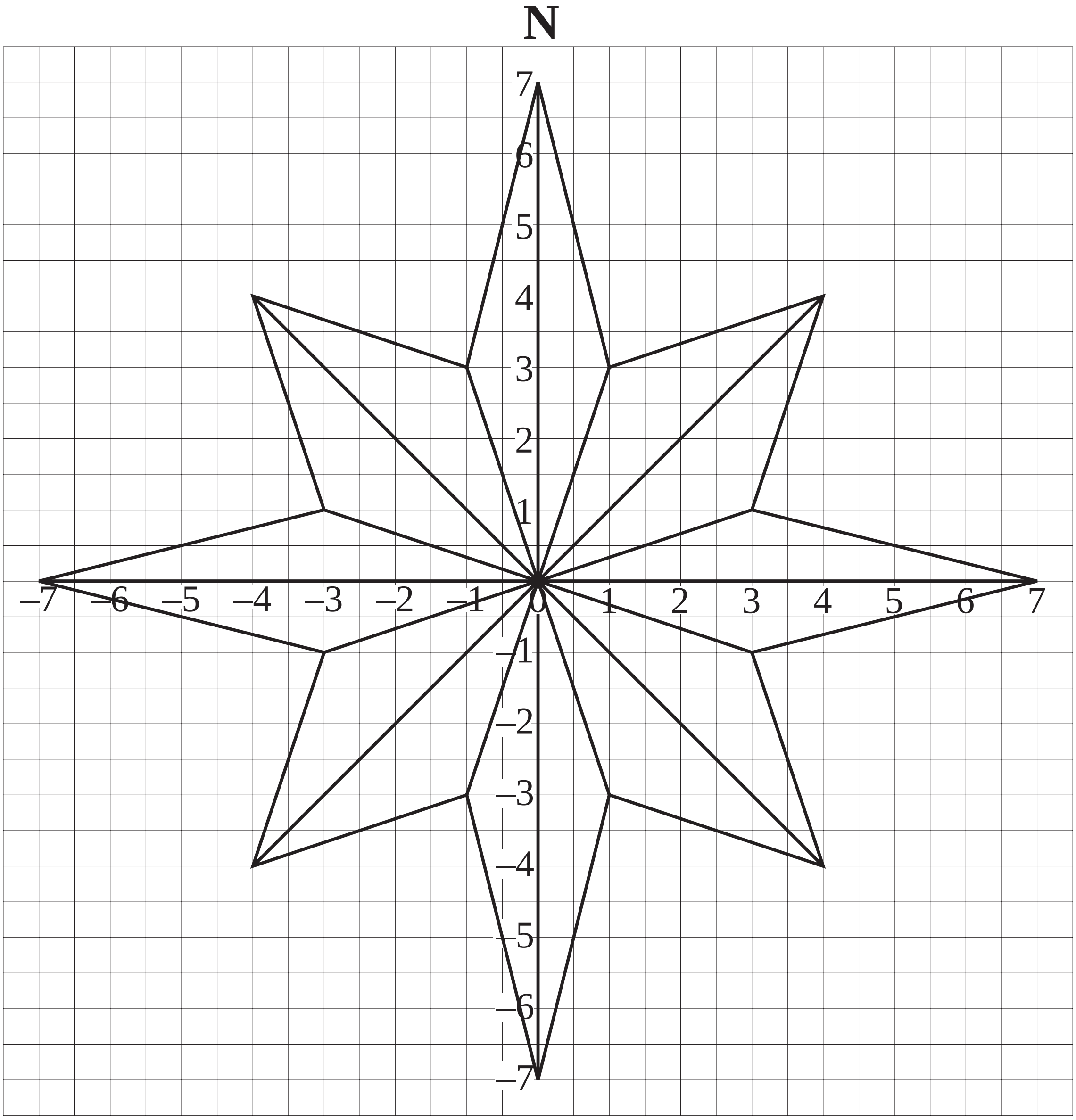
	Section	*Question No.*	*Page*
Practice Book Y7A	2.2	10, 11	62

UNIT 5 *Angles* Activities

Activities

ACTIVITY 5.1 *Compass Rose Construction*

Here is a compass rose, symmetric about both the NS and the EW lines, so you can construct it using instructions for any one quarter.



1. Introducing coordinate axes, e.g. x in the E direction, and y in the N direction, as shown, what are the coordinates of the vertices of the rose in the positive quadrant?
2. Give a complete set of instructions for drawing all lines in the positive quadrant.
3. Give directions to now complete the diagram, using reflections.

Extension

Draw your own compass rose, giving a complete set of instructions for completing the drawing.

ACTIVITY 5.2 *Sam Loyd's Dissection*

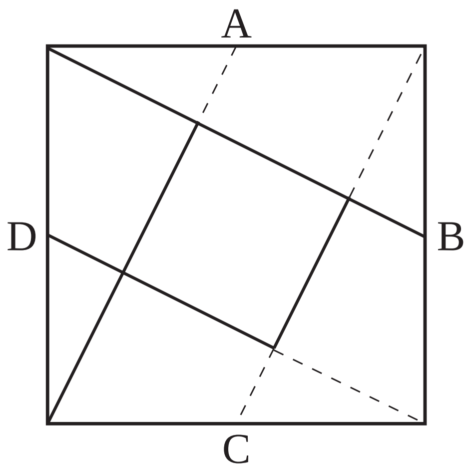
Sam Loyd's famous dissection problem was designed in the 1920s.

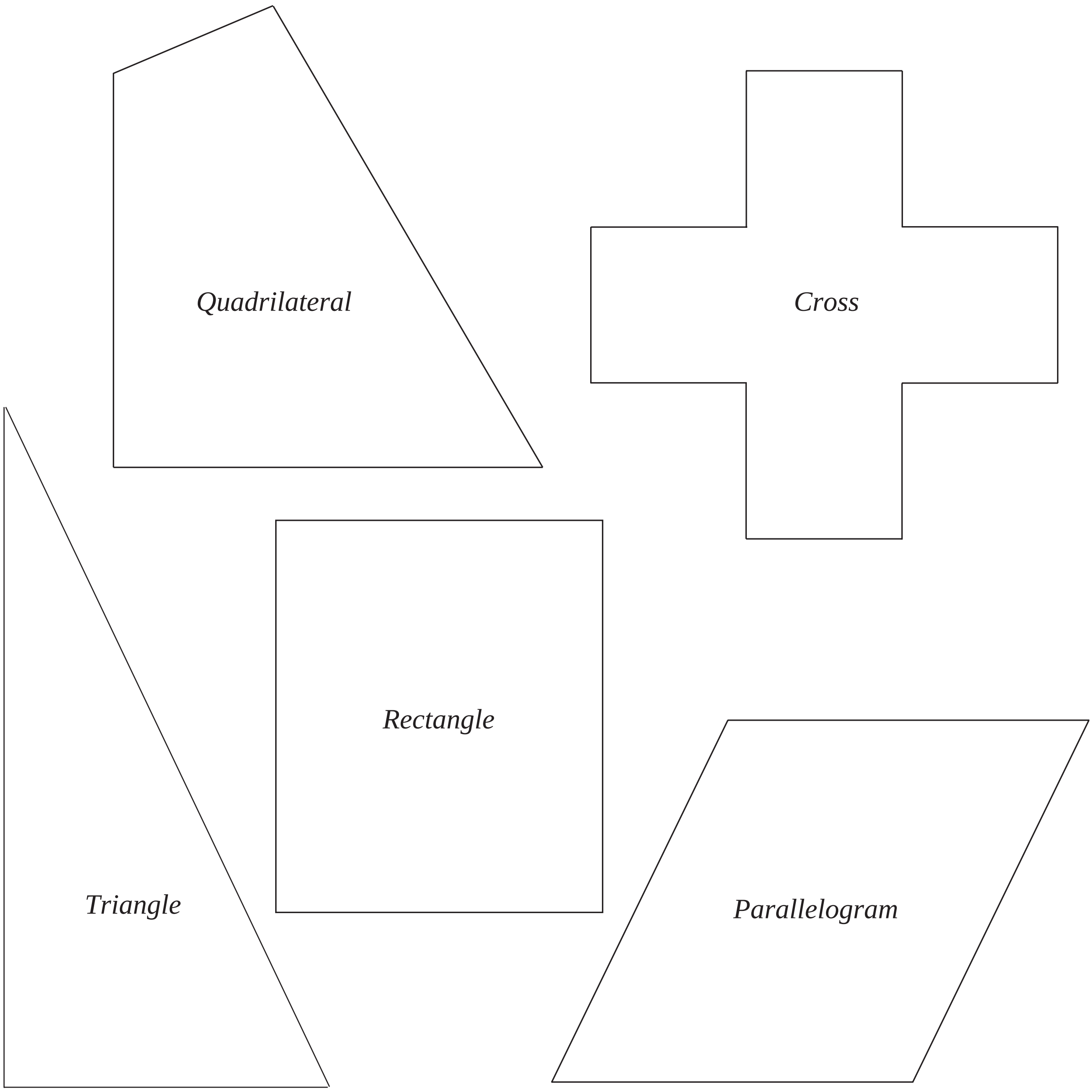
Draw a 5 cm square as shown on the right. Find the midpoints (A, B, C and D in diagram) on each side and join them up as indicated.

Using the diagram as a guide, cut your square into 5 pieces along the bold lines.

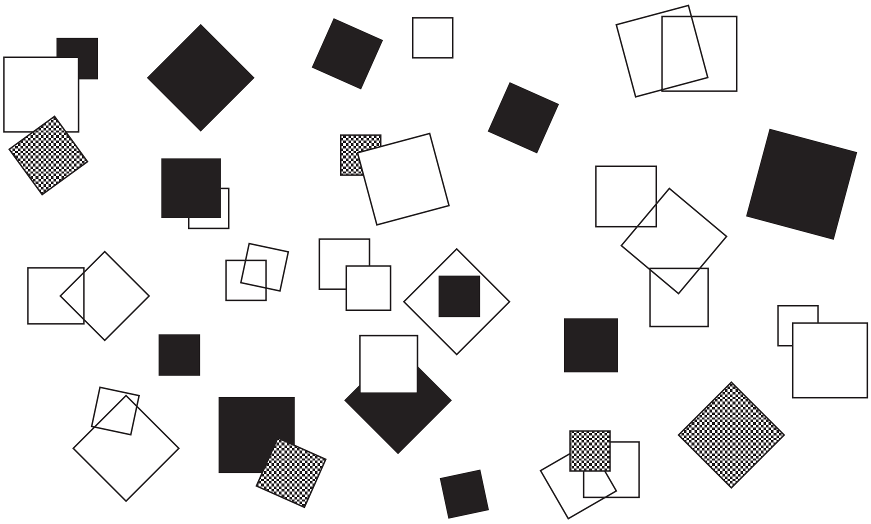
Do not cut along the dotted lines.

Use the 5 pieces to make all the shapes below.





ACTIVITY 5.3 *Overlapping Squares*



Take two squares and put them down on a surface so that they overlap. The squares can be of any size, not necessarily the same.

1. Which of the following shapes can be formed by the overlap:

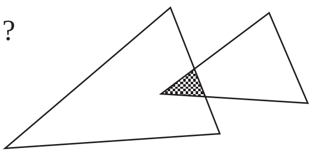
   (a) rectangle (b) square (c) kite (d) rhombus?

2. Can two squares intersect so that a triangle is formed by the overlap?

3. Can two squares intersect so that the overlap forms a polygon of n sides for values of n equal to

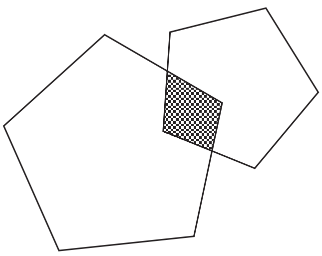
   (a) 5 (b) 6 (c) 7 (d) 8 (e) 9 (f) 10?

4. What happens when two triangles overlap?



Extensions

1. What happens when two pentagons overlap?



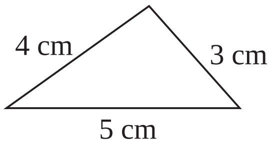
2. What happens when two *different* shapes, e.g. square and triangle, overlap?

ACTIVITY 5.4 *Constructing Triangles*

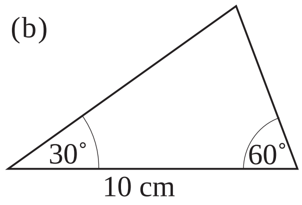
Constructing triangles, using a ruler and protractor, is straightforward when sufficient information is given. Sometimes not enough information is available: at other times you may be given too much information, some of which may be redundant (i.e. not needed).

1. Using the information on the sketches, draw accurately the following triangles.

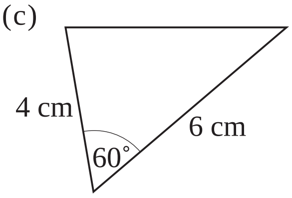
(a)



(b)



(c)

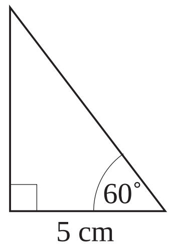


In each case, measure all other sides and angles.

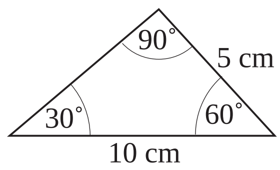
Each of these triangles is exactly defined with sufficient information (but not too much) to enable you to draw the triangle. We refer to these cases as 'SSS' (three side lengths given), 'ASA' (angle, side, angle) and 'SAS' (side, angle, side).

2. (a) Draw accurately the following triangle and then measure all other sides and angles.

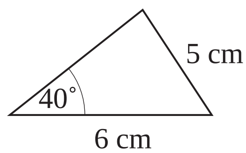
(b) Compare this triangle with triangle (b) in question 1. What do you notice?



So, if you are given the triangle opposite to draw you actually have more information than you need! You will have to decide which information to use.



3. Draw accurately the triangle sketched opposite. Be careful as there are *two* distinct possibilities!

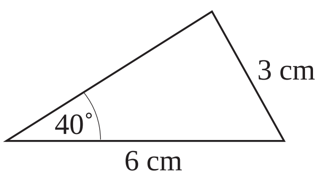


This is the 'ASS' case, and it does not necessarily have a unique (only one) solution. As you saw in question 3, there were two distinct triangles that agreed with the information given, i.e. there was insufficient information given for a unique solution.

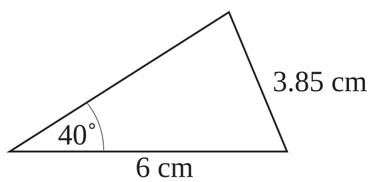
Extension

Can you construct either of the triangles below?

(a)

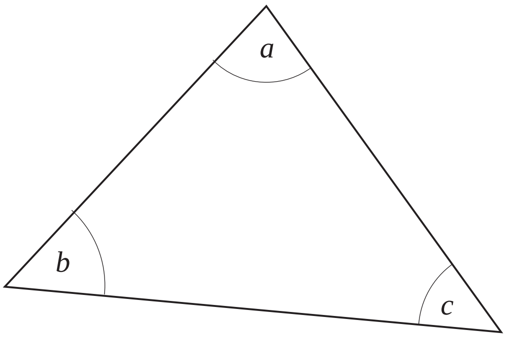
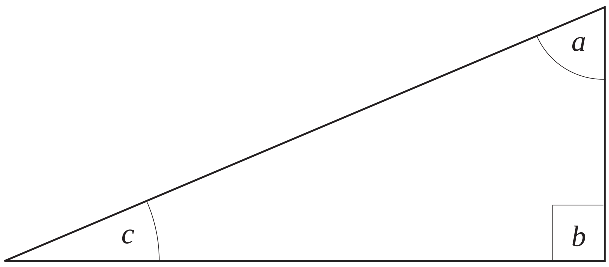
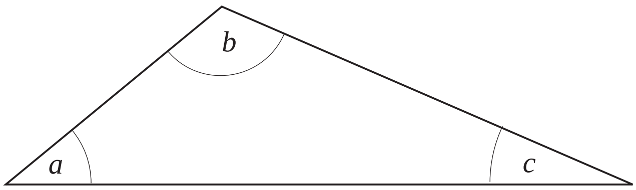


(b)



ACTIVITY 5.5 *Angles in Triangles*

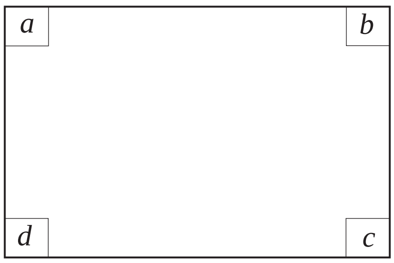
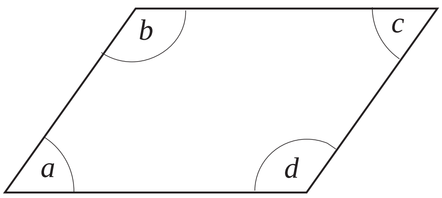
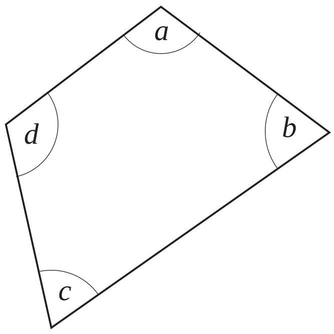
In each of the three triangles, measure all the angles as accurately as possible, and add up the values.

Triangle	*Angles* a	b	c	$a + b + c$
				
				
				

What do you notice? Repeat the exercise with your own triangles.

ACTIVITY 5.6 *Angles in Quadrilaterals*

In each of the three quadrilaterals, measure all the angles as accurately as possible, and add up the values.

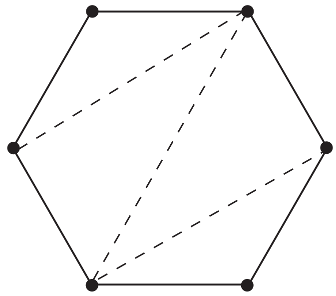
Quadrilateral	*Angles* a	b	c	d	$a + b + c + d$
					
					
					

What do you notice? Repeat the exercise with your own quadrilaterals.

Extension

Given that the interior angles of a triangle sum to $180°$, show that the interior angles of a quadrilateral sum to $360°$.

ACTIVITY 5.7 *Interior Angles in Polygons*



You can find the sum of the interior angles in any polygon, by dividing it up into triangles with lines connecting the vertices.

For example, the hexagon shown opposite has been divided into 4 internal triangles.

The sum of all the interior angles of the hexagon is equal to the sum of all the angles in each triangle, so:

$$\text{sum of interior angles} = 4 \times 180\,° = 720\,°$$

1. Repeat the same analysis for the following shapes:

   (a) quadrilateral (b) pentagon (c) heptagon

   (d) octagon (e) nonagon (f) dodecagon.

2. Copy and complete the table.

Name of Polygon	**Number of Sides**	**Number of Triangles**	**Sum of Interior Angles**
Triangle	3	1	180 °
Quadrilateral			
Pentagon			
Hexagon	6	4	720 °
Heptagon			
Octagon			
Nonagon			
Dodecagon			

Extension

What is the formula for the sum of the interior angles of a polygon with n sides?

ACTIVITIES 5.1 - 5.4 *Notes and Solutions*

Notes and solutions are given only where appropriate.

5.1 1. (7, 0), (3, 1), (4, 4), (1, 3), (0, 7)

2. Join (7, 0) to (3, 1) to (4, 4) to (1, 3) to (0, 7) and
(0, 0) to (7, 0) ; (0, 0) to (3, 1) ; (0, 0) to (4, 4) ;
(0, 0) to (1, 3) : and (0, 0) to (0, 7).

3. Reflect shape in x -axis, and then reflect new shape in y-axis (or the other way round).

5.3 1. (a) Yes (b) Yes (c) No (d) No

2. Yes

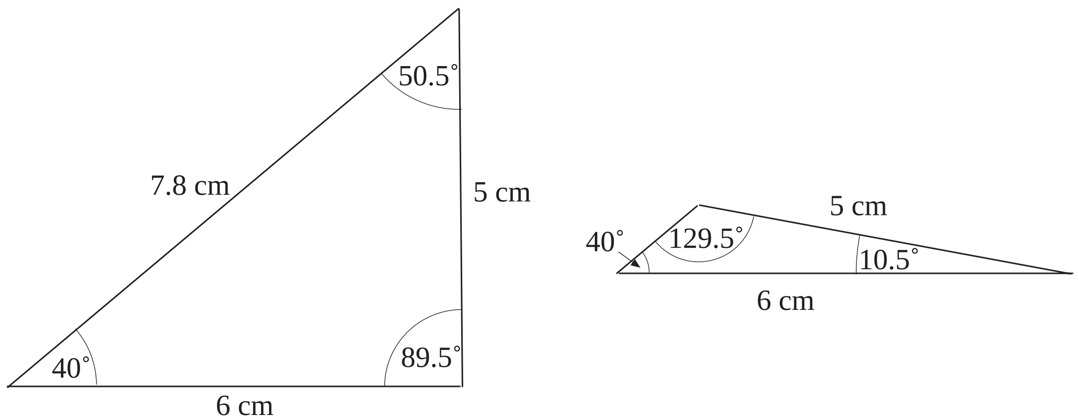
3. 5-8 : Yes : 9-10 : No

4. Overlap forms polygon of n sides with $n \le 6$.

5.4 1. (a) 90 °, 37 °, 53 ° (b) 90 °, 5 cm, 8.7 cm (c) 5.3 cm, 79 °, 41 °

2. (a) 10 cm, 8.7 cm, 30 ° (b) identical triangles (congruent)

3. There are two distinct triangles as shown below.



Extension

(a) not possible

(b) unique answer (with angle of 90 ° at vertex)

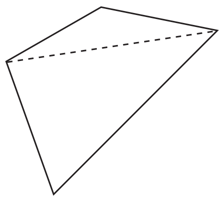
ACTIVITIES 5.5 - 5.7 *Notes and Solutions*

Notes and solutions are given only where appropriate.

5.5 angles add to $180°$ (but note that this is *not* a proof!)

5.6 angles add to $360°$ (but, again, note that this is *not* a proof!)

Extension
Any quadrilateral can be divided into two triangles.



5.7 For a polygon with *n* sides, the sum of the interior angles is $180(n-2)$; hence the values in the table should be $180°$, $360°$, $540°$, $720°$, $900°$, $1080°$, $1160°$, $1340°$.

UNIT 5 *Angles* Lesson Plans **St**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Angles and Turns**	
	Introduction	OS 5.1
	Interactive exercises	OS 5.2
	Practice	PB 5.1, Q1
	Review answers	
	Set homework	PB 5.1, Q2
2.	**Compass Directions**	
	Discuss homework	
	Introduction	OS 5.3
	Clockwise and anticlockwise	
	Practice	PB 5.1, Q3 and Q4
	Review answers	
	Practice	PB 5.1, Q5
	Review answers	
	Set homework	PB 5.1, Q6 and Q7
3.	**Measuring Angles**	
	Discuss homework	
	Introduction and revision	OS 5.4
	Practice	PB 5.2, Q1 and Q4
	Review answers	
	Activity	Activity 5.2 or 5.3
	Set homework	Complete Activity or PB 5.2, Q3
4.	**Classifying Angles**	
	Discuss homework	
	Introduction	OS 5.5
	Practice	PB 5.3, Q1
	Review answers	
	Practice	PB 5.3, Q3
	Discuss solutions	
	Set homework	PB 5.3, Q4

UNIT 5 *Angles* Lesson Plans **St**

Lesson No.	*Suggested Plan*	*References*
5.	**Angles on a Line**	
	Discuss homework	
	Introduction	OS 5.6
	Practice	PB 5.4, Q1
	Review answers	
	Mental Test	M 5.1
	Review answers	
	Set homework	PB 5.4, Q7 and Q8
6.	**Angles at a Point**	
	Discuss Homework	
	Introduction	OS 5.7
	Practice	PB 5.4, Q2
	Review answers	
	Mental Test	M 5.2
	Review answers	
	Set homework	PB 5.4, Q3 and Q5
7.	**Constructing Triangles**	
	Discuss homework	
	Introduction	OS 5.8
	Practice	PB 5.5, Q1
	Review answers	
	Further practice	PB 5.5, Q4
	Discuss solutions	
	Set homework	PB 5.5, Q5
8.	**Revision Test and Review**	
	Discuss homework	
	Revision Test	RT 5.1 (Standard)
9.	**Revision**	
	Give back marked tests	
	Go over test questions interactively	
	Revise key topics	

UNIT 5 *Angles* Lesson Plans **A**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Angles and Turns**	
	Introduction	OS 5.1
	Interactive exercises	OS 5.2
	Practice	PB 5.1, Q1
	Review answers	
	Set homework	PB 5.1, Q2
2.	**Compass Directions**	
	Discuss homework	
	Introduction	OS 5.3
	Clockwise and anticlockwise	
	Practice	PB 5.1, Q3 and Q4
	Review answers	
	Practice	PB 5.1, Q5
	Review answers	
	Set homework	PB 5.1, Q6 and Q7
3.	**Angles**	
	Discuss homework	
	Measuring angles - revision	OS 5.4
	Practice	PB 5.2, Q1
	Review answers	
	Classifying angles	OS 5.5
	Practice	PB 5.3, Q1
	Review answers	
	Set homework	PB 5.3, Q3 and Q4
4.	**Angles on a Line and at a Point**	
	Discuss homework	
	Introduction – angles on a line	OS 5.6
	Practice	PB 5.4, Q1
	Review answers	
	Angles at a point	OS 5.7
	Practice	PB 5.4, Q2
	Review answers	
	Mental Test	M 5.1 or M 5.2
	Review answers	
	Set homework	PB 5.4, Q3 and Q7

UNIT 5 *Angles* Lesson Plans **A**

Lesson No.	*Suggested Plan*	*References*
5.	**Constructing Triangles**	
	Discuss homework	
	Introduction	OS 5.8
	Practice	PB 5.5, Q1
	Review answers	
	Further practice	PB 5.5, Q4
	Discuss solutions	
	Set homework	PB 5.5, Q5
6.	**Angles in a Triangle**	
	Discuss homework	
	Introduction – sum of angles in a triangle	OS 5.9
	Practice	PB 5.6, Q1
	Review answers	
	Practice	PB 5.6, Q2
	Review answers	
	Extended Activity	Activity 5.6
	Set homework	Complete Activity 5.6 or PB 5.6, Q4
7.	**Classifying Triangles**	
	Discuss homework	
	Mental Test	M 5.3 *or* M 5.4
	Review answers	
	Classifying triangles – revise	OS 5.10
	Practice	PB 5.6, Q3
	Review answers	
	Set homework	PB 5.6
8.	**Revision Test and Review**	
	Discuss homework	
	Revision Test	RT 5.2 (Academic)
9.	**Revision**	
	Give back marked tests	
	Go over test questions interactively	
	Revise key topics	

UNIT 5 *Angles* Lesson Plans E

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Turns and Compass Directions**	
	Introduction – angles and turns	OS 5.1 and OS 5.2
	Compass directions	OS 5.3
	Practice	PB 5.1, Q3 and Q4
	Review answers	
	Activity	Activity 5.1
	Set homework	Complete Activity 5.1 or PB 5.2, Q3
2.	**Angles**	
	Discuss homework	
	Measuring angles – revision	OS 5.4
	Practice	PB 5.2, Q1
	Review answers	
	Classifying angles	OS 5.5
	Practice	PB 5.3, Q1
	Review answers	
	Set homework	PB 5.3, Q3 and Q4
3.	**Angles on a Line and at a Point**	
	Discuss homework	
	Introduction – angles on a line	OS 5.6
	Practice	PB 5.4, Q1
	Review answers	
	Angles at a point	OS 5.7
	Practice	PB 5.4, Q2
	Review answers	
	Mental Test	M 5.1 or M 5.2
	Review answers	
	Set homework	PB 5.4, Q3 and Q7

UNIT 5 *Angles* Lesson Plans **E**

Lesson No.	*Suggested Plan*	*References*
4.	**Constructing Triangles**	
	Discuss homework	
	Introduction	OS 5.8
	Practice	PB 5.5, Q1
	Review answers	
	Further practice	PB 5.5, Q4
	Discuss solutions	
	Activity	Activity 5.4
	Set homework	Complete Activity 5.4 or PB 5.5, Q5
5.	**Angles in a Triangle**	
	Discuss homework	
	Introduction – sum of angles in a triangle	OS 5.9
	Practice	PB 5.6, Q1
	Review answers	
	Practice	PB 5.6, Q2
	Review answers	
	Extended Activity	Activity 5.6
	Set homework	Complete Activity 5.6 or PB 5.6, Q4
6.	**Classifying Triangles**	
	Discuss homework	
	Mental Test	M 5.3 or M 5.4
	Review answers	
	Classifying triangles – revise	OS 5.10
	Practice	PB 5.6, Q3
	Review answers	
	Set homework	PB 5.6
7.	**More Triangles**	
	Discuss homework	
	Practice	PB 5.6, Q8
	Review answers	
	Activity	Activity 5.7
	Set homework	Complete Activity 5.7 or PB 5.6, Q9 and Q10

UNIT 5 *Angles* Lesson Plans E

Lesson No.	*Suggested Plan*	*References*
8.	**Revision Test and Review**	
	Discuss homework	
	Revision Test	RT 5.3 (Express)
9.	**Revision**	
	Give back marked tests	
	Go over test questions interactively	
	Revise key topics	

Y7	**UNIT 5** ***Angles*** Lesson Plan 1	*Angles and Turns*
Activity	**Angles and turns**	***Notes***
1A	T: Today we are going to look at angles and turns and the connections between them.	T gives each P two plastic drinking straws, a pin and a cork or a piece of Blu-tack. Ps join their straws by putting the pin through one end of each straw, and then putting on the cork or Blu-tack. After discussion, they agree that pin marks the halfway point on the line formed by the two straws. The joining point will be the starting point for what follows.
	T: Now position your straws so that they both point upwards from the starting point. You will move only one of them, keeping the other one in this position. T: Are you ready? *(Yes!)*	Whole class activity.
	T: Now let's make two complete turns with the straw. 1 turn ..., and a half turn ... a quarter turn ... . Right. T: Let's see if you can work in fractions. Turn the straw through $\frac{1}{3}$ turn, $\frac{3}{4}$ turn, $1\frac{1}{4}$ turns, $2\frac{1}{3}$ turns. Well done.	T asks and Ps make the turns with their straws. T watches Ps closely and corrects when necessary. If Ps seem hesitant, T should demonstrate and then give them further practice.
1B	T: The units we use to measure the size of a turn are 'degrees'. Degrees are written as $\circ$ (T on BB). Can anyone tell us how many degrees are in one complete turn? P: $360°$ T: That's right. There are $360°$ in one complete turn. T: How many cm are there in 1 m? (100) How many gm are there in 1 kg? (1000) As we use a number system based on 10, why do you think we use $360°$ for this measurement? P: But 1 hour is 60 minutes. T: You are right. And there is another number that can have a connection with the number 360. *(?)* T: How many days are there in one year? Ps: 365 (366) T: Right. Before the next lesson, see if you can find some information about the possible connection between the $360°$ of the complete turn and another number system and/or the number of days in a year.	Quick questions, T pointing to Ps to answer.
1C *(continued)*	T: Let's go back to the turns again. Still keeping one straw upright, move the other one through $180°$. How many turns is that? P: A half. T: Correct. Now move the straw back to the starting position and then turn it through $90°$. That is ....? P: Quarter turn. T: That's right. The point where the two lines meet at the starting point is called an angle. With your straws, show me an angle of $45°$.	Correcting where necessary. Praising.

Y7	UNIT 5 *Angles* Lesson Plan 1	*Angles and Turns*
Activity		***Notes***
1C *(continued)*	T: Now show me an angle of $270°$ ... which of the angles do you mean? Ps indicate point to the larger angle. T: Show me an angle of $360°$, ... $720°$. *(?)* T: Yes; this angle can't be shown using these half lines. *20 mins*	Correcting where necessary. Praising.
2	**OS 5.2** At Q2, T can introduce the concept of turning clockwise or anticlockwise. e.g. P: Q2 (a) Emma turns through $90°$ (shows this on OHP). *T shakes head to indicate disagreement.* T: I don't agree. I have written down the answer $270°$. *28 mins*	Whole class activity. Task appears on OHP. T asks questions. Ps come to OHP and show turns and answer questions. Other Ps agree/disagree. Discussion. Praising. Ps protest and try to convince T that they are right. Finally they agree that Emma could turn either clockwise or anticlockwise, so both answers are correct. Similarly for (b) and (c). The need for clarification of direction of turns is stressed by T.
3	**PB 5.1, Q1 (b), (c)** *38 mins*	Individual work, monitored, helped. Ps read the tasks in their PBs, work out the answers and write them in their Ex.Bs. When most pupils have finished, T points to Ps in turn for answers and reasons. Agreement. Feedback. Self-correction. Praising.
4	**Clock hands** T: Can anyone tell me what Big Ben is and where he can be seen? T: Have you seen Big Ben?	Ps answer: clock on St Stephen's Tower on Houses of Parliament in London.
4A *(continued)*	T: Think of a clockface, or a watch with hands (called an analogue watch). T: (a) What angle does the hour hand (the small hand) turn through from noon to 3 p.m.? $(90°)$ (b) " from noon to 1 p.m.? $(30°)$ (c) " from 4 p.m. to 6 p.m.? $(60°)$	Whole class activity. T reads out questions, one by one. For question (a), T asks a stronger pupil to draw a clockface on the BB and show the answer on it. Subsequent Ps can draw on this clockface to show their answers.

<table>
<tr><td>Y7</td><td>UNIT 5 Angles Lesson Plan 1</td><td>Angles and Turns</td></tr>
<tr><td>Activity</td><td></td><td>Notes</td></tr>
<tr><td>4A
(continued)</td><td>T: (d) What angle does the hour hand turn through from noon to midnight? ($360°$)
(e) " in 60 minutes? ($30°$)
(f) from 6 a.m. to 3 p.m? ($270°$)
(g) in one day? ($720°$)</td><td>Agreement. Praising</td></tr>
<tr><td>4B</td><td>T: What angle does the minute (longer) hand of Big Ben turn through:
(a) from noon to half past twelve? ($180°$)
(b) from 3 o'clock to a quarter to 4 ? ($270°$)
(c) from half past 6 to 8 o'clock? ($540°$)
(d) from 2 o'clock to 5 o'clock? ($1080°$)
(e) while the hour hand turns through $60°$? ($720°$)

45 mins</td><td>Individual work, monitored, helped.
Task appears on OHP or copy given to each P.

Checking. Tasks might be difficult for slower Ps; in this case, stronger Ps come to BB to show and explain the answers.
Agreement. Feedback. Self-correction. Praising</td></tr>
<tr><td>5</td><td>Homework
A: PB 5.1, Q2
B: Compass rose
Study the compass rose on p 63 of PB Y7A. Make a copy of it on the paper provided. (T gives each P a piece of tracing paper to use for this task.)
C: PB 5.1, Q1 (a) You might find it useful to use your compass rose for this.</td><td>T tells Ps that they will each need a protractor, a pair of compasses, a ruler and a sharp pencil for the next few lessons.</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

Y7	UNIT 5 *Angles* Lesson Plan 2	*Compass Directions*
Activity		***Notes***
1	**Checking homework**	
1A	**PB 5.1, Q2**	T asks questions; points to P; P answers. Agreement. Feedback. Self-correction. Praising.
1B	**Compass rose** T: How did you get on with the compass rose? Has anyone never seen a compass?	T has some copies for those who have not managed the work, or have forgotten to bring it.
1C	**PB 5.1, Q1 (a)**	Each P sets compass rose onto the figure in PB. T asks questions, Ps answer (might change answers written at home). Agreement. Feedback. Self-correction. Praising.
1D	**The historical origin of the use of $360°$.**	Any information from Ps is given. T then summarises/ clarifies/explains.
	10 mins	
2	**OS 5.3** **PB 5.1, Q3 to Q5.**	Whole class activity. Task appears on OHP. T asks question; Ps volunteer; T points to P; P comes to OHP and shows the answer, giving reasons. Other Ps listen; check on their own compasses, and agree/ disagree. Discussion where necessary, finally agreement. Praising. Mainly slower Ps should be encouraged to come to OHP.
	20 mins	
3	**PB 5.1, Q3 (a), (b), (c), (d)** **PB 5.1, Q4 (c), (d)** **PB 5.1, Q5 (a), (c), (d), (g)**	Individual work. Ps with a good grasp of the topic should be able to work alone here. Really strong Ps can manage without the compass rose as they will be able to visualise; others will need to use it. Discussion centring on compass rose on OS 5.3 (with text covered). Ps come to OHP and show answers. Agreement. Feedback. Self-correction. Praising.
	30 mins	

Y7	**UNIT 5** ***Angles*** Lesson Plan 2	*Compass Directions*
Activity		***Notes***
4A	**PB 5.1, Q6** - question changed to read: "Nigel stands on a low hill. He can see various things around him. Draw a suitable set of axes in your PB and plot Nigel's position and the positions of the things he can see. The coordinates are: Nigel (9, 7) Factory (9, 15) Radio Mast (16, 14) Old Fort (16, 0) Lighthouse (– 1, 7) Ship (0, – 2) Crane (9, – 0.5) Church Tower (17.5, 7)"	To make Ps use the information learned in 'Plotting Points' (Unit 3, Lesson Plan 3), T does not show the diagram in PB to Ps, but, instead, gives them the relevant coordinates. In Ex.Bs, Ps mark positions on their own set of axes. Checking: T gets Ps to open PBs on p66 and tells them how to draw a set of axes on the diagram. They can do this, neatly, in the PBs. Ps can then compare this with the one drawn in their Ex.Bs, and can check and correct. Feedback. Praising.
4B	T: Close your Practice Book, please. Let the factory be north of Nigel. **PB 5.1, Q6 (a), (b), (c), (d) (i), (ii), (e), (i), (iv)**	Whole class activity. The diagram appears on OHP. T asks questions; P chosen to come to OHP shows, answers, reasons. Other Ps listen, and check answer in their Ex.Bs using their compass rose (fitting it onto diagram shown in PB). Agreement. Praising.
4C	T: Now answer this question in your Ex.Bs. **PB 5.1, Q6 (d) (iii)**	Individual work, then checking at OHP. Agreement. Feedback. Self-correction. Praising.
	45 mins	
5	**Set homework** **PB 5.1, Q3 (e) - (i)** **PB 5.1, Q4 (a), (b)** **PB 5.1, Q5, (b), (e), (f)** **PB 5.1, Q7**	T reminds Ps to bring their protractors to the next lesson.

Y7	UNIT 5 *Angles* Lesson Plan 3	*Measuring, Drawing and Classifying Angles*
Activity 1	**Checking homework.** **PB 5.1, Q3 (e) - (i)** **PB 5.1, Q4 (a), (b)** **PB 5.1, Q5, (b), (e), (f)** **PB 5.1, Q7** *8 mins*	***Notes*** At start of lesson, T chooses P to write answers on BB. This should be done quickly. P: (writes) e.g. PB 5.1, Q3 (e) 135° Q3 (f) 45° .... Q7 (g) NW Q7 (h) No T asks Ps if they agree with the answers, question by question. Discussion if necessary. If there are many mistakes, T asks Ps for their answers and then asks one P to explain their reasoning, showing it on the OHP. For Q3, Q4 and Q5, OS 5.3 can be used (without text) for Ps to show and reason their answers, using a labelled compass rose. For Q7, T can sketch figure onto BB and Ps can give their reasoning using this.
2A	**Angles** T: Now I'm going to ask you some quick questions. Try to work out the answers in your head. If you can't, you can use your Ex.Bs. We'll do this as quickly as possible .... ready? What is the angle around a complete circle? (360°) How many degrees are around a point on a straight line? (180°) How many degrees are there in a right angle? (90°) How many degrees are there in half a right angle? (45°) How many degrees are there in one third of a right angle? (30°) $360^\circ - 210^\circ = ?$ (150°) $320^\circ + \ ? = 360^\circ$ (40°) $? + 185^\circ = 360^\circ$ (175°) Which direction is opposite north? (south) Which direction is opposite east? (west) What is the opposite of SW? (NE)	Mental work, aloud, to warm up. T asks questions, points to P, who answers. Agreement. Praising.
2B	T: Now hold up your half lines and show me: a right angle an angle of 90° *(trick)* 30° 120° 180° 210° 60° 270° 300° *16 mins*	T now gives out the half lines (drinking straws) Ps used in Lesson 1 to show turns. T asks questions, Ps show, and T checks that they are correct. Agreement. Correction. Praising

Y7	UNIT 5 *Angles* Lesson Plan 3	*Measuring, Drawing and Classifying Angles*
Activity		***Notes***
3A	**OS 5.5** *(with lines of text omitted)* T: On your sheet you can see six different angles. Can you estimate the size of each angle? Try doing this, and write the size you estimate close to each angle.	Each P is given a copy of OS 5.5 without the text, and works on it. Individual work. Each P makes their own estimates. After 1-2 minutes, T can ask several Ps for their answers and let them disagree. It soon becomes obvious that this is pointless, and that there must be a better method. T asks Ps to take out their protractors.
3B	T: I'll show you how to measure an angle with a protractor.	Whole class activity. AT BB, T demonstrates how to measure an angle, using the board ruler and protractor.
	T: Now you can measure angle (c).	Then Ps place their protractors on angle (c) on their sheet. T asks them to hold protractors in this position, and walks between Ps, checking that they are correct. Ps then read off size of angle. Discussion.
	T: Now measure angles (b), (d) and (f) and write the sizes of the angles on the sheet.	T monitors progress and helps where necessary. Ps volunteer and T chooses Ps to give answers. Discussion. Agreement. Praising.
3C	T: What about angle (a)? What size did you estimate for this?	T asks each P for their estimate.
	T: What range of angles you can measure with your protractor?	
	P: From $0°$ to $180°$.	
	T: So how can we determine angle (a)? *(?)*	
	T: What do we know about the size of the angle around a point on a straight line? *($180°$)*	Ps volunteer answers.
	T: So the angles on both sides of a straight line total....? *($360°$)*	
	T: How this can help us find the size of angle (a)?	T helps Ps to understand that smaller angle can be measured, and used to determine larger one. Ps find size of angle (a) and angle (e). Compare results; agreement.
	T: How do these compare with your estimates?	
3D	T: Who was the best estimator? For each angle, find the difference between your estimate and the actual size and then add up all the differences.	Ps work out sum and winner is chosen. Praising.
3E	T: Angles are described as *acute*, *obtuse* or *reflex*, according to their size.	T explains classification of angles. (Right angle neither acute nor obtuse; angle around a point on a straight line neither obtuse nor reflex.)
	36 mins	

Y7	**UNIT 5** ***Angles*** Lesson Plan 3	*Measuring, Drawing and Classifying Angles*
Activity		***Notes***
4	**PB 5.3, Q1**	Quick individual work followed by fast-paced discussion. (T asks; P answers; other Ps agree/ disagree; correction; praising.)
	39 mins	
5	**PB 5.2, Q4 (b), (e), (h)**	Whole class activity T goes over method and then Ps work in Ex.Bs. T will need to monitor Ps work, helping and correcting where necessary. If there is time, T can give Ps other angles to draw.
	45 mins	
6	**PB 5.2, Q1 (a), (d), (f)** **PB 5.2, Q2 (a), (d)** **PB 5.2, Q4 (a), (d), (f), (g)** **PB 5.3, Q2 (a)**	

Y7	UNIT 5 *Angles* Lesson Plan 4	*Finding Angles on a Line and at a Point*
Activity		***Notes***
1A/B	**PB 5.2, Q1 (a), (d), (f)** **PB 5.2, Q2 (a), (d)**	T asks the size of each angle; Ps answer and agree. If there are problems, Ps can measure with protractors and T see any problems. Care needed with Q2, as Ps might not give reflex angles. T might need to repeat process for reflex angles.
1C	**PB 5.2, Q4 (a), (d), (f), (g)**	Ps open Ex.Bs; T walks around Ps checking that angles are approximately correct. If not, T repeats method at BB, using board equipment.
1D	**PB 5.3, Q2 (a)**	Quick checking; recap meanings of 'acute', 'obtuse' and reflex' angles.
	8 mins	
2	**Mental work**	Mental work.
2A	**M 5.2, Q1 - Q8**	These questions are good for reviewing turns and compass directions. Ps can use their compass roses. T asks questions, Ps volunteer to answer. Agreement. Praising.
2B	Extra questions Q9 An angle round a point on a straight line has size $140°$. What is the size of the other angle at the point? $(40°)$ Q10 How many degrees are there around a point? $(360°)$ Q11 An angle round a point has size $210°$. What is the size of the other angle? $(150°)$	Further mental work.
2C	Continuing mental work: **PB 5.4, Q1 (a)** **PB 5.4, Q1 (c)** **PB 5.4, Q2 (c)**	T sketches the diagrams on BB, one-by-one, and Ps calculate answers mentally, indicating when they are ready. T chooses P to answer. Agreement. Praising. Ps should find the mental work easy. For the last two questions, T calls Ps to BB for them to explain how they calculated their answers. Slower pupils can use paper for the final 3 questions if necessary. The main topic for the lesson follows on naturally from this mental work.
	26 mins	

Y7	**UNIT 5** ***Angles*** Lesson Plan 4	*Finding Angles on a Line and at a Point*
Activity		***Notes***
3	**PB 5.4, Q1 (b), (d)** **PB 5.4, Q2 (a), (d)** *32 mins*	Individual work, monitored, helped. If Ps have coped well with 2C, above, these questions can be answered quickly. If Ps are not competent with this, further explanation from T is needed. (If only a few Ps have problems, T can help them while other Ps do individual work.)
4	**PB 5.4, Q10** T: What can you tell me about a regular polygon? *38 mins*	Whole class activity. Q10 helps with recap of facts about polygons (see Unit 3), and lays foundations for future more complicated tasks. After discussion over parts (a), (b) and (c), if there is time and Ps are interested, T can show Ps how to construct a regular hexagon in a circle with the aid of compasses.
5A **5B**	**PB 5.4, Q7** T: Draw two parallel lines (e.g. using the sides of a straight ruler), and then draw a third line which intersects them. (a) How many angles are there? (b) Compare the angles. What do you notice? *45 mins*	Two tasks for individual work. Ps all start on first task. When stronger Ps seem to have finished they can continue on to the second task (5B), shown on OHP. Slower Ps can also start on 5B. 3 minutes before the end of the lesson, T must stop Ps working and get Ps to volunteer answers to 5A and reasons for them. Discussion, agreement. Praising. Stronger P comes to BB to give answers to 5B. Agreement. Praising. Self-correction.
	Set homework **PB 5.4, Q1 (f)** **PB 5.4, Q2 (f)** **PB 5.4, Q3** **PB 5.4, Q4**	T asks Ps to bring protractors, compasses and a sharp pencil to the next lesson.

Y7	**UNIT 5 *Angles*** Lesson Plan 5	*Constructing Triangles*
Activity		***Notes***
1A	**Checking homework** **PB 5.4, Q1 (f)** **PB 5.4, Q2 (f)** **PB 5.4, Q3** **PB 5.4, Q4** *3 mins*	Ps give answers to these simple questions. Agreement. Feedback. Self-correction. Praising.
2A	**PB 5.3, Q3** T: Can you imagine what a triangle looks like? *(Yes)*	Whole class activity.
2B	T: (a) Can you imagine a triangle with one obtuse angle? Sketch one in your Ex.B. Who would like to draw it on the BB? (b) Draw a triangle with two obtuse angles. (c) Draw a triangle with no obtuse angles. (d) Draw a triangle with at most one right angle. (e) Draw a triangle with at least one right angle. *10 mins*	Ps volunteer; T chooses P to come to board and sketch triangle. Other Ps agree/disagree. T asks another P to show which is the obtuse angle, and then to name the types of the other angles in the triangle. At the same time, T walks among Ps, checking and correcting triangles they have drawn in Ex. Bs. Pupils discuss meaning of the expressions 'at most' and 'at least'. Also discuss why a triangle can have neither two obtuse angles nor two right angles.
3	**Constructing triangles**	
3A	(a) Draw a line and plot a point on it. Place each of your rice grains on the line more than 3 cm from the point. (b) Mark a point in your Ex.B. Place your rice grains on your Ex.B. so that they are each less than 3 cm from the point. What can you say about the position of the grains? (c) Mark another point in your Ex.B. Place your rice grains on your Ex.B. so that they are each 3 cm from the point. What geometrical figure do the point form? Could you draw one? What will you need to help you?	Whole class activity. To construct triangle, T gets Ps to find points with certain properties on the page of their Ex.B. To make this a practical exercise, T has brought a small bag of rice grains (or split peas). T gives each P about 15-20 grains, to use as instructed. T reads the instructions; Ps work; T walks among Ps watching and helping. T and Ps then discuss results and answer the questions. Agreement. Praising.
3B *(continued)*	T: John is searching for hidden treasure. He has half of the secret letter which gives directions to the place where it is buried. He reads, "Walk 2 m north from the centre of the island; turn west and walk 3 m. There is a palm tree at this spot. The treasure is 5 m from the palm ...." T: Could we draw a map? *(Yes!)*	This task is fairly long but it fits well with 3A and helps Ps consider how we find points on a plane, why we use our compasses and shows how we arrange geometrical figures (e.g. triangles).

Y7	**UNIT 5** ***Angles*** Lesson Plan 5	*Constructing Triangles*

Activity

3B
(continued)

OK. Let's draw a set of axes in your Ex.Bs.

How do you think we should label the axes?

P: The perpendicular axis should be labelled north and the horizontal one east.

T: Fine. What units shall we use?

Ps: Metres.

T: So, we'll find the palm tree first. What are its coordinates?

P: (– 3, 2)

T: Right. Where is the treasure?

P: Five units from the palm.

T: In what direction?

P: We don't know.

T: So - where is the treasure buried?

P: It's somewhere in the circle around the palm.

T: Let's construct the places it can be. From now on use your compasses.

T: Can you give me the coordinates of some positions where the treasure might be buried?

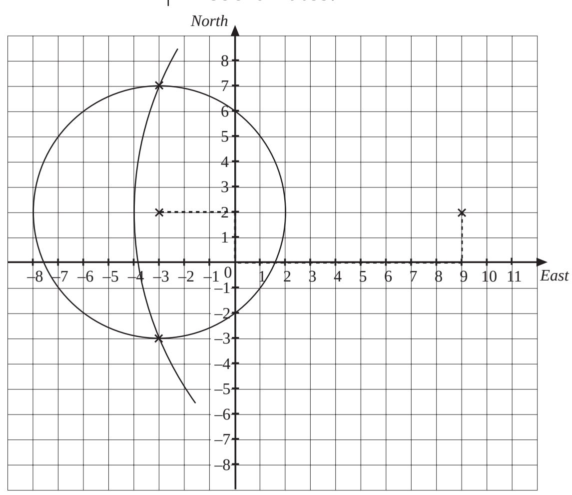
Ps: (2, 2), (– 3, – 3), (– 3, 7), (– 8, 2). (1, 5), (– 6, 6), ...

T: Would it help if we knew something else about the treasure? For example, where would you look if you knew that it was somewhere on the perpendicular axis?

P: I would dig at the point (0, 6) or (0, – 2).

T: But John has no other information ...

T: I have to disclose that the other half of the secret letter is in my pocket ... It says, "Walk 9 m east from the centre of the island, then turn north and walk 2 m. There you will find a spring. The treasure is buried 13 m from the spring."



T: Who can show me the position of the spring?

T: What are its coordinates?

P: (9, 2)

T: Right. Where does the second half of the letter say the treasure can be?

T: Shall we tell John where to dig?

Ps: Yes! At the point (– 3, – 3) or (– 3, 7).

T: And if we knew that the treasure was exactly NW or SW of the centre of the island?

....

Notes

Ps can recall their knowledge about graphs, writing and reading coordinates, and can combine this with their understanding of compass directions.
The two parts of the 'letter' appear on OHP. T leads Ps to the solution.
At each step, T asks Ps to suggest what to do next. Then Ps do it in Ex.Bs and T on BB (using board equipment). T also walks among Ps, watching, and helping if necessary, as they do the same.

T lets Ps volunteer to answer with points, to give them practice with coordinates.

P comes out to show on BB.

Finally Ps find the position of the buried treasure. T praises them.

26 mins

Y7	**UNIT 5 *Angles*** Lesson Plan 5	*Constructing Triangles*
Activity	**Right angles in triangles**	***Notes***
4A	Somewhere in the country of Lilliput there is a little palm tree and a little spring. The distance between them is 12 cm. Gulliver is lying on the ground. His right thumb is 5 cm from the palm tree and 13 cm from the spring. Draw a sketch (without ruler and compasses) to show how we could find the position of Gulliver's thumb. T: What kind of figure do you see here? Ps: A triangle. T: What can you say about its dimensions? Ps: It has sides of length 12 cm, 5 cm and 13 cm. T: .... about its angles? Ps: ? T: OK. We'll see.	Whole class activity which will link Activities 3B and 4B. Task appears on OHP. Here we use a sketch in preparation for constructing the triangle. Mathematical expressions can be introduced and discussed leading to the method used in the 'Solution' on p81 of PB. Ps instruct T, who makes a sketch on BB; Ps in Ex.Bs. (They can agree to use only one of the two possible triangles.)
4B	Construct a triangle of length 12 cm, 5 cm and 13 cm. First draw a sketch, then plan your construction on it. T: Now we can answer the question about the angles. So? Ps: The triangle has a right angle and two acute angles. T: Are you sure that it is exactly a right angle? Ps: Yes! T: Measure it with your protractor. P_1: Mine is only $89°$. P_2: Mine is $90.5°$. T: We'll look at right angled triangles in more detail later on. *34 mins*	Task appears on OHP. Individual work, but T and Ps agree that as this is almost the same problem as 4A, so they can use the same sketch and plan. Ps sketch triangle in Ex.Bs. T monitors Ps and helps them to use their equipment (ruler, compasses). When *everyone* is ready, T shows the construction on BB using equipment. Feedback. Praising.
5	**PB 5.5, Q1 (c)** *40 mins*	Whole class activity. T leads Ps in planning the steps needed to construct the triangle (see p80 of PB), T writing them on BB. When plan is complete, Ps construct triangle in Ex.Bs. T walks among Ps, monitoring and helping where necessary. T then looks at all Ps work to see if it is correct.

Y7	**UNIT 5** ***Angles*** Lesson Plan 5	*Constructing Triangles*
Activity		***Notes***
6	**PB 5.5, Q1 (d)**	Individual work, monitored, helped. T reminds Ps to make a sketch an plan first. This is a construction that Ps have not met before, so many will struggle. When T notices that many Ps are having problems, T calls a stronger P to sketch plan on BB. Ps then continue with their individual work. T checks Ps by walking among them. Then T asks Ps to measure angles of triangle and discuss if there are any connections between the length of the sides and the size of the angles.
	45 mins	
	Set homework (1) Draw the triangles in **PB 5.5, Q5** **PB 5.5, Q4 (c), (d)** (2) Measure the angles of the triangles you constructed during the lesson and in homework (1). What do you notice about the sum of the angles in each of the triangles?	

Y7	**UNIT 5** ***Angles*** Lesson Plan 6	*Angles in a Triangle, Classifying Triangles*
Activity		***Notes***
1A	**Checking homework**	T asks Ps if they managed to construct each of the triangles. Discussion follows as to why Q4 (c) cannot be drawn. T leads argument from "because the two arcs don't cross" to "if the sum of any two sides of a triangle is smaller than the third, the triangle cannot be constructed". Then T checks triangles in Q5 and Q4 (d) by walking among Ps and looking at their Ex.Bs.
1B	**Measuring, adding, noticing**	T asks different Ps the angles of the triangles in PB 5.5, Q1 (c), (d); Q5; Q4 (d), and the sum of the angles in each of these triangles. Others agree (or not). Agreement, self-correction, with everyone finding the sum $180°$. Having established the conditions for the sides of a triangle, T and Ps go on to the next stage. For the moment, Ps have to accept that these statements are true without seeing any proofs.
	10 mins	
2A	**PB 5.6, Q1 (a), (b)**	Whole class activity. For (a), T asks Ps how to proceed. T writes on BB and Ps in Ex.Bs. A (slower) P is called to BB and asked to do the same for (b). T may help. If this P seems to understand the problem, individual work can follow; if not, further practice and discussion should take place.
2B	**PB 5.6, Q1 (c), (d)**	Individual work, monitored, helped. Checking at BB: T sketches the triangle, chooses a P volunteer to come out and write the solution, giving reasons. Agreement, feedback, self-correction. Praising.
	18 mins	

Y7	UNIT 5 *Angles* Lesson Plan 6	*Angles in a Triangle, Classifying Triangles*
Activity		***Notes***
3A	**Finding a connection between the lengths of the sides and the sizes of the angles by comparing them**	Whole class activity. The situation is similar to that in 1B. Again, no proofs are given but Ps must know the following facts: *the largest angle in a triangle is the one opposite the longest side (and inversely);* *the angles oppposite sides of equal length are equal in size (and inversely).* Here T and Ps can look at symmetry, and with Q4 (d), multiple symmetry.
3B	**PB 5.6, Q2 (a), (b), (c)**	Whole class activity. T and Ps discuss and agree which angles are equal. Then P comes to BB and answers the question (T may help).
3C	**PB 5.6, Q2 (d)**	Individual work. Checking at BB - P volunteers to come to BB to sketch triangle, write and give reasons. Agreement, feedback, self-correction. Praising.
	28 mins	
4A	**Classification of triangles**	Using the triangles in Q2, T initiates discussion and explains properties of isosceles triangle, equilateral triangle and scalene triangle. Discussion re properties of these triangles (see p84 in PB).
4B	**PB 5.6, Q3 (a), (b), (d)**	Individual work. Checking: T points to P whoe naswers question, with reasons. Agreement, feedback, self-correction. Praising.
	35 mins	
5A	**PB 5.4, Q4 (a), (b)** with the wording changed to read, 'For each triangle below, find the marked angles.'	Whole class activity. This task is straighforward; Ps have to find an angle of a triangle and the size of the other angle round a point on a straight line. For (a), T can ask Ps what to do and then T write on BB, Ps in Ex.Bs. T explains how to find the exterior angle (straight line $180°$). T then explains interior angle. T sketches triangle (b) on BB, asks P to name marked angle on it and chooses a P to answer the question.

Y7	**UNIT 5** ***Angles*** Lesson Plan 6	*Angles in a Triangle, Classifying Triangles*
Activity		***Notes***
5B	**PB 5.6, Q4 (c)**	Checking at BB. P comes to BB, writes and gives reasons. Agreement, feedback, self-correction. Praising.
	43 mins	
6	**Review** T: What can you say about the lengths of the sides of a triangle?, What is the sum of the interior angles of a triangle?, What two facts can you state about an isosceles triangle? etc.	This section provides a quick review of the information learned in the lesson. T can use the figures on p84 of PB. If pupils have difficulty with the extent of the content of the lesson, a topic (e.g. exterior angle) can be left for the following lesson.
	45 mins	
	Set homework **PB 5.6, Q1 (e), (f)** **PB 5.6, Q3 (c)** **PB 5.6, Q4 (d)** **PB 5.6, Q6** (for stronger Ps)	

<table>
<tr><td>Y7</td><td>UNIT 5 Angles Lesson Plan 7</td><td>Angles in Quadrilaterals and Some Review Work</td></tr>
<tr><td>Activity</td><td></td><td>Notes</td></tr>
<tr><td>1
1A</td><td>Checking homework
PB 5.6, Q1 (e), (f)</td><td>T asks for just the answers, maybe for reasons in some cases.
Agreement, feedback, self-correction. Praising.</td></tr>
<tr><td>1B</td><td>PB 5.6, Q3 (c)</td><td>When they have given answers, T can ask Ps what they know about isosceles triangles.</td></tr>
<tr><td>1C</td><td>PB 5.6, Q4 (d)</td><td>T asks P to give reasons for answer. T and Ps review interior and exterior angles.
Agreement. Feedback. Self-correction. Praising.</td></tr>
<tr><td>1D</td><td>PB 5.6, Q6 (for stronger pupils)

8 mins</td><td>T calls stronger P to BB to outline the task and give answer with reasons.
Then T asks if Ps found an answer that was true for all triangles, and if anyone could prove this. If no-one volunteers, T can guide the class to the proof:
e.g. What is the sum of an exterior angle and the interior angle next to it in a triangle?
How many pairs of interior/ exterior angles are in a triangle?
What is the sum total of these angles?
What is the total of the interior angles?
So is the total of the interior angles?
Who can think of a way of putting this that we will remember?</td></tr>
<tr><td>2

(continued)</td><td>PB 5.3, Q4 plus:
(c) only acute angles,
(d) exactly one right angle,
(e) two neighbouring right angles (the others are different),
(f) exactly three right angles,
(g) four right angles.</td><td>Whole class activity.
This task not only sets up the first topic of this lesson, but also helps Ps to recall and review another of the topics, classifying angles.
Task appears on OHP.
Ps try to sketch in their Ex.Bs, one of them working at BB. Others agree/disagree.
4-sided shapes have four angles,</td></tr>
</table>

Y7	UNIT 5 *Angles* Lesson Plan 7	*Angles in Quadrilaterals and Some Review Work*
Activity		***Notes***
2 *(continued)*	*16 mins*	the sum of which is $360°$ (task (g); quadrilateral (f) does not exist (if it has three right angles, the fourth angle has to be a right angle); with (e) we can see that one of 'the others' is acute, one is obtuse ... After seeing all these examples, Ps can guess why (c) does not exist and if the different quadrilaterals might have the same total for their four interior angles.
3	**Activity 5.6** *26 mins*	Individual work, monitored helped. Each P is given a copy of Activity 5.6 and works on it. Ps also recap on measuring angles, covered earlier in this unit. T walks among Ps, watching and correcting where necessary. (It is not necessary to measure the angles of the rectangle, just those of the other quadrilaterals on the sheet.) While Ps are working, T can check and, if necessary correct, their method of measuring. The *Extension* can be given to stronger Ps as homework. (No proof is given at this stage.)
4	**M 5.3** *40 mins*	Mental work. T encourages Ps to work out answers in their heads, but slower Ps can use Ex.Bs where necessary. T asks questions, Ps think (some writes), volunteer, T chooses P to answer with reasons (maybe at BB). T and Ps are recapping topics from the whole unit. Agreement. Praising.
5	**PB 5.1, Q8** *45 mins*	Whole class activity. Ps recall compass directions (may use compass roses). Then T asks questions, Ps look at map in question, volunteer and answer (reviewing the topic).

Y7	UNIT 5 *Angles* Lesson Plan 7	*Angles in Quadrilaterals and Some Review Work*
Activity		*Notes*
	Set homework **M 5.4** **PB 5.5, Q1 (a)** **Activity 5.6** ***Extension*** (for stronger Ps)	

UNIT 5 Angles Mental Tests

M 5.1 Standard Route *(no calculator)*

1. How many degrees are there in (a) $\frac{1}{2}$ turn, (b) $\frac{1}{4}$ turn ? ((a) $180°$ (b) $90°$)

2. You are facing east and make a $\frac{1}{4}$ turn clockwise.
   In which direction are you now facing? (south)

3. What fraction of a turn takes you clockwise from west to south? ($\frac{3}{4}$ turn)

4. How many degrees are there between: (a) south and north, ($180°$)
   (b) south and west? ($90°$)

5. You are facing due west and turn clockwise through an angle of $45°$.
   In which direction are you now facing? (northwest (NW))

6. How many degrees are there in an anticlockwise turn between north and northwest? ($45°$)

7. Is an angle of size $120°$, *acute*, *obtuse* or *reflex*? (obtuse)

8. How many degrees are there around a point? ($360°$)

M 5.2 Standard Route *(no calculator)*

1. How many degrees are there in (a) whole turn, (b) $\frac{3}{4}$ turn ? ((a) $360°$ (b) $270°$)

2. You are facing west and make a $\frac{1}{4}$ turn anticlockwise.
   In which direction are you now facing? (south)

3. What fraction of a turn takes you clockwise from east to south? ($\frac{1}{4}$ turn)

4. How many degrees are there between: (a) east and west, ($180°$)
   (b) north and east? ($90°$)

5. You are facing due south and turn anticlockwise through an angle of $45°$.
   In which direction are you now facing? (southeast (SE))

6. How many degrees are there in a clockwise turn between south and northwest? ($135°$)

7. Is an angle of size $210°$, *acute*, *obtuse* or *reflex*? (reflex)

8. How many degrees are there around a point on a straight line? ($180°$)

UNIT 5 Angles Mental Tests

M 5.3 Academic and Express Route *(no calculator)*

1. Two angles round a point have sizes $120°$ and $160°$.
   What is the size of the third angle ? ($80°$)
2. What is the sum of the interior angles of a triangle? ($180°$)
3. Two angles in a triangle are $40°$ and $80°$. What is the size of the other angle? ($60°$)
4. What is the size of any angle in an equilateral triangle? ($60°$)
5. What two facts can you state about the angles in an isosceles triangle? (two equal angles, two equal sides)
6. The unequal angle in an isosceles triangle is of size $40°$.
   What is the size of the other angle? ($70°$)
7. What are the sizes of the angles in a right angled isosceles triangle? ($90°$, $45°$, $45°$)
8. In an isosceles triangle, the two equal angles are of size $42°$.
   What is the size of the other angle? ($96°$)
9. What is the size of each of the interior angles of a square? ($90°$)

M 5.4 Academic and Express Route *(no calculator)*

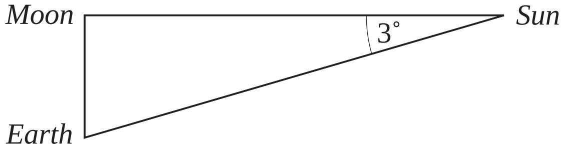
1. Two angles round a point have sizes $100°$ and $150°$.
   What is the size of the third angle ? ($110°$)
2. What is the sum of the interior angles of a triangle? ($180°$)
3. Two angles in a triangle are $50°$ and $70°$. What is the size of the other angle? ($60°$)
4. What can you say about the lengths of the sides of an isosceles triangle? (two are of equal length)
5. What two facts can you state about the angles in an equilateral triangle? (angles all equal; angles equal $60°$)
6. The unequal angle in an isosceles triangle is of size $80°$.
   What is the size of the other angle? ($50°$)
7. In a right angled triangle, one angle is of size $35°$.
   What are the sizes of the other two angles? ($90°$, $55°$)
8. In an isosceles triangle, the two equal angles are of size $54°$.
   What is the size of the other angle? ($72°$)
9. What is the size of each of the interior angle of a rectangle? ($90°$)

UNIT 5 *Angles* Teaching Notes

Historical Background and Introduction

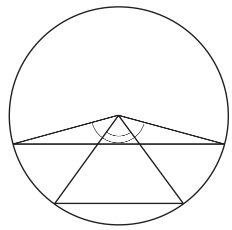
An important part of the mathematics syllabus over the next 5 years is geometry, and this first unit deals with angle measures.

The origins of angle measures are not due to any one person but to a variety of developments in different countries. For example, *Aristarchus* (around 260 BC), in his treatise, *On the Sizes and Distances of the Sun and Moon*, made the observation that when the moon is half full, the angle between the lines of sight of the sun and the moon is less than a right angle by one-thirtieth of a quadrant (the systematic use of the $360°$ circle came a little later). In today's language, this gave the angle $3°$ in the diagram below.



In fact, the angle should have been about $0° 10'$.

It is not known just when the systematic use of $360°$ was established, but it seems likely to have been largely due to *Hipparchus* (180-125 BC), who is thought to have produced the first trigonometric table.



It was firmly established by *Ptolemy* (c 100-178 AD), who used it consistently in his astronomical treatise. He noted that the ratio of arc to chord reduced as the angle subtended at the centre decreased, with a limit of 1 and he actually produced tables giving values for angles varying from $0°$ to $100°$.

Although the use of $360°$ was adopted by most mathematicians, the idea of using $400°$ for a circle was developed in Scandinavian countries and is, in fact, still used on a limited basis. (It is even included on most calculators with the 'grad' mode for angles.)

Angle geometry is one topic in mathematics where 'proof' should be emphasised. So, for example, the *verification* that the sum of the angles in a triangle is $180°$ is not at all the same as a proof, and this should be made clear to pupils. In fact, the difference between

conjecture, *proof* and *verification*

should be emphasised, especially for pupils on the *Express Route*; brief dictionary definitions are:

- *conjecture* – an opinion formed without proof, based on slight or no evidence;
- *proof* – that which proves or establishes the truth of anything;
- *verification* – the process of ascertaining, confirming or testing truth or accuracy.

The unit also introduces compass directions; their origin is somewhat obscure and they have, at times, been attributed to the Chinese, Arabs, Greeks, Etruscans, Finns and Italians! What is clear, though, is that they were used, in a primitive way, as early as the 13th century, for navigation of ships, and that their use was widespread among seagoing nations by the 16th century. Even the earliest designs used 32 points (or subdivisions) on the compass, and sophisticated compasses were very much the order of the day by the early 18th century. The compass works on the principle that the earth has a magnetic field so that the needle of the compass indicates the direction of that field – magnetic North. Nowadays, ships (and planes) have sophisticated radar, but compass directions are still of great value to many, including walkers and hikers!

This is also the first unit of the course where accuracy of construction (angles, sides, etc.) is crucial. You must stress the importance of accurate construction and measurements – and ensure that pupils have the right equipment (ruler, protractor, pair of compasses, sharp pencil, etc.). *You* must show the same skills on the board, and you should definitely use board equipment to emphasise the accuracy needed.

Routes		**Standard**	**Academic**	**Express**
5.1	Angles and Turns	✓	✓	✓
5.2	Measuring Angles	✓	✓	✓
5.3	Classifying Angles	✓	✓	✓
5.4	Angles on a Line and Angles at a Point	(✓)	✓	✓
5.5	Constructing Triangles	✓	✓	✓
5.4	Finding Angles in Triangles	✗	(✓)	✓
Language				
•	Angles and turns	✓	✓	✓
•	Compass directions	✓	✓	✓
•	Clockwise and anticlockwise	✓	✓	✓
•	Acute, obtuse, reflex and right angles	✓	✓	✓
•	Isosceles, equilateral and scalene triangles	✗	(✓)	✓

(✓) *denotes extension work for these pupils*

Misconceptions

- It is important to always use the 'degrees' sign for angles to avoid confusion, e.g. $60°$, not 60.
- Pupils must know that a right angle is *exactly* $90°$ (one quarter turn), and is therefore neither reflex nor acute.

Challenging Questions

The following questions are more challenging than others in the same section:

	Section	*Question No.*	*Page*
Practice Book Y7A	5.2	6	73
" "	5.4	10 (c)	80
" "	5.6	5	87
" "	5.6	11	89

UNIT 6 *Arithmetic: Multiplication of Decimals* Activities

Activities

ACTIVITY 6.1 *Secret Sums*

1. Find the missing numbers, marked by * in the following sums:

(a) $\begin{array}{rccc} & 2 & * & 3 \\ + & 1 & 7 & * \\ \hline & * & 6 & 5 \\ \hline \end{array}$ (b) $\begin{array}{rccc} & 4 & * & 7 \\ - & * & 1 & 8 \\ \hline & 1 & 7 & * \\ \hline \end{array}$ (c) $\begin{array}{rccc} & 7 & * & 0 \\ - & 3 & 6 & * \\ \hline & * & 3 & 8 \\ \hline \end{array}$ (d) $\begin{array}{rccc} & & 3 & 7 \\ \times & & & * \\ \hline & * & * & 8 \\ \hline \end{array}$ (e) $\begin{array}{rccc} & 1 & * & 4 \\ \times & & & * \\ \hline & 4 & 0 & 2 \\ \hline \end{array}$

2. Find two possible solutions of:

$$\begin{array}{rccc} & * & 2 & * \\ \times & & & 2 \\ \hline & 8 & * & 6 \\ \hline \end{array}$$

3. Find the missing numbers in the sums:

(a) $\begin{array}{rcccc} & * & 2 & * \\ \times & & * & 7 \\ \hline & 8 & * & 9 \\ * & * & 4 & * \\ \hline * & * & * & * \\ \hline \end{array}$ (b) $\begin{array}{r|ccc} \multicolumn{1}{r}{} & & * & 3 \\ \cline{2-4} 5 & * & 1 & * \\ \multicolumn{1}{r}{} & 2 & 0 & \\ \cline{2-3} \multicolumn{1}{r}{} & & * & * \\ \multicolumn{1}{r}{} & & * & * \\ \cline{3-4} \end{array}$ (c) $\begin{array}{rcccc} & & 2 & * & 6 \\ \times & & & * & 4 \\ \hline & & * & 6 & * \\ * & * & * & 2 & * \\ \hline * & * & * & * & * \\ \hline \end{array}$

(There are 2 possible solutions to this sum!)

4. The 10 letters A to K, leaving out I, stand for the 10 digits 0 – 9, but not necessarily in that order. Find which letter stands for each digit, if the following sums hold:

A × B = B	F × H = CJ
B × C = AC	H × J = KJ
C × D = BC	J × K = E
D × E = CH	K × G = G
E × F = DK	A × G = G

Extension

Find the missing numbers for the sum:

$$\begin{array}{rr|ccccc} \multicolumn{2}{r}{} & & & * & * & * \\ \cline{3-7} * & * & * & 9 & * & * & * \\ \multicolumn{2}{r}{} & & * & * & & \\ \cline{4-5} \multicolumn{2}{r}{} & & * & * & * & \\ \multicolumn{2}{r}{} & & * & * & * & \\ \cline{4-6} \multicolumn{2}{r}{} & & & 2 & * & * \\ \multicolumn{2}{r}{} & & & * & * & * \\ \cline{5-7} \end{array}$$

ACTIVITY 6.2 *Egyptian Multiplication*

The Egyptian method for multiplication was based simply on a continual doubling process. For example, to multiply 27 by 137, follow these instructions:

1. In two columns write down 1 and 137 (always choose the larger number)

	1	137	*Line 1*
	2	274	*Line 2*
delete	$\boxed{4 \quad 548}$		*Line 3*
	8	1096	*Line 4*
stop	16	2192	*Line 5*

2. Double both sides until the number 27 will be passed on the left hand side on the next double (e.g. $16 \times 2 = 32$ so go no further than *Line 5*)

3. Select on the left hand side the numbers that add up to 27

$$27 = 16 + 8 + 2 + 1$$

4. Delete any number not used in the addition to 27 (i.e. 4), and the corresponding number on the right hand side (see *Line 3*)

5. Add up the numbers remaining on the right hand side

137	*from Line 1*
274	*from Line 2*
1096	*from Line 4*
2192	*from Line 5*
3699	

6. This is the answer, i.e.

$$27 \times 137 = 3699$$

Problems

Use Egyptian multiplication to find:

1. 13×250
2. 16×135
3. 25×49

Extension Analyse the method to see why it works.

(*Hint*: Write
$$27 \times 137 = (16 + 8 + 2 + 1) \times 137$$
$$= (16 \times 137) + (8 \times 37) + (2 \times 137) + (1 \times 137))$$

ACTIVITY 6.3 *Russian Multiplication*

One upon a time, so legend has it, Russian peasants could only add and multiply or divide by 2. So they developed a clever method of multiplying any two numbers.

For example, to multiply 27 by 137, they followed this method:

1. In two columns write down the numbers
2. Divide the left hand column by 2 ignoring any remainders, and multiply the right hand column by 2
3. Repeat this process until the number 1 is reached in the left hand column (*Line 5*)
4. Delete any row which has an *even* number in the left hand column (*Line 3*)
5. Add up the numbers remaining in the right hand column (*Lines 1, 2, 4* and *5*)
6. Check the answer – it should be 27×137

	27	137	*Line 1*
	13	274	*Line 2*
even	6	$\boxed{548}$	*Line 3*
	3	1096	*Line 4*
	1	2192	*Line 5*
		3699	

Problems

Use Russian multiplication to find:

1. 13×250
2. 16×135
3. 25×49

Extension Analyse the method to see why it works.

(*Hint*: Write

$$
\begin{aligned}
27 \times 137 &= (26+1) \times 137 \\
&= 26 \times 137 + 137 \\
&= 13 \times 2 \times 137 + 137 \\
&= 13 \times 274 + 137 \\
&= (12+1) \times 274 + 137, \text{ etc.)}
\end{aligned}
$$

ACTIVITY 6.4 *Multiplication Using Roman Numerals*

You may be familiar with Roman numerals, but, in case not, the first twenty numbers are shown on the right. Note that:

'IV' means 1 before 5, i.e. 4

and that the system is based on '5' rather than '10'.

Number	*Roman Numeral*
1	I
2	II
3	III
4	IV
5	V
6	VI
7	VII
8	VIII
9	IX
10	X
11	XI
12	XII
13	XIII
14	XIV
15	XV
16	XVI
17	XVII
18	XVIII
19	XIX
20	XX

The next symbols used are:

Number	*Roman Numeral*
50	L
100	C
500	D
1000	M

Problems

1. Write out Roman numerals for 21 to 50 inclusive.

2. What is 137 in Roman numerals?

We will now see how to multiply two numbers, expressed in Roman numerals, together. But first, some important multiplication.

3. What is:

(a) I × V (b) V × V (c) V × X (d) V × L (e) I × X

(f) X × X (g) L × X (h) I × C (i) V × C (j) X × C

4. For 27×137, copy and complete this long multiplication calculation:

C X X X V I I
X X V I I

C X X X V I I × I →
C X X X V I I × I →
C X X X V I I × V →
C X X X V I I × X →
C X X X V I I × X →

Add (Check that your answer is correct.)

5. Calculate 16×135 using Roman numerals. Check your answer.

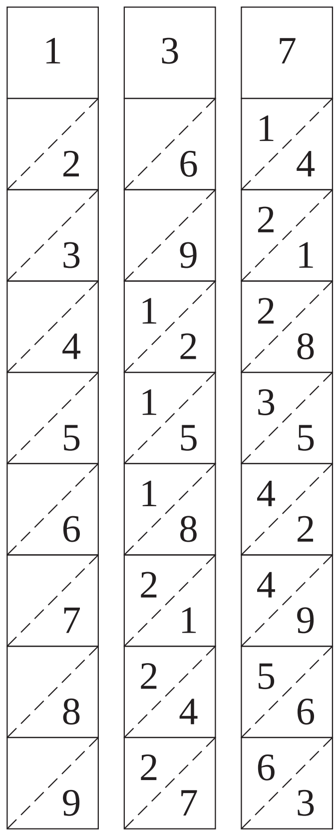
You probably know now why this system is no longer in everyday use for calculations of this type!

ACTIVITY 6.5 *Napier's Bones (or Rods)*

You will need a copy of the Resource Sheet in order to first obtain a set of *Napier's Bones*. Note how they are constructed. The first row is the whole numbers 1 to 9, and the following rows are 2 ×, 3 ×, 4 ×, . . . , 9 × the first row, but note that two-digit numbers are placed either side of the diagonals. From your copy of the sheet, cut out each column – these are the *bones* or *rods*!

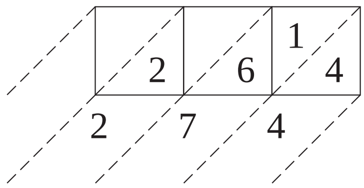
To multiply, for example, 137×27:

1. Pick out the rods which start with 1, 3 and 7



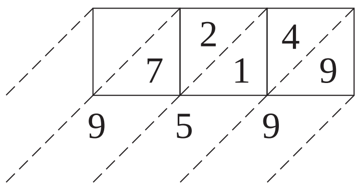
For 27

2. Pick out the 2nd row, and add up along the diagonals



This shows that $2 \times 137 = 274$

3. Pick out the 7th row, and add up along the diagonals



This shows that $7 \times 137 = 959$

4. As we want 27×137, the final calculation is

$$\begin{aligned} 27 \times 137 &= (20 \times 137) + (7 \times 137) \\ &= 2740 + 959 \\ &= 3699 \end{aligned}$$

Problems

Use your Napier's Rods to find:

1. 16×135 2. 25×49 3. 13×250

ACTIVITY 6.5 RESOURCE SHEET

Napier's Bones (or Rods)

1	2	3	4	5	6	7	8	9
2	4	6	8	1/0	1/2	1/4	1/6	1/8
3	6	9	1/2	1/5	1/8	2/1	2/4	2/7
4	8	1/2	1/6	2/0	2/4	2/8	3/2	3/6
5	1/0	1/5	2/0	2/5	3/0	3/5	4/0	4/5
6	1/2	1/8	2/4	3/0	3/6	4/2	4/8	5/4
7	1/4	2/1	2/8	3/5	4/2	4/9	5/6	6/3
8	1/6	2/4	3/2	4/0	4/8	5/6	6/4	7/2
9	1/8	2/7	3/6	4/5	5/4	6/3	7/2	8/1

ACTIVITIES 6.1 - 6.3 *Notes and Solutions*

Notes and solutions are given only where appropriate.

6.1 1.(a)
$$\begin{array}{r} 293 \\ +172 \\ \hline 465 \\ \hline \end{array}$$
(b)
$$\begin{array}{r} 497 \\ -318 \\ \hline 179 \\ \hline \end{array}$$
(c)
$$\begin{array}{r} 700 \\ -362 \\ \hline 338 \\ \hline \end{array}$$
(d)
$$\begin{array}{r} 37 \\ \times\ \ 4 \\ \hline 148 \\ \hline \end{array}$$
(e)
$$\begin{array}{r} 134 \\ \times\ \ 3 \\ \hline 402 \\ \hline \end{array}$$

2.
$$\begin{array}{r} 423 \\ \times\ \ 2 \\ \hline 846 \\ \hline \end{array} \qquad \begin{array}{r} 428 \\ \times\ \ 2 \\ \hline 856 \\ \hline \end{array}$$

3.(a)
$$\begin{array}{r} 127 \\ \times\ \ 27 \\ \hline 889 \\ 2540 \\ \hline 3429 \\ \hline \end{array}$$
(b)
$$\begin{array}{r} 43 \\ 5\overline{)215} \\ 20 \\ \hline 15 \\ 15 \\ \hline \end{array}$$
(c)
$$\begin{array}{r} 216 \\ \times\ \ 74 \\ \hline 864 \\ 15120 \\ \hline 15984 \\ \hline \end{array} \quad \text{or} \quad \begin{array}{r} 216 \\ \times\ \ 24 \\ \hline 864 \\ 4320 \\ \hline 5184 \\ \hline \end{array}$$

4. A = 1, B = 3, C = 5, D = 7, E = 8,
F = 9, G = 0, H = 6, J = 4, K = 2

Extension 19 107 divided by 99

6.2 1. 3250

2. 2160

3. 1225

6.3 1. 3250

2. 2160

3. 1225

ACTIVITIES 6.4 - 6.5 *Notes and Solutions*

6.4

21	X X I	36	X X X V I
22	X X I I	37	X X X V I I
23	X X I II I	38	X X X V I I I
24	X X I V	39	X X X I X
25	X X V	40	X X X X
26	X X V I	41	X X X 1
27	X X V I I	42	X X X X I I
28	X X V I I I	43	X X X X I I I
29	X X I X	44	X X X X I V
30	X X X	45	X X X X V
31	X X X I	46	X X X X V I
32	X X X I I	47	X X X X V I I
33	X X X I I I	48	X X X X V I I I
34	X X X I V	49	X X X X I X
35	X X X V	50	L

2. C X X X V I I

3. (a) V (b) X X V (c) L (d) C C L (e) X
   (f) C (g) D (h) C (i) D (j) M

4.

		C X X X V I I
		X X V I I
C X X X V I I × I	→	C X X X V I I
C X X X V I I × I	→	C X X X V I I
C X X X V I I × V	→	D L L L(X X V)V V
C X X X V I I × X	→	M C C C L X X
C X X X V I I × X	→	M C C C L X X
		M M M D C I C *(after adding and simpifying!)*

5. M M C L X

6.5 1. 2160 2. 1225 3. 3250

UNIT 6 *Arithmetic: Multiplication of Decimals* Lesson Plans **St**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Multiplication of Whole Numbers**	
	Mental Test	M 6.1
	Discuss answers and revise problems: Multiplication Tables	OS 6.
	Exercises	PB 6.1, Q1
	Discuss solutions	
	Exercises	PB 6.1, Q7
	Set homework	PB 6.1, Q5 and Q6
2.	**Methods of Multiplication**	
	Discuss homework	
	Long multiplication – review	PB 6.2
	Napier's method	OS 6.3
	Exercises	PB 6.1, Q3
	Box method	OS 6.3
	Exercises	PB 6.1, Q3
	Mental Test	M 6.2
	Set homework	PB 6.2
3.	**Multiplying with Decimals**	
	Discuss homework	
	Introduce methods	
	Deducing answers	OS 6.4
	Exercises	PB 6.3, Q1
	Discuss solutions	
	Activity	Activity 6.1
	Mental Test	M 6.3
	Discuss answers	
	Set homework	Complete Activity 6.1 or PB 6.3

UNIT 6 *Arithmetic: Multiplication of Decimals* Lesson Plans **St**

Lesson No.	*Suggested Plan*	*References*
4.	**Multiplication in Context**	
	Discuss homework	
	Worked examples	PB 6.4
	Exercises	PB 6.4, Q1
	Discuss solutions	
	Exercises	PB 6.4, Q2
	Discuss solutions	
	Mental Test	M 6.4
	Discuss answers	
	Set homework	PB 6.4
5.	**Revision Test and Review**	
	Discuss homework	
	Revision Test	RT 6.1 (Standard)
6.	**Revision**	
	Give back marked tests	
	Go over test questions interactively	
	Revise key topics	

UNIT 6 *Arithmetic: Multiplication of Decimals* Lesson Plans **A** and **E**

Lesson No.	*Suggested Plan*	*References*
1.	**Methods of Multiplication 1**	
	Mental Test	M 6.1
	Discuss answers	
	Multiplication tables	OS 6.1
	Exercises	PB 6.1, Q1
	Discuss answers	
	Activity	Activity 6.2
	Set homework	Complete Activity 6.2
2.	**Methods of Multiplication 2**	
	Discuss homework	
	Mental Test	M 6.2
	Discuss answers	
	Napier method	OS 6.3
	Exercises	PB 6.1, Q3
	Box method	OS 6.3
	Exercises	PB 6.1, Q3
	Activity	Activity 6.3 or Activity 6.5
	Set homework	Complete Activity
3.	**Multiplication with Decimals**	
	Discuss homework	
	Deducing answers	OS 6.4
	Exercises at speed (interactive)	PB 6.3, Q1 , Q2 and Q3
	Mental Test	M 6.5
	Discuss answers	
	Set homework	Activity 6.4
4.	**Multiplication in Context**	
	Discuss homework	
	Exercises at speed (interactive)	PB 6.4, Q1 to Q10
	Mental Test	M 6.6
	Discuss answers	
	Set homework	PB 6.4, Q11 to Q14

UNIT 6 *Arithmetic: Multiplication of Decimals* Lesson Plans A and E

Lesson No.	*Suggested Plan*	*References*
5.	**Revision Test and Review**	
	Discuss homework	
	Revision Test	RT 6.2/3 (Academic/Express)
6.	**Revision**	
	Give back marked tests	
	Go over test questions interactively	
	Revise key topics	

Y7	UNIT 6 *Multiplication of Decimals* Lesson Plan 1	*The Multiplication Table, Multiplication and Division by Powers of 10*
Activity	**Multiplication**	***Notes***
1A	T: Can you still remember how to multiply numbers? Ps: Yes. No. T: We'll start with some simple ones. Can anyone calculate 4×5 ? Ps: 20 T: Why? Ps ? T: What does it mean: Do I have to take the number 4 five times? Describe it mathematically in another way. Ps: It means $4 + 4 + 4 + 4 + 4$, and that is 20. T: So what is 8×3, and why? P: $8 \times 3 = 24$ because $8 + 8 + 8 = 24$. T: Right, but we won't add all the time. It's important to know multiplications up to 100. Let's see how you are getting on.	Whole class activity. T introduces multiplication as repeated addition of the same number. Ps may be allowed to answer in chorus.
1B	**OS 6.1**	Whole class activity, question by question. T shows OS 6.1 on OHP, asks Ps and fills in numbers. All Ps involved; slower ones are asked several times. Agreement, disagreement. Praising.
	10 mins	
2	**PB 6.1, Q3** T: Stop now. Let's review answers. Who would like to show and explain their solution? T (after P has answered): Why did you divide in part (b)? What type of relationship is there between the multiplication and the division? P (stronger): The process of division is multiplication in reverse. T: Give me an example of this ... P: $30 \div 5 = 6$ since $6 \times 5 = 30$.	Individual work. T monitors, helping slower Ps where necessary. T emphasises answering with whole sentence. Praising.
	15 mins	
3A *(continued)*	**Multiply by powers of 10** T: I know that you can multiply by even bigger numbers, but these are special numbers! Can you remember the place value table? Draw one in your Ex.Bs. Think about decimal numbers too. T: What is this table based on? Ps: The system is based on 10. T: What does it mean? P: It means that 10 units make 1 ten, 10 tens make 1 hundred, ... 10 tenths are 1 unit. T: What difference does it make if the digit 3 is tens or units? Ps: Its value is ten times more if it is a ten than if it is a unit. T: And what about if the 3 is a hundred? P: Its value is 100 times as much.	

Y7	**UNIT 6** ***Multiplication of Decimals*** Lesson Plan 1	*The Multiplication Table, Multiplication and Division by Powers of 10*
Activity		***Notes***
3A *(continued)*	T: Let's take 5! I mean, five units: - who can write it in my table? - multiply it by 10. Where will it be now? - multiply it by 100. Where now? - multiply it by 1000. Where now?	P comes to BB, writes, answers, gives reasons. Other Ps write in their Ex.Bs. Agree or not. Praising.
	T: Let's look at the number 32. Multiply it by 10, 100, 1000. How does each digit move?	Another P comes to BB; writes, explains. Praising.
	T: Who can state the rule for multiplying by powers of ten?	T helps Ps state the rule *(if we multiply by a number, 10, 100, 1000, each digit of the number takes a higher place in the place value table, and the missing digits are replaced with zeros)* and ensures that the process is described in precise mathematical language. Praising.
3B	T: Does this rule still hold if we multiply decimals? Let's see! T (reads from OHP): The thickness of one sheet of card is 0.46 mm. What is the thickness of 10, 100, 1000 sheets? Use the place value table for this.	Individual work, monitored, helped. Task appears on OHP, Ps work in Ex.Bs. Discussion at BB. P comes and uses previous table (still on BB) to write the 0.46, etc.. Reasoning. Others agree/disagree. Then T shows Ps that the previous rule holds true for decimals as well.
	25 mins	
4	Calculate: (a) 23×10 (b) 5×100 (c) 401×100 (d) 6.3×10 (e) 3.14×10 (f) 0.27×100 (g) 25.2×100 (h) 6.18×1000	Individual work, monitored, helped. Task appears on BB. T gives Ps exactly 4 minutes to write down answers. Ps then write answers on BB; class check each answer. Agreement, feedback, self-correction. Praising.
	31 mins	
5A	**Division** T: Now we'll look at division. Remember what we said just now, about the relation between multiplication and division?	
	P: Division is multiplication in reverse.	Slower P repeats this. Praising.
	T: OK. Now do these calculations and then explain what you did: (a) $30 \div 10 =$ P: 3, since $3 \times 10 = 30$. (b) $400 \div 100 =$ P: 4, since $4 \times 100 = 400$. (c) $580 \div 10 =$ P: 58, since $58 \times 10 = 580$. (d) $8000 \div 100 =$ P: 80, since $80 \times 100 = 8000$ (e) $27\,000 \div 1000 =$ P: 27, since $27 \times 1000 = 27\,000$	Whole class activity. Tasks appear on BB or OHP. Ps volunteer, T chooses P to explain and write on BB or OHP. Agreement. Praising.
(continued)		

Y7	UNIT 6 ***Multiplication of Decimals*** Lesson Plan 1	*The Multiplication Table, Multiplication and Division by Powers of 10*

Activity | ***Notes***

5A *(continued)*

T: Who can state the rule for dividing by powers of ten?

Ps try to state the rule in words *(if we divide a number by 10, 100, 1000, each digit moves 1, 2, 3 steps to the right, to a lower place in the place value table).*

Responses. Agreement. Praising.

T: What do you think the numbers look like which are divisible by 10, 100, 1000 without a remainder?

T: Any what about decimals?
Does the same rule apply?

Ps: Yes.

T: For example, calculate:

(a) 25.8 ÷ 10 = (2.58)	(b) 6.2 ÷ 10 = (0.62)
(c) 0.5 ÷ 10 = (0.62)	(d) 332 ÷ 10 = (33.2)
(e) 435.6 ÷ 100 = (0.05)	(f) 628 ÷ 100 = (6.28)
(g) 52 ÷ 1000 = (0.052)	

Whole class activity.
Task appears on BB or OHP.
Ps volunteer and one of them explains; T writes result on BB or OHP.
Agreement, feedback. Praising.

39 mins

6

Revision
Now try these on your own:

(a) 200 ÷ 10	(b) 380 ÷ 10
(c) 5600 ÷ 100	(d) 44 ÷ 10
(e) 440 ÷ 100	(f) 92 ÷ 100
(g) 3950 ÷ 1000	

Individual work, monitored, helped.

Tasks appear on OHP.

Ps work in Ex.Bs.

When most Ps have finished, T asks, Ps answer, T writes on OHP.

Agreement, Feedback, self-correction. Praising.

45 mins

Set homework

PB 6.1, Q7

PB 6.3, Q2 (a), (b), (c), (d), (g)

PB 8.2, Q1 (b), (d), (f), (i)

Find out something about John Napier – who he was, where he lived and why he is famous.

Y7	UNIT 6 *Multiplication of Decimals* Lesson Plan 2	*Methods of Multiplication*
Activity		***Notes***
1	**Checking homework** **PB 6.1, Q7** **PB 6.3, Q2 (a), (b), (c), (d), (g)** **PB 8.2, Q1 (b), (d), (f), (i)** T: Do you agree with the answers? Which on do you think is wrong? Who got them all right? Who had one, ... two, ... three mistakes? *5 mins*	T has already asked one of Ps to write answers on BB as soon as P arrives. Checking, discussion. Agreement, feedback, self-correction. Praising.
2	**Mental work** **T:** Right ... now you think you can do multiplication. Let's see if you're right. **M 6.1** plus Q11 3.2×10 Q12 5.4×100 Q13 0.49×10 Q14 $15 \div 100$ Q15 $6.7 \div 10$ Q16 20×30 *13 mins*	Mental work, aloud (recap and warming up). T asks questions, Ps answer at speed. Quick response from T; praising; next question. At Q5 ($3 \times 8 = 8 \times 3$) T can get Ps to state this property of multiplication (factors are interchangeable).
3	**John Napier** T: What have you found out about John Napier? T: As you've discovered, John Napier dealt with agricultural problems and mathematics was just a hobby. Despite this, he invented several things in maths. Since he had little time for calculations, he invented a mechanical method of multiplying large numbers. Before we look at this, we'll recap 'long multiplication'. *18 mins*	Individual Ps write facts on BB. All Ps write all facts in Ex.Bs. Discussion. Praising.
4	**Long multiplication** Calculate (a) 243×3 (b) 36×28 (c) 108×73 T: Now try these on your own. You have 2 minutes. (d) 35×19 (e) 137×27 *26 mins*	Whole class activity. T writes on BB, calls Ps out and they solve the task and explain how to multiply larger numbers. Other Ps listen, correcting if necessary, and write solutions in Ex.Bs. Praising. Individual work, monitored, helped. T puts solution, in full, on OHP so that Ps can correct their own work. T observes mistakes and draws attention to the correct method. Praising for successful Ps.

Y7	**UNIT 6** ***Multiplication of Decimals*** Lesson Plan 2	*Methods of Multiplication*
Activity		***Notes***
5 **5A**	**Box method** T: Let's look at the multiplication 35×19. Can anyone suggest a way to do it in your head? P_1: I would break it down (goes to BB, writes and says) $35 \times 10 + 35 \times 9$ T: Fine. P_2: It's almost 35×20, so I would ... (writes on BB) $35 \times 20 - 35 = 700 - 35 = 665$ T: Well done! That's much easier. But the first method is the easier if the multiplier is not close to one of the tens. Let's look at it again. Can we break it down further? P_3: (write on BB): $30 \times 10 + 5 \times 10 + 30 \times 9 + 5 \times 9$ T: Is everything here? To make sure we don't miss anything we can arrange it in boxes ... **OS 6.3**	Whole class activity. T lets Ps guess and give other solutions, encourages them to write their ideas on BB; praises. Finally leads them to 'invent' the Box Method.
5B	T: Could we use the box method for larger numbers too? Look at 137×27. *34 mins*	T puts lower half of OS 6.3 onto OHP and asks Ps to copy it into Ex.Bs. They then fill in the boxes together (T at OHP, Ps in Ex.Bs) and add them up. Now T asks Ps what to do. T draws 3×2 table on BB, Ps in Ex.Bs, etc. Praising.
6 **6A**	**Napier's method** T: It's not too difficult to find 100×20, but John Napier dealt with even larger numbers. Since he found all the multiplications very tiring and calculators weren't available, he invented something to help him. His method is very simple ... **OS 6.3** T: Now let's see how Napier multiplied larger numbers.	T puts top half of OS 6.3 onto OHP, asks Ps to copy it into Ex.Bs and explains Napier's method.
6B	**Activity 6.5** *45 mins*	Then T gives each P a copy of Activity 6.5 Resource Sheet and, after Ps have cut out their 'bones', they all work through the example in Activity 6.5. If there is time, T can give Ps another multiplication to work out using Napier's method.
	Set homework **PB 6.2, Q1 (g), (k), (n)** by long multiplication **PB 6.2, Q3, (b), (c)** by box method **PB 6.2, Q3, (d), (f),** by Napier's method	

Y7	**UNIT 6** ***Multiplication of Decimals*** Lesson Plan 3	*Change of Order and Multiplication with Decimals*
Activity **1**	**Checking homework.** **PB 6.2, Q1 (g), (k), (n)** by long multiplication **PB 6.2, Q3 (b), (c)** by box method **PB 6.2, Q3 (d), (f)** by Napier's method T: Who would like to explain at the BB how we multiply by box/ Napier's method? *6 mins*	***Notes*** T asks, Ps give answers. Agreement, feedback, self-correction. Praising. The two 'new' methods Ps met in the previous lesson can now be reinforced as homework is checked. P writes on BB and explains (using 'bones'). Class agrees or not. Self-correction. Praising.
2	**Mental work** **M 6.3,** with some changes: Q1 - Q6 remain the same, Q7 $32 \div \ldots\ldots = 0.32$ Q8 $0.4 \times \ldots\ldots = 4$ Q9 $5.9 \div \ldots\ldots = 0.59$ Q10 $7.1 \times \ldots\ldots = 710$ *10 mins*	Mental work, aloud, question by question, to warm up and prepare for the lesson's topic. Agreement/disagreement. Praising.
3 **3A**	**Changing order of questions** T: We're going to look at some properties of multiplication. First, find out if each of these statements is true or false. (a) $4 \times 7 = 7 \times 6$ (b) $4 \times 7 = 7 \times 4$ (c) $(2 \times 3) \times 4 = 2 + (3 \times 4)$ (d) $(2 \times 3) \times 4 = 2 \times (3 \times 4)$ (e) $(2 \times 3) \times 4 = (2 \times 4) \times 3$	Whole class activity. Statements appear on OHP. T points, P answers. Reasoning, agreement. Praising Then Ps state the rules in words, slower Ps can be chosen for this. T can help with the other rule *(order of multiplication with 2 factors does not change answer; for the product of 3 factors grouping does not change the answer).*
3B	T: Let's see if you can *use* what you know. Work out the following - try to find the quickest method. (a) $(2 \times 9) \times 5$ (b) $50 \times (2 \times 37)$ (c) $2.9 \times 4 \times 25$ (d) $5 \times 17.3 \times 20$ (e) $59 \times 27 \times 0 \times 38$ *18 mins*	Individual work, monitored, helped. T writes tasks on BB, Ps work in Ex.Bs. Checking at BB; P writes and explains the solution. (Task (e) develops divergent thinking.) Agreement, feedback, self-correction. Praising.
4	**OS 6.2** T: Can you recognise here some of the rules we have met? P_1. A and B are true because of change of order. P_2: E is true because of change of grouping. T: Fine. But there are four other statements that are true. Is this a coincidence, or can you find a pattern? *24 mins*	Task on OHP. Mental work aloud, at speed. Agreement. Praising. Focus on D, F, G and I. T helps Ps realise that *a product will not change if one of the factors is divided by any (non zero) number, while the other factor is multiplied by the same number.*

Y7	UNIT 6 ***Multiplication of Decimals*** Lesson Plan 3	*Change of Order and Multiplication with Decimals*
Activity		***Notes***
5	**Practice** T: Now you're going so tackle some groups of tasks. Calculate the answers quickly, then compare the products with the first one in each group, look at their changes and write down what you notice. (a) $3 \times 2 =$, $9 \times 2 =$, $3 \times 6 =$, $9 \times 6 =$, $30 \times 20 =$ (b) $40 \times 20 =$, $40 \times 10 =$, $20 \times 20 =$, $20 \times 10 =$, $4 \times 2 =$ (c) $30 \times 2 =$, $10 \times 2 =$, $3 \times 200 =$, $3 \times 2000 =$, $300 \times 200 =$ (d) $40 \times 2 =$, $0.4 \times 2 =$, $4 \times 0.2 =$, $400 \times 200 =$, $0.4 \times 0.2 =$ *36 mins*	Individual work, monitored, helped. Each P is given a sheet with the tasks on it, to work on. When most Ps have finished task (c) (some stronger Ps will have finished all tasks), T stops their work for a detailed discussion. First T shows OS with answers (previously prepared by T). After checking answers, T and Ps find out how the product changes if both factors are multiplied (task (a)), both factors are divided (task (b)), or one of them is multiplied and the other divided (task (c)). Then they come to task (d). T calls to BB a stronger P who successfully finished this task. P writes and explains solution. Class agrees or not; T can make Ps check, dividing them into two groups. Finally, T makes Ps repeat what they know about changes of product.
6	**OS 6.4 A, C, E, H** T: Now let's see how we multiply decimals. *40 mins*	Whole class activity. T writes tasks on BB. Only tasks A, C, E and H are used now, as we are concentrating on multiplication of decimals. T asks, Ps answer and explain, deducing the changes of product from the changes of factors. Agreement. Praising. Then T steers Ps to state the rule *(there are as many decimal places in the product as there were in total in the factors).*
7A	**PB 6.3, Q1 (j), (m)** **PB 6.3, Q3 (a)**	Whole class activity. Each multiplication is solved and reasoned by another P at BB. The others write in Ex.Bs; agree or not.

PB 5.2, Q1 (a), (d), (f)

Y7	UNIT 6 *Multiplication of Decimals* Lesson Plan 3	*Change of Order and Multiplication with Decimals*
Activity		***Notes***
7B	T: Now, you have 2 minutes to work out the next two multiplications. **PB 6.3, Q1 (l)** **PB 6.3, Q3 (e)** *45 mins*	Individual work. Checking at BB. Agreement, feedback, self-correction. Praising.
	Set homework **PB 6.1, Q2** **PB 6.3, Q3 (e), (f), (h), (i), (j)** **PB 6.3, Q1 (a), (b)** **PB 6.3, Q3 (c), (f)**	

Y7	UNIT 6 *Multiplication of Decimals* Lesson Plan 4	*Multiplication in Context*
Activity		***Notes***
1	**Checking homework** **PB 6.1, Q2** **PB 6.3, Q3 (e), (f), (h), (i), (j)** **PB 6.3, Q1 (a), (b)** **PB 6.3, Q3 (c), (f)** *8 mins*	Checking homework also acts to recap on the work covered so far in the unit. T has prepared OS to show solutions; Ps check and correct their work. T ensures that they go over: - properties of multiplication (changing order and grouping in PB 6.1, Q2 and PB 6.3, Q20); - changes of product (PB 6.1, Q2); - multiplying powers of ten (PB 6.3, Q2); - multiplying with decimals (PB 6.3, Q1 and Q3).
2	**M 6.6** *16 mins*	Mental work, without writing, whenever possible. Tasks appear on OHP; T asks; Ps answer and explain. Slower Ps may write on BB if they find it necessary.
3	**PB 6.4, Q4** **PB 6.4, Q7** **PB 6.4, Q8** **PB 6.4, Q12** *28 mins*	Individual work. These questions are not difficult. T should select from them according to the type of multiplication to be practised: - long multiplication - multiplication by powers of ten - multiplying with decimals and give them to Ps as individual work. T monitors Ps' work and helps slower ones if necessary. T should wait for all Ps to answer all four questions. Stronger Ps can be given copies of Activity 6.2 when they have finished. Checking: solutions shown at BB by slower Ps, reviewing how to multiply. Agreement, feedback, self-correction. Praising.
4	**Activity 6.2: Egyptian multiplication** *31 mins*	A stronger P, at BB, shows (and maybe tries to explain) how the Egyptians multiplied. Praising.

Y7	**UNIT 6** ***Multiplication of Decimals*** Lesson Plan 4	*Multiplication in Context*

Activity 5

Extra questions

1. Nigel is facing north. He turns $28.5°$ clockwise 12 times. If he wants to be facing north again, what angle does he now have to turn through,
   (a) clockwise, $(18°)$
   (b) anticlockwise? $(342°)$

2. Copy and continue each sequence, giving the next three numbers. What is the rule?
   (a) 0.0047, 0.047, 0.47, ... (4.7, 47, 470, ...)
   (b) 1.3, 2.6, 5.2, ... (10.4, 20.8, 41.6, ...)

3. The formula below is used to convert temperatures from degrees Fahrenheit to degrees Celsius.

   $°F = °C \times 1.8 + 32$

   The normal temperature of the human body is $36.6°C$. Convert this temperature to degrees Fahrenheit. $(97.88°F)$

4. I thought of a number and divided it by 100. I then added 1.275 to the quotient and got 2.6. What was the number I thought of? (132.5)

45 mins

Notes

Team work. T divides class into four mixed-ability groups, each containing at least one of the stronger Ps who will help the others to understand. The questions are important because they involve the use of other topics learnt earlier.

T gives Ps a copy of the extra questions (one copy between two Ps) and they work in their groups, writing answers in Ex.Bs. T monitors discussions and calculations. Ps work through all the questions.

When T sees that all groups have finished question 1, T calls a slower P from one of the groups to write the answer on BB and explain.

Before this, T has prepared a 4×4 scoring grid (for 4 groups and 4 questions) on an OS.

Each question is worth two points, awarded if all the group's members have the correct answer in their Ex.Bs.

Each questions is answered at BB by a P from a different group; the groups whose member explains the solution is awarded an extra point, so it is important for each group to ensure that *all* its members understand the solutions.

Finally, T gives the competition results (maximum of 9 points per group), praises Ps and, maybe, rewards winning group.

Set homework

PB 6.4, Q5

PB 6.4, Q9

PB 6.4, Q10

PB 6.4, Q11

PB 6.4, Q13

UNIT 6 Arithmetic: Multiplication of Decimals — Mental Tests

M 6.1 Standard Route *(no calculator)*

1. 6×2 (12)
2. 7×3 (21)
3. 4×5 (20)
2. 10×8 (80)
5. Is this statement true or false: $3 \times 8 = 8 \times 3$? (true)
6. James gets £2 per week pocket money. How much does he get in 4 weeks? (£8)
7. It costs £3 each for children to visit an aquarium.
   How much will it cost in total for 5 children? (£15)
8. An office block has 7 floors. There are 3 windows on each floor.
   How many windows are there altogether? (21)
9. 100×6 (600)
10. Tickets to a school play cost £2 each. A school sells 100 tickets.
    How much money does the school get? (£200)

M 6.2 Standard Route *(no calculator)*

1. 3×7 (21)
2. 8×4 (32)
3. 7×9 (63)
4. 100×91 (9100)
5. Is this statement true or false: $3 \times 14 = 22 \times 2$? (false)
6. Miles gets £7 per week pocket money.
   How much does he get in 8 weeks? (£56)
7. A theatre ticket for an adult costs £6.
   How much will it cost to buy tickets for 5 adults? (£30)
8. A train has 7 coaches. There are 10 windows in each coach.
   How many windows are there altogether? (70)
9. 30×50 (1500)
10. Tickets to a museum cost £4 each. On one day, 100 tickets were sold.
    How much money did the museum take? (£400)

UNIT 6 Arithmetic: Multiplication of Decimals — Mental Tests

M 6.3 Standard Route *(no calculator)*

1. Joshua spends 30p each day on sweets.
   How much does he spend on sweets in 5 days? (£1.50 or 150p)
2. If there are 4 legs on every chair, how many legs are there on 9 chairs? (36)
3. 0.5×10 (5)
4. 10×2.4 (24)
5. 0.12×100 (12)
6. 1.3×100 (130)
7. 3×0.6 (1.8)
8. 0.2×0.7 (0.14)
9. A meal costs £3.50. Find the cost of 4 meals. (£14)
10. 127×2 (254)

M 6.4 Standard Route *(no calculator)*

1. Mary spends 40p each day on sweets.
   How much does she spend on sweets in 5 days? (£2 or 200p)
2. If there are 5 legs on every chair, how many legs are there on 11 chairs? (55)
3. 0.4×10 (4)
4. 10×1.9 (19)
5. 0.27×100 (27)
6. 2.9×100 (290)
7. 4×0.3 (1.2)
8. 0.4×7 (2.1)
9. A book costs £4.50. Find the cost of 4 books. (£18)
10. 261×2 (522)

UNIT 6 Arithmetic: Multiplication of Decimals — Mental Tests

M 6.5 Academic and Express Route *(no calculator)*

1. 7×9 (63)
2. 8×6 (48)
2. 6×7 (42)
4. 8.2×1000 (8200)
5. A train ticket costs £9.50. Samantha buys 5 tickets each week.
   How much does she spend on tickets in a week? (£47.50)
6. 497×2 (994)
7. 362×3 (1086)
8. A meal costs £3.99. What is the total cost of 6 meals? (£23.94)
9. 0.8×0.4 (0.32)
10. 0.3×1.2 (0.36)

M 6.6 Academic and Express Route *(no calculator)*

1. 2.39×100 (239)
2. 1000×4.97 (4970)
3. 30×16 (480)
4. 0.4×0.9 (0.36)
5. 6×1.2 (7.2)
6. Cloth costs £1.20 per metre. Find the cost of 7 m. (£8.40)
7. A box of chocolate bars contains 8 layers with 12 boxes in each layer.
   How many bars are there in the box? (96)
8. A shop sells 20 books costing £2.48 each.
   How much money does the shop get for the books? (£49.60)
9. If $35 \times 48 = 1680$, what is (a) 3.5×4.8, (16.80)
   (b) 0.35×48 ? (16.80)

UNIT 6 *Arithmetic: Multiplication of Decimals* Teaching Notes

Historical Background and Introduction

This is another of the basic Arithmetic Units, extending the previous work on addition and subtraction to multiplication, both of whole numbers and of decimals.

There are many interesting ways of multiplying, invented back in history when there were no aids to calculation. In section 6.2 of the Practice Book, pupils are introduced to both Napier's method and Russian multiplication; these, together with Egyptian multiplication, are further analysed in the Activities (Activities 6.2, 6.3 and 6.5). Napier's method (or Napier's bones) is the starting point for the invention of logarithms.

John Napier was born in Edinburgh in 1550, and his father was an important gentleman landowner. John Napier was educated at St Andrew's University, but left for Europe before graduating. Whilst in Europe he gained his knowledge of higher mathematics. In 1571 he returned to Scotland where he began to run his father's estates. He married in 1574, by which time he had built a castle. He approached agricultural problems in a scientific way, experimenting with soil fertilization.

Napier's study of mathematics, though, was just a hobby, and he found it difficult to make time for his calculations. Despite this, he invented logarithms; used Napier's bones* for mechanically multiplying, dividing and taking square and cube roots; found exponential expressions for trigonometric functions, and introduced the decimal notation for fractions!

He died in Edinburgh in April 1617.

Routes		**Standard**	**Academic**	**Express**
6.1	Multiplication of Whole Numbers	✓	✓	✓
6.2	Long Multiplication	✓	✓	✓
6.3	Multiplication with Decimals	(✓)	✓	✓
6.4	Problems Involving Multiplication	(✓)	✓	✓

(✓) *denotes extension work for these pupils*

Language				
•	multiplication	✓	✓	✓
•	Napier's method	✓	✓	✓
•	Russian multiplication	✓	✓	✓
•	Box method	✓	✓	✓

* The rods Napier produced were made of ivory, so they looked like bones – hence the name.

UNIT 6 Teaching Notes

Misconceptions

- 0.1×0.1 is often thought to be 0.1; this can readily be seen to be false, as $0.1 \times 10 \times 0.1 = 0.1$
- 2.3×10 is *not* 2.30 or 20.3

Challenging Questions

The following questions are more challenging than others in the same section:

	Section	*Question No.*	*Page*
Practice Book Y7A	6.2	3 (f)	94
	6.3	2 (e), (f), (j)	95
	6.3	3	96
	6.4	11, 14	97

UNIT 7 *Number Patterns and Sequences* Activities

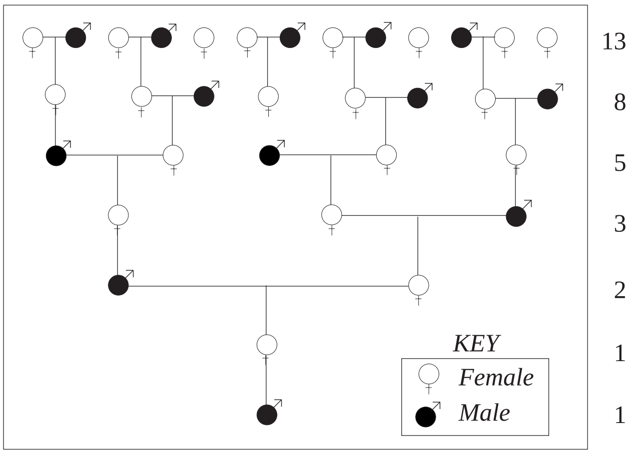
Activities

ACTIVITY 7.1 *Fibonacci's Sequence*

The Italian mathematician, *Leonardo de Pisano* (nicknamed *Fibonacci*) lived from about AD1170 to 1250. He devoted much of his time and effort to the study of the so-called *Fibonacci numbers*:

1, 1, 2, 3, 5, 8, 13, 21, 34, . . .

This sequence appears frequently in the natural world; for example, in the pattern of reproduction of bees (shown opposite), the arrangements of leaves on stems, petals on flowers and spirals on cones.



Pattern of bee reproduction

1. Write down the next seven numbers in the sequence.

2. Consider the first *four* numbers in the sequence

1, 1, 2, 3

Multiply the two outside numbers together and then multiply the two inside numbers together. What is the difference?

Repeat this procedure for any four consecutive numbers in Fibonacci's sequence.

What do you notice?

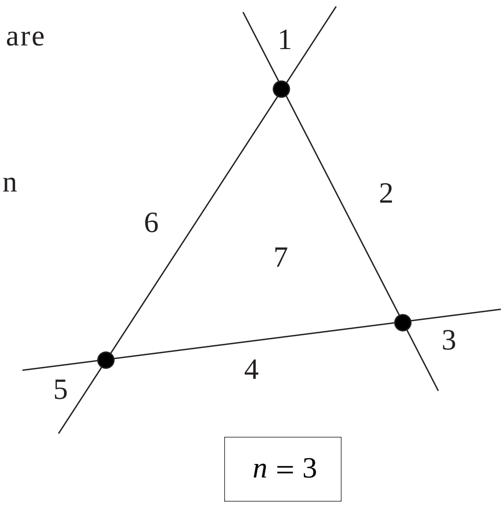
Extension
Use the same rule for generating the sequence, but start with

(a) 2, 5 (b) 1, 3.

In each case, find the next seven terms.

ACTIVITY 7.2 *Lines*

If three lines are arranged as in the diagram, there are seven regions formed, with three crossover points.



This investigation looks at the relationship between

- the number of lines, n

and the maximum number of

- crossover points
- regions.

1. Draw similar diagrams to find the maximum number of crossover points and regions for:

   (a) 2 lines (b) 4 lines (c) 5 lines.

2. Predict the result for:

   (a) 6 lines (b) 7 lines.

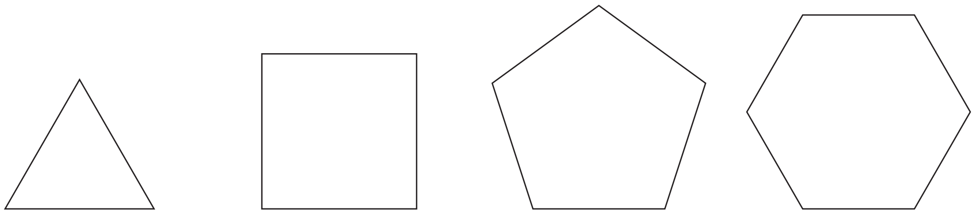
Extension

(a) Generalise your results and write down formulae for the maximum number of crossovers and regions.

(b) Use the formulae to predict the maximum number of crossover points and regions for:

   (i) 20 lines (ii) 100 lines.

ACTIVITY 7.3 *Regular Polygons*



$u_1 = 3$ $u_2 = 4$ $u_3 = 5$ $u_4 = 6$

Here is a sequence of regular polygons. Let u_n be the number of sides of the *n*th shape in the sequence. You can see that:

$$u_1 = 3, \quad u_2 = 4, \ \ldots$$

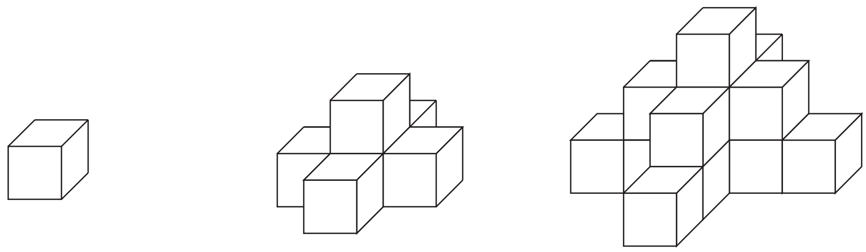
1. What is the value of u_5 and u_6?
2. What is the general formula for u_n? Check your answer for u_7.
3. How many diagonals can be drawn from a single vertex in each of the shapes above?
4. How many diagonals can be drawn from a vertex of the *n*th shape in the sequence?
5. How many diagonals in total can be drawn in each of the shapes above?

Extension

How many diagonals in total can be drawn in the *n*th shape?

ACTIVITY 7.4 *Towers*

We will investigate how many cubes are needed to build towers like these, where the 'towers' are amde up of a series of steps up to the pinnacle.



1 2 3

1. How many cubes are needed for each of the towers above?

2. For tower '3', how many cubes are needed for each layer?

3. For tower '4', how many cubes are needed for the bottom layer? How many are needed for the whole tower?

You can present the information and predict how many cubes are needed by taking first and second differences, as shown below. First copy the table; include your answers to questions 2 and 3 together with any other information this leads to.

Tower No.	*1*		*2*		*3*		*4*		*5*		*6*
No. of cubes needed	1		6		?		?		?		?
Ist difference		5		?		?		x		y	
2nd difference			4		4		4		4		

4. If the 2nd difference remains constant, what is the value of

   (a) x (b) y ?

5. Hence deduce the number of cubes neede for tower '5' and tower '6'.

Extension
How many cubes are needed for tower '10' ?

ACTIVITIES 7.1 - 7.4 *Notes and Solutions*

Notes and solutions are given only where appropriate.

7.1 1. 55, 89, 144, 233, 377, 610, 987

2. Differ by 1

Extension

(a) 2, 5, 7, 12, 19, 31, 50, 81, 131

(b) 1, 3, 4, 7, 11, 18, 29, 47, 76

7.2 1. (a) 1, 4 (b) 6, 11 (c) 10, 16

2. (a) 15, 22 (b) 21, 29

Extension

(a) $\frac{n(n-1)}{2}$, $\frac{n(n+1)}{2}+1$ (b) (i) 190, 211 (ii) 4950, 5051

7.3 1. 7, 8

2. $u_n = n + 2$

3. 0, 1, 2, 3

4. $n - 1$

5. 0, 2, 5, 9

Extension

$\frac{1}{2}(n-1)(n+2)$

7.4 1. 1, 6, 15

2. 1, 5, 9

3. 13, 28

4. (a) 17 (b) 21

5. 45, 66

6. 190

UNIT 7 *Number Patterns and Sequences* Lesson Plans **St**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Multiples**	
	Introduction	OS 7.1 / 7.2
	Exercises	PB 7.1, Q1
	Discuss solutions	
	Exercises	PB 7.1, Q2
	Discuss solutions	
	Set homework	PB 7.1, Q3 and Q9
2.	**Next Term of a Sequence**	
	Discuss homework	
	Finding the next term	OS 7.3
	Exercises	PB 7.2, Q1
	Discuss solutions	
	Exercises	PB 7.2, Q3
	Discuss solutions	
	Set homework	PB 7.2, Q3
3.	**Patterns**	
	Discuss homework	
	Introduction	OS 7.4
	Exercises	PB 7.2, Q4
	Discuss solutions	
	Set homework	Activity 7.1 or 7.2
4.	**Number Machines**	
	Discuss homework	
	Introduction	OS 7.6
	Exercises	PB 7.3, Q1
	Discuss solutions	
	Exercises	PB 7.3, Q2
	Discuss solutions	
	Mental Test	M 7.1
	Discuss answers	
	Set homework	PB 7.3, Q3

UNIT 7 *Number Patterns and Sequences* Lesson Plans **St**

Lesson No.	*Suggested Plan*	*References*
5.	**Revision Test and Review** Discuss homework Revision Test	 RT 7.1 (Standard)
6.	**Revision** Give back marked tests Go over test questions interactively Revise key topics	

UNIT 7 *Number Patterns and Sequences* Lesson Plans A

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Multiples**	
	Introduction	OS 7.1 / 7.2
	Exercises	PB 7.1, Q1
	Discuss solutions	
	Exercises	PB 7.1, Q2
	Discuss solutions	
	Set homework	PB 7.1, Q3 and Q9
2.	**Next Term of a Sequence**	
	Discuss homework	
	Finding the next term	OS 7.3
	Exercises	PB 7.2, Q1
	Discuss solutions	
	Exercises	PB 7.2, Q3
	Discuss solutions	
	Set homework	PB 7.2, Q3
3.	**Patterns**	
	Discuss homework	
	Introduction	OS 7.4
	Exercises	PB 7.2, Q4
	Discuss solutions	
	Set homework	Activity 7.1 or 7.2
4.	**Number Machines**	
	Discuss homework	
	Introduction	OS 7.6
	Exercises	PB 7.3, Q1
	Discuss solutions	
	Exercises	PB 7.3, Q2
	Discuss solutions	
	Mental Test	M 7.1
	Discuss answers	
	Set homework	PB 7.3, Q3

UNIT 7 *Number Patterns and Sequences* Lesson Plans **A**

Lesson No.	*Suggested Plan*	*References*
5.	**Generating Sequences**	
	Discuss homework	
	Introduction	OS 7.7
	Exercises	PB 7.3, Q6
	Discuss solutions	
	Mental Test	M 7.2
	Discuss answers	
	Set homework	PB 7.3, Q7 and Q11
6.	**General Terms**	
	Discuss homework	
	Introduction	OS 7.7 and 7.8
	Exercises	PB 7.4, Q2
	Discuss solutions	
	Exercises	PB 7.4, Q6
	Discuss solutions	
	Set homework	PB 7.4, Q7 or Activity 7.3 or Activity 7.4
7.	**Revision Test and Review**	
	Discuss homework	
	Revision Test	RT 7.2 (Academic)
8.	**Revision**	
	Give back marked tests	
	Go over test questions interactively	
	Revise key topics	

UNIT 7 *Number Patterns and Sequences* Lesson Plans **E**

These are based on 45/50 minute lessons.

Lesson No.	*Suggested Plan*	*References*
1.	**Multiples**	
	Introduction	OS 7.1 / 7.2
	Exercises	PB 7.1, Q1
	Discuss solutions	
	Exercises	PB 7.1, Q2
	Discuss solutions	
	Set homework	PB 7.1, Q3 and Q9
2.	**Next Term of a Sequence**	
	Discuss homework	
	Finding the next term	OS 7.3
	Interactive exercises	PB 7.2, Q1 and Q2
	Geometric problems	PB 7.2, Q4
	Review answers	
	Set homework	PB 7.2, Q6 and Q7
3.	**Number Machines**	
	Discuss homework	
	Introduction	OS 7.6
	Exercises	PB 7.3, Q1
	Discuss solutions	
	Exercises	PB 7.3, Q2
	Discuss solutions	
	Mental Test	M 7.1
	Discuss answers	
	Set homework	PB 7.3, Q3

UNIT 7 *Number Patterns and Sequences* Lesson Plans **E**

Lesson No.	*Suggested Plan*	*References*
4.	**Generating Sequences**	
	Discuss homework	
	Introduction	OS 7.7
	Exercises	PB 7.3, Q6
	Discuss solutions	
	Mental Test	M 7.2
	Discuss answers	
	Set homework	PB 7.3, Q7 and Q11
5.	**General Terms 1**	
	Discuss homework	
	Introduction	OS 7.8
	Exercises	PB 7.4, Q6
	Discuss solutions	
	Activity	Activity 7.3 or 7.4
	Set homework	PB 7.4, Q7
6.	**General Terms 2**	
	Discuss homework	
	More complex problems (interactively)	PB 7.4, Q9
	Mental Test	PB 7.2, Q1 and Q2
	Review answers	
	Set homework	PB 7.4, Q10
7.	**Revision Test and Review**	
	Discuss homework	
	Revision Test	RT 7.3 (Express)
8.	**Revision**	
	Give back marked tests	
	Go over test questions interactively	
	Revise key topics	

Y7	**UNIT 7** ***Number Patterns and Sequences*** Lesson Plan 1	*Multiples and Other Sequences*
Activity		***Notes***
1	**Revision** T: Let's see if you can remember how to multiply ... (a) 3×4, 7×9, 6×8, ... (b) 20×4, 5×30, 300×2, 7×1000, ... (c) 6×1, 6×2, 6×3, 6×4, 6×9, 6×30, 6×200 T: What can we say about all the products we get when we multiply by the number 6? *(They are all multiples of 6)* *5 mins*	Mental work to 'warm up'; everyone contributing. T asks, Ps answer, T praises.
2A	**Multiples of 5** **OS 7.1** T: Shade all the multiples of 5 on your sheet. T (after most Ps have finished): What is the first multiple? P (e.g.): 10 *(Wrong)* T: Who agrees? Who disagrees? T: Now answer the questions you see under the number grid.	Each P has a copy of OS 7.1. Individual work, T monitoring. After agreeing on the first multiple (5), T asks P to read out multiples of 5 up to 100. Agreement, feedback, self-correction. Praising. Whole class activity; quick questions with quick answers. T asks, P answers, other Ps agree or not. Praising.
2B	T: What are the differences between neighbouring multiples of 5? *(5)* How can you find the 201st multiple if you know the 200th one? $(+5)$ How can you find the 199th multiple if you know the 200th one? (-5) What is the 399th multiple of 5? $(5 \times 400 - 5 = 2000 - 5 = 1995)$ What are the differences between the neighbouring multiples of 6? *(6)* What is the 99th multiple of 6? $(6 \times 100 - 6 = 600 - 6 = 594)$ *15 mins*	Whole class activity; T should allow time for Ps to think and then volunteer answers. Ps answer and explain. Praising.
3A	**Using the number square** **PB 7.1, Q2**	Individual work, monitored, helped. Ps work in Ex.Bs. Checking: T asks, P answers and explains. Agreement, feedback, self-correction. Praising.
3B *(continued)*	**Introducing the use of letters for numbers** T: The nth multiple of 11 is 88. What is n ? *(8)* The kth multiple of 11 is 110. What is k ? *(10)* The mth multiple of 11 is 198. What is m ? *(18)* *23 mins*	Then T asks some extra questions to accustom Ps to using letters. For 3rd question, T can allow Ps to write in Ex.Bs, but can also ask if anyone can think of another method (leading to $n + k = m$ for stronger Ps).

Y7	UNIT 7 *Number Patterns and Sequences* Lesson Plan 1	*Multiples and Other Sequences*
Activity		***Notes***
4	**Number sequences - lowest common multiple** T: In the earlier part of the lesson we dealt with two sequences ... (writes on BB) 5, 10, 15, 20, ... 11, 22, 33, 44, ... T: What can we say about the terms of the first sequence? *(All multiples of 5)* T: And the terms of the second sequence? *(All multiples of 11)* T: What are the differences between neighbouring multiples of 5? *(5)* T: What are the differences between neighbouring multiples of 11? *(11)* T: Are there any terms that are common to both sequences? Let's put the two shaded number grids close to each other. *(55)* T: Are there any others? *(e.g. 110, 330)* T: Which term of the first sequence is the number 55? *(11th term)* T: Which term of the second sequence is the number 55 ? *(5th term)* T: What is the lowest common multiple of 5 and 11 ? *(55)* *30 mins*	Whole class activity. T asks, Ps answer, going over questions interactively, reinforcing Ps' understanding from the earlier part of the lesson. Explanation wherever necessary. Praising. T introduces the concept of 'lowest common multiple'.
5	**Further work with sequences** T: Let's look at this sequence ... (writes on BB): 2, 6, 10, 14, ... T: What do you notice? *(Differences of 4)* T: So how would you find the next term? What is it? *(+4, 18)* T: Who can give me the next three terms? *(22, 26, 30)* T: And what about the next three terms in the sequence 14, 11, 8, 5, ... ? (on BB) *(2, – 1, – 4)* *36 mins*	Whole class activity. T leads Ps to realise that the differences between neighbouring terms are the same for each pair of terms, and also that the terms of the sequence are not multiples of any number. Ps volunteer answers. Praising. Ps find the differences and then give the next three terms. Agreement. Praising.
6	**Constant differences** **OS 7.3 Q1, 2, 5, 6 and 7** For Q1 and Q2, T can ask Ps to describe the terms of the sequence. *(Q1: odd number; Q2: multiples of 3)* *41 mins*	Task appears on OHP. T asks Ps (encouraging slower ones at Q1, Q2, Q5) to come to OHP and write in answers, giving reasons. Others listen and agree or disagree, helping P at OHP. Praising.
7	**Practice at finding the next term** **PB 7.2, Q3 (a), (b), (f)** *45 mins*	Individual work. Checking at BB. Agreement, feedback, self-correction. Praising.
	Set homework **PB 7.1, Q3** **PB 7.1, Q4 (d), (e)** **PB 7.2, Q2 (c), (e)** **PB 7.2, Q3 (c), (e)**	

Y7	UNIT 7 *Number Patterns and Sequences* Lesson Plan 2	*Sequences and Patterns*
Activity		***Notes***
1	**Checking homework** **PB 7.1, Q3** **(a)** 8, 16, 24, 32, 40, 48, 56, 64 **(b)** 6, 12, 18, 24, 30, 36, 42, 48 **(c)** 24 (d) 48, 72 **PB 7.1, Q4 (d)** 6000 **(e)** $n = 4$ **PB 7.2, Q2 (c)** 26 **(e)** 21 **PB 7.2, Q3 (c)** 99, 116, 133 **(e)** 4.12, 4.26, 4.40 *4 mins*	T points to P to answer. Others agree or not. Praising. Self-correction.
2	**Mental work with sequences** T: What was the common property of the sequences we looked at in the last lesson? *(Neighbouring differences the same)* Right. Let's see if you can continue this sequence for three more terms: 1, 5, 9, 13, ... *(17, 21, 25)* T: Good. How did you find the terms? *(Differences between neighbouring terms are 4, so add 4 to previous term)* T: Fine. Let's see how you get on with these: (a) 6, 11, 16, 21, ... *(26, 31, 36)* (b) 18, 15, 12, 9, ... *(6, 3, 0)* (c) 0.2, 0.4, 0.6, 0.8, ... *(1.0, 1.2, 1.4)* (d) –13. –10, –7, – 4, ... *(–1. 2, 5)* (e) 5.9, 4.7, 3.5, 2.3, ... *(1.1, –0.1, –1.3)* 14 *mins*	Mental work. T says first four terms slowly; Ps think and then volunteer. T repeats terms, then asks a stronger P to give answer and explain so that slower Ps can listen to the reasoning (care with precise mathematical language). Slower Ps need to be encouraged to answer (a), (b) and (c). Stronger Ps calculate (d) and (e) in their heads, other Ps may write in Ex.Bs. Agreement. Praising.
3	**Sequences in context** T: We often meet sequences in real life, but may not think of them as sequences. The next term of a sequence is not always obvious. Let's look at an example. **OS 7.4 Flower Beds** T: e.g. Can you tell me how to extend the $n = 1$ flower bed to get the $n = 2$ one? Do we have to do the same for $n = 3$? ... for $n = 4$? What do you predict for $n = 5$? 22 *mins*	Start off with individual work, monitored, helped. Each P has a copy of OHP. T asks Ps to count the number of paving stones and write in the answers. Then interactive discussion led by T about how the number of paving stones increases, and why.
4A *(continued)*	**Drawing sequence patterns** **PB 7.2, Q4 (b)** T: e.g. How many more dots are in the second pattern than in the first? *(3)* So what is the difference between these two terms of the sequence? *(3)* How many more dots are in the third pattern than in the second? *(4)*	Whole class activity. T calls different Ps to draw patterns. Then T asks Ps questions. Praising.

Y7	UNIT 7 **Number Patterns and Sequences** Lesson Plan 2	*Sequences and Patterns*
Activity		***Notes***
4A *(continued)*	So what is the difference between these two terms of the sequence? *(4)* Is it the same difference as before? *(No, larger by 1)* Why? .... etc.	Praising. While the Ps draw the four patterns on BB they discuss the problem and work out the differences in increases. The next 2 Ps continue the sequence, at BB, and explain their answers. Praising.
4B	**PB 7.2, Q4 (d)** T: Is there anything distinctive about the numbers in this sequence? P: They're all square numbers. *34 mins*	Individual work, monitored, helped. Ps discuss their answers and explain sequence of differences. T explains why they are called 'square' numbers.
5A	**Practice with sequences** T: Let's look at these sequences. Work out the differences and then find the next three terms. (a) 4, 7, 11, 16, 22, ... *(29, 37, 46)* (b) 2, 4, 8, 14, 22, ... *(32, 44, 58)* (c) 7, 8, 10, 14, 22, ... *(38, 70, 134)* (d) 32, 31, 29, 26, 22, ... *(17, 11, 4)* (e) 18, 22, 20, 24, 22, ... *(26, 24, 28)*	Whole class activity. T writes sequences on BB, one at a time, and calls a P to BB to find the differences. Other Ps work in Ex.Bs. Ps decide on rule and another P writes the next three terms on BB. Agreement. Praising.
5B	T: Now let's see how you get on on your own: (f) 6, 7, 10, 15, 22, ... *(31, 42, 55)* (g) 82, 50, 34, 26, 22, ... *(20, 19, 18.5)* (h) 10, 12, 16, 18, 22, ... *(24, 28, 30)* (i) 22, 22, 22, 22, 22, ... *(22, 22, 22)* *45 mins*	Task appears on OHP or BB. Individual work, monitored, helped. Checking at BB; writing down differences, drawing up the rule, finding the next three terms. Agreement, feedback, self-correction. Praising.
	Set homework **PB 7.2, Q4, (a), (c)** **PB 7.2, Q6 (d), (e)** **PB 7.2, Q7 (a), (c)** T asks for volunteers (stronger Ps) to prepare a brief talk on Fibonacci (including the original problem leading to Fibonacci's Sequence) for the rest of the class, using notes from T (Historical Background in 'Teaching Notes') and any other sources.	

Y7	**UNIT 7** ***Number Patterns and Sequences*** Lesson Plan 3	*Number Machines*
Activity		***Notes***
1	**Checking homework** **PB 7.2, Q4 (a)** 30, 42, 56 **(c)** 17, 20, 23 **PB 7.2, Q6 (d)** 56, 72, 90 **(e)** 18, 24.5, 32 **PB 7.2, Q7 (a)** 8 **(c)** 14 *4 mins*	T has already asked one of Ps to write sequences with the differences and missing terms on BB. Then checking, discussion. Agreement, feedback, self-correction. Praising.
2	**Fibonacci's Sequence**	
2A	Short report from P(s) about Fibonacci, including interpretation of the problem which leads to the famous sequence.	
2B	Explanation of Fibonacci's Sequence.	Whole class activity. When Ps understand the problem, T leads then to write up the first seven terms of the sequence and draw up its rule.
2C	**Activity 7,1 Q1 and 2** *16 mins*	Individual work, monitored, helped. Then checking, discussion, agreement. Praising.
3	**Introducing number machines** **PB 7.3, Q1, Q2 and more** T: Do you know what 'fruit machines' are? Usually you put a coin into a slot, press a button, and nothing comes out! With our machines something always comes out! For example, this one always adds 2 to the number you put in. T: What number comes out if you put in the number 7? (9) T: You put in number 11? *(13)* T: 29? *(31)* T: OK. The next machine always subtracts 5. What comes out if you put in the number 8? *(3)* T: You put in the number 2? *(–3)* T: The next machine adds 1 to the number I put into it. What number did I put in if the number 6 came out? *(5)* ... etc. *26 mins*	Mental work with everyone contributing. (T can use more machines and/or more numbers.) T asks, points to a P, praises and continues.
4 *(continued)*	**Introducing letters** **PB 7.3, Q3 (a), (b)** Checking, T on BB: | 1 2 3 4 5 ... ... +1 → | T: 1 P: 1 + 1 = 2 (T writes) T: 2 P: 2 + 1 = 3 (T writes) .... T: 5 P: 5 + 1 = 6 (T writes) T: (Draws in the first row of the table): ▲ P: ▲ + 1	Individual work, monitored, helped. Checking at BB. T draws a table on BB, asks one P to answer and fills in the table. Ps realise the necessity of using letters.

Y7	**UNIT 7** ***Number Patterns and Sequences*** Lesson Plan 3	*Number Machines*
Activity		***Notes***
4 *(continued)*	T: (Writes in next column): a P: $a+1$ T: b P: $b+1$ T: n P: $n+1$ T: Right. When we describe what this machine does we'll use a letter, for example, the letter *n*. So the rule for this machine is: 'You put n in and $n+1$ comes out'. We can write this as, $n \rightarrow n+1$. (Continue in the same way with part (b): $n \rightarrow n \times 2$ or $2n$.) *34 mins*	
5A	**More practice** **PB 7.3, Q5 (a), (c)**	Whole class activity. After Ps have decided on the rule T encourages them to write it using letters.
5B	**PB 7.3, Q5 (d)** *41 mins*	Individual work. Checking aloud. Agreement, feedback, self-correction. Praising.
6	**Double machines** T: Finally, let me introduce the very top technology: Ladies and Gentlemen ... (sketches a double machine on BB, e.g. $\times 2$; $+3$) ..... the DOUBLE MACHINE! Let's draw a machine and find out what we get when we put 1, 2, 3, 4, 5, ... into it. *45 mins*	Whole class activity. Ps work in Ex.Bs. T calls Ps (volunteers) to fill in gaps of the second row. Agreement. Praising.
	Set homework (1) **PB 7.3, Q3 (c)** (2) **PB 7.3, Q5 (b)** (3) Write down the rule for each of the previous machines, using letters. (4) We have a double machine which does $+3$; $\times 2$. Do we get the same numbers as before when we put the numbers 1, 2, 3, 4, 5, ... into it?	

Y7 UNIT 7 *Number Patterns and Sequences* Lesson Plan 4 *Generating Sequences*

Activity | *Notes*

1

Mental work

T: Let's see how much you have forgotten in (4) days.

M 7.1 with 'say' instead of 'find out' or 'write down'.

Notes: Mental work reinforcing topics covered previously. T asks Ps (particularly slower ones) for answers.

10 mins

2

Checking homework

(1) **PB 7.3, Q3 (c)** 3, 4, 5, 6, 7, ...

(2) **PB 7.3, Q5 (b)** $\times 10$

(3) Writing down the rule for the two previous machines, using letters. $n+2$; $10n$

(4) Putting the numbers 1, 2, 3, 4, 5, ... into the $+3$; $\times 2$ double machine. 8, 10, 12, 14, 16

Notes: Verbal checking of (1) and (2), then the rules $n \rightarrow n+2$ and $n \rightarrow 10n$ are written on BB by Ps; from now on these are referred to as 'formulae'.

Agreement, praising.

T now draws two tables; fills first on with data of $\times 2$; $+3$ double machine. Then T asks a P to fill the other with data from $+3$; $\times 2$ double machine.

Agreement, comparing. Praising.

16 mins

3A

Formulae for double machines

T: Who can give me the formulae for the previous double machines?

Notes: Whole class activity.

The $n \times 2 + 3$ $(\text{or } 2n+3)$ formula is straightforward, but with $(n+3) \times 2$, Ps might forget the order when brackets are present. If so, T has to point out misconception and remind Ps of BODMAS.

3B

PB 7.3, Q11 (b) (i) *(1, 3, 5, 7, 9)*

PB 7.3, Q11 (b) (ii) *(7, 11, 15, 19, 23)*

Notes: Individual work.

Checking at BB. T encourages Ps to use the wording 'formula of the sequence' instead of 'formula of the machine'.

Agreement, feedback, self-correction. Praising.

24 mins

4

Generating sequences

PB 7.3, Q6 (a), (b), (e)

PB 7.3, Q7 (e)

T: Let's see what sequences are generated by these formulae. Write the terms in a table and compare them to find any sequence there might be.

n	1	2	3	4	5
$3n$	3	6	9	...	
$3n+1$	...				
$3n-2$	...				
$5n-2$	...				

T: Can anyone tell us the properties of the $3n$ sequence?

(They are multiples of 3)

Notes: Whole class activity.

T calls Ps to BB to write down the first 5 terms of the sequences. Ps work in Ex.Bs. Then T asks questions to help Ps recognise common properties of some sequences.

(continued)

Y7	UNIT 7 *Number Patterns and Sequences*	Lesson Plan 4	*Generating Sequences*

Activity		***Notes***
4 *(continued)*	T: What about $3n + 1$ **?** *(The numbers are larger by 1 than the multiples of 3)* T: And $3n - 2$? *(Smaller by 2 than the multiples of 3)* T: And $5n - 2$? *(Smaller by 2 than the multiples of 5)* T: Are you sure? What are the multiples of 5? *(5, 10, 15, 20, 25, ...)* T: OK, you're right. Is there any relationship between the first three sequences? Look at their differences. T: What do you think are the differences for the sequence $9n - 3$ $6n + 1$ $11n - 2$? Why? *32 mins*	When Ps have understood the relationship (the multiple of n is the difference), T encourages them to explain it. Then T gets Ps to explain the difference 5 for the sequence $5n - 2$, and goes on to ask further questions. Agreement. Praising.
5	**Further work with sequences** T: Look at these sequences: $4n + 3$ $7n - 2$ (a) Write down what you think the differences will be for each sequence. *(4, 7)* (b) Write down the first five terms for each sequence. *(7, 11, 15, 19, 23) (5, 12, 19, 26, 33)* (c) Write down the 10th term of each sequence. *(43; 68)* *39 mins*	Individual work, monitored, helped. Task appears on OHP or BB, Ps work in Ex.Bs. Checking at OHP or BB. Discussion, agreement, feedback, self-correction. Praising.
6	**Finding formulae** **PB 7.3, Q12 (a), (b)** T: Write down the differences under each pair of terms. Do they change? *(No)* What is the difference? *(4)* What can you say about the differences? *(Multiples of 4)* Is this the sequence $4n$? *(No)* What would that sequence be? *(4, 8, 12, ...)* How is that difference from this sequence? *(These terms are larger by 1 than the multiples of 4)* So what's the formula? *($4n + 1$)* Let's check this for ourselves: what does $4n + 1$ give if $n = 1$? *(5)* What is the 5th term of the formula $4n + 1$? *(21)* T: Now let's look at the second sequence. *($3n - 1$)* *45 mins*	Whole class activity. T reminds Ps what they have previously learned about differences, and leads them to find the formulae. Praising. T chooses a stronger volunteer P to find this formula and check it in the same way. Agreement. Praising.
	Set homework **PB 7.3, Q11 (b) (iii)** **PB 7.3, Q7 (d)** **PB 7.3, Q8 (a), (d)** **PB 7.3, Q12 (c)**	

Y7	UNIT 7 *Number Patterns and Sequences* Lesson Plan 5	*Formulae for General Terms*
Activity 1	**Checking homework** **PB 7.3, Q11 (b) (iii)** 3, 8, 13, 18, 23 **PB 7.3, Q7 (d)** 5, 8, 11, 14, 17 **PB 7.3, Q8 (a)** 21 **(d)** 34 **PB 7.3, Q12 (c)** $5n+1$ *8 mins*	***Notes*** Checking interactively, with Ps repeating aloud the points they have covered in the previous two lessons *(operation of number machines, how to generate number sequences, prediction of differences of a sequence given its linear formula, finding the (e.g. 8th) term of a sequence if its formula is known).* T asks, Ps answer. The final question might cause problems for some Ps, so it is important that it is checked thoroughly, before going on to similar tasks in this lesson.
2 2A 2B	**Determining the formula for general terms of sequence** Look at this sequence (on BB): $\boxed{2,\ 6,\ 10,\ 14,\ 18,\ \ldots}$ What is its formula? *(* $4n-2$ *)* Now try one on your own. Write down the formula of the sequence (on BB): $\boxed{7,\ 13,\ 19,\ 25,\ 30,\ \ldots}$ *(* $6n+1$ *)* *16 mins*	After detailed discussion of Q12 (c), a slower P should be asked to come to BB and find this formula. T may give help. Individual work, monitored, helped. Checking at BB with a slower P. Agreement, feedback, self-correction. Praising.
3A 3B	**Second method** T: Now we are going to learn another method for finding the formula for the *n*th term of sequences which have the same differences between each term. T: Let's look at the first sequence we used just now. How do you get the second term from the first one? *(By adding 4 to it)* How do you get the third term from the second? *(By adding 4 to it)* ... the third from the first? *(By adding* 4×2 *to it)* ... the fourth from the first? *(By adding* 4×3 *to it)* ... the 11th from the first? *(By adding* 4×10 *to it)* What is the 101st term of this sequence? *(* $2+4\times 100=402$ *)* What is the formula of the *n*th term? *(* $2+4\times(n-1)$ *)* Do you think this is the same as we wrote down earlier? Who would like to prove it? T: Now we'll look at the other sequence we used earlier in the lesson. What are its differences? *(6)* What is the first term? *(7)* How do we get the 58th term? *(* $7+6\times 57$ *)* How do we get the *n*th term? *(* $7+6\times(n-1)$ *)* Is it the same as we got there? *(* $7+6\times(n-1)=7+6n-6=6n+1$ *)* *26 mins*	Whole class activity. T guides Ps interactively to find the 'new' method for writing down the formula. T asks, Ps think, volunteer, answer. Maybe a stronger P will volunteer to come to BB and write $2+4\times(n-1)=2+4n-4=4n-2$ T encourages some slower Ps to answer wherever possible. Praising.

Y7	UNIT 7 *Number Patterns and Sequences* Lesson Plan 5	*Formulae for General Terms*
Activity		***Notes***
4A	**Further practice** **PB 7.4, Q3 (b)** T: Who'd like to use the 'old' method? Who would choose the 'new' one?	T chooses two Ps who will write down the *n*th term in different ways; T divides BB into two parts for Ps to work. Others work in Ex.Bs, using either method, and listen to Ps at BB explaining.
	T: Before you start, make sure that the differences between each term are the same.	When Ps have written down the formulae $6n - 1$ and $5 + 6 \times (n-1)$, T asks Ps questions to show that they give the same sequence.
	T (to both Ps): Using your own formula: (a) write down the 8th term, *(47)* (b) write down the 100th term, *(599)* (c) write down the 1001st term. *(6000)*	Praising.
4B	T: Now everyone can do the next problem using the 'new' method. **PB 7.4, Q3 (e)** $(6 + 4(n-1))$	Individual work, monitored, helped. Checking: T writes formula on BB. Feedback, self-correction. Praising.
	36 mins	
5	**Problems in context** T: (1) In an open-air theatre, there are 22 seats in the first row of the trapezoid shaped auditorium. Each row contains more by 2 than the previous one. How many seats are there in (a) the 16th row, (b) the *n*th row?	Individual work. Tasks appear on OHP. T monitors Ps' work and helps slower ones, mainly to decode the texts.
	(2) Sue is knitting a scarf. On the first day she knits 10 cm. Each day she knits more by 10 cm than on the previous day. How many days does it take her to knit a scarf 1 m long?	Checking, explaining, agreement. T reminds Ps to answer in whole sentences. Feedback, self-correction. Praising. For (2), T must dispel misconception leading to answer of 10 days.
	45 mins	
	Set homework **(1) M 7.2** **(2) PB 7.4, Q7 (b), (d)**	Each P is given a copy of M 7.2.

UNIT 7 Number Patterns and Sequences Mental Tests

M 7.1 Standard Route *(no calculator)*

1. Write down the first 4 multiples of 3. (3, 6, 9, 12)
2. Write down the first 4 multiples of 5. (5, 10, 15, 20)
3. Write down the next 2 numbers in each sequence:
   (a) 2, 4, 6, 8, 10, . . . (12, 14)
   (b) 4, 8, 12, 16, 20, . . . (24, 28)
   (c) 3, 5, 7, 9, 11, . . . (13, 15)
   (d) 4, 6, 8, 10, 12, . . . (14, 16)
   (e) 10, 9, 8, 7, 6, . . . (5, 4)
   (f) 100, 101, 102, 103, 104, . . . (105, 106)
4. What is the 100th multiple of 7? (700)
5. What is the 4th multiple of 8? (32)

M 7.2 Academic Route *(no calculator)*

1. Write down the first 5 multiples of 6. (6, 12, 18, 24, 30)
2. Write down the first 5 multiples of 9. (9, 18, 27, 36, 45)
3. What is the 6th multiple of 8? (48)
4. Write down the next 2 terms in these sequences:
   (a) 4, 8, 12, 16, 20, . . . (24, 28)
   (b) 20, 18, 16, 14, 12, . . . (10, 8)
   (c) 100, 102, 104, 106, 108, . . . (110, 112)
   (d) 7, 11, 15, 19, 23, . . . (27, 31)
   (e) 5, 11, 17, 23, 29, . . . (35, 41)
5. Write down the first 4 terms in the sequences given by the *n*th term formulae:
   (a) $4n$ (4, 8, 12, 16)
   (b) $2n+1$ (3, 5, 7, 9)

UNIT 7 Number Patterns and Sequences Mental Tests

M 7.3 Express Route *(no calculator)*

1. Write down the first 6 multiples of 9. (9, 18, 27, 36, 45, 54)

2. What is the 4th multiple of 21? (84)

3. Write down the next 2 terms in these sequences:

   (a) 5, 11, 17, 23, 29, . . . (35, 41)

   (b) 8, 6, 4, 2, 0, . . . (-2, -4)

   (c) 21, 32, 43, 54, 65, . . . (76, 87)

   (d) 1, 8, 15, 22, 29, . . . (36, 43)

4. Write down the first 4 terms in the sequences given by these *n*th term formulae:

   (a) $4n$ (4, 8, 12, 16)

   (b) $2n+1$ (3, 5, 7, 9)

   (c) $5n-3$ (2, 7, 12, 17)

5. Write down the *n*th term formula for this sequence:

   7, 14, 21, 28, 35, . . . ($7n$)

UNIT 7 *Number Patterns and Sequences* Teaching Notes

Historical Background and Introduction

The history behind this topic is, at best, difficult to find. As we will see, this is a unit of work very much dedicated to the ideas and concepts of numerical methods, rather than to analytical approaches. There is little classical historical background other than the well-known Fibonacci sequence.

Fibonacci is the nickname of *Leonardo Pisano,* (1170-1250), who was born in the Italian town of Pisa (famous for its leaning tower). He travelled extensively, and, as a direct result of that, became familiar with the Hindu-Arabic number system based on the numerals 1 to 9 and zero. It was this system which he made known in Europe through his book *Liber Abaci* (The Book of Calculating), which he finished writing in 1202.

It was in this same book that he introduced the following problem:

> "*A man put a pair of rabbits in a place surrounded by a wall. How many pairs of rabbits can be produced from that pair in a year if it is supposed that every month each pair begets a new pair which from the second month on becomes productive?*"

This leads to the now famous sequence:

$$1,\ 1,\ 2,\ 3,\ 5,\ 8,\ 13,\ 21,\ 34,\ 55,\ \ldots$$

though it was not named as the Fibonacci sequence until 500 years later.

There is an excellent website devoted to this sequence and all the mathematics surrounding it, to be found at:

http://www/ee.Surrey.ac.uk/Personal/R.Knott/Fibonacci/Fib.html

Some maths educationalists would regard 'pattern spotting' as a fundamental part of mathematics, but there are real dangers and pitfalls with this philosophy. For example, take the sequence

$$5,\ 10,\ 15,\ \ldots,\ \ldots$$

Almost everyone, when asked for the next few numbers in the sequence, would opt for 20, 25, 30, ...

on the ground that there is a common difference of 5 between each term. Yes, there is a common difference of 5 between each of the terms stated, but how do we know that this will continue?

Take, for example, the sequence defined by

$$u_n = n^3 - 6n^2 + 16n - 6, \quad n = 1,\ 2,\ 3,\ 4,\ \ldots$$

$$u_1 = 1 - 6 + 16 - 6 = 5$$

$$u_2 = 8 - 24 + 32 - 6 = 10$$

$$u_3 = 27 - 54 + 48 - 6 = 15$$

$$u_4 = 64 - 96 + 64 - 6 = 26$$

and not 20 (!) So the answer 26, 49, 90, . . . is also an acceptable one. The lesson here us that you need to *justify* the answer given. In other words, no one (except the originator of the question) can know what the next four terms of that sequence are; so, for any answer, even with the simplest of constant differences, you need to state the assumption that you have made.

This really is a crucial point, and although it may be at this stage lost on most of your pupils, you need to get them into the habit of justifying the answers given, i.e. don't just ask for the next four terms of a sequence, but ask for *the reason WHY*?

UNIT 7 Teaching Notes

Routes		Standard	Academic	Express
7.1	Multiple	✓	✓	✓
7.2	Finding the Next Term	✓	✓	✓
7.3	Generating Number Sequences	(✓)	✓	✓
7.4	Formulae for General Terms	(✓)	✓	✓
Language				
•	multiple	✓	✓	✓
•	sequence	✓	✓	✓
•	difference	✓	✓	✓
•	general term	(✓)	✓	✓
•	number machine	(✓)	✓	✓
•	*n*th term	×	(✓)	✓

(✓) *denotes extension work for these pupils*

Misconceptions

There are many other sequences apart from one that have constant differences,

e.g. $2, 4, 8, 16, 32, \ldots, 2^n, \ldots$

$1, 1, 2, 3, 5, 8, 13, \ldots,$ (Fibonacci)

$1, 4, 9, 16, 25, \ldots, n^2. \ldots$

$1, 8, 27, 64, 125, \ldots, n^3, \ldots$

Challenging Questions

The following questions are more challenging than others in the same section:

	Section	*Question No.*	*Page*
Practice Book Y7A	7.1	9	102
	7.1	10, 11, 12	103
	7.2	6, 7, 8	106
	7.4	9	114
	7.4	10	115

UNITS 1-5 **Diagnostic Test A** (Standard)

You have ONE HOUR to complete this test.
You are not allowed to use a calculator.

1. Rachel, Marcus and Matthew travel to school by car, bicycle or bus. Each one of them uses a different method of transport. Use the clues with the logic table below to find how each travels to school.

   Clue 1 : Rachel does not travel by bus.

   Clue 2 : Marcus does not travel by car or by bus.

	Car	*Bicycle*	*Bus*
Rachel			
Marcus			
Matthew			

Complete these statements:

Rachel travels to school by

Marcus travels to school by

Matthew travels to school by

(5 marks)

2. This table gives information about the favourite sports of pupils in a Year 7 class.

	Favourite Sport		
	Football	*Athletics*	*Other*
Boys	10	4	1
Girls	5	4	7

Answer these questions:

(a) How many boys chose *Athletics*?

(b) What was the most popular sport with the boys?

(c) How many girls are in the class?

(d) How many pupils are in the class?

(5 marks)

UNITS 1-5

Diagnostic Test A (Standard)

3. Write:

   (a) 958 to the nearest 10 [ ], and to the nearest 100 [ ],

   (b) 145 to the nearest 10 [ ], and to the nearest 100 [ ].

(4 marks)

4. Write these numbers, correct to 1 decimal place:

   (a) 0.52 [ ]

   (b) 0.86 [ ]

(2 marks)

5. Write these numbers as figures:

   (a) four hundred and sixty two, [ ]

   (b) three hundred and seven. [ ]

(2 marks)

6. What does the '6' represent in the number 562 ? [ ]

(1 mark)

7. Write these numbers in order, with the smallest first:

   424, 391, 89, 409 [ ]

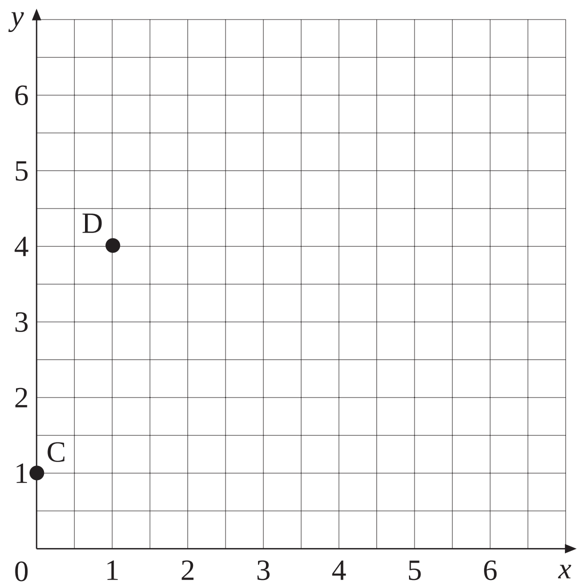
(1 mark)

UNITS 1-5

Diagnostic Test A (Standard)

8. (a) On the coordinate grid below, mark the points

A (4, 3) and B (3, 0)



(b) What are the coordinates of the points:

(i) C , (,) (ii) D ? (,)

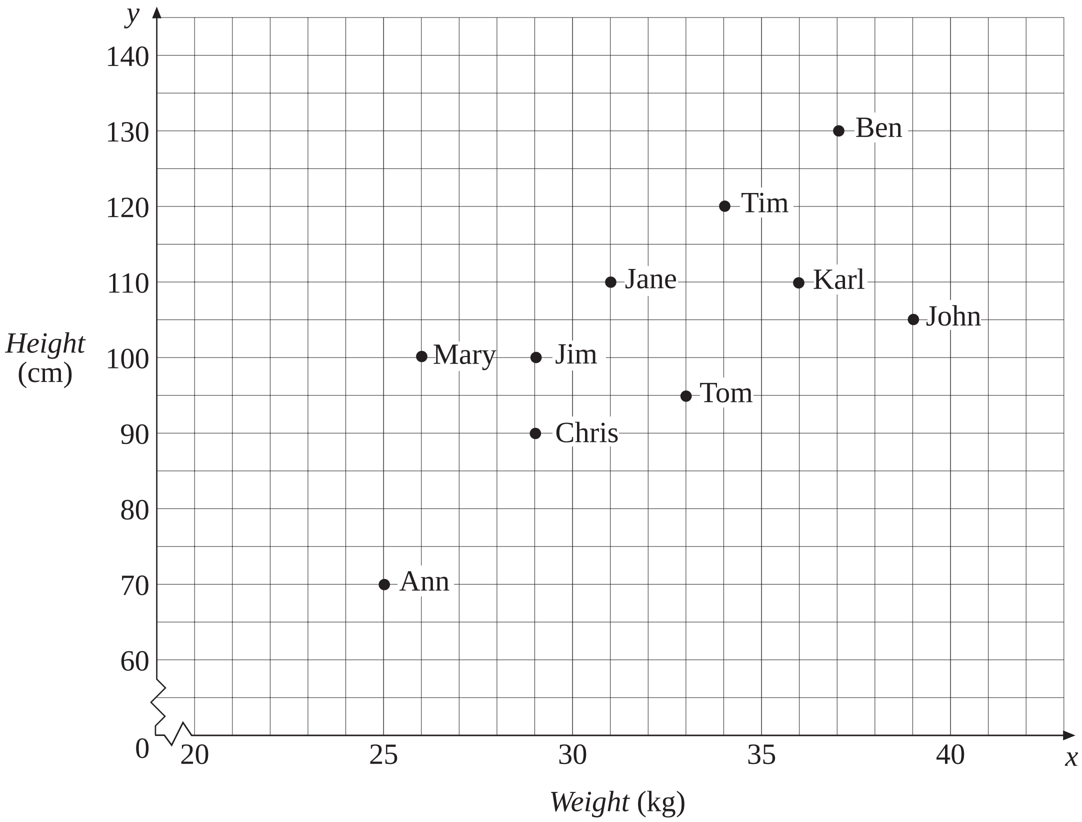
(c) What name is given to the shape ABCD ?

(5 marks)

UNITS 1-5

Diagnostic Test A (Standard)

9. The scatter graph below shows the heights and weights of some children.



(a) What height is Tim?

(b) What is Chris's weight?

(c) Who is the same height as Jane?

(d) Who is the tallest of these children?

(e) Who is the heaviest of these children?

(5 marks)

UNITS 1-5

Diagnostic Test A (Standard)

10. Calculate:

(a) $19 + 17 =$ ☐

(b) $27 + 125 =$ ☐

(c) $76 - 28 =$ ☐

(d) $241 - 167 =$ ☐

(4 marks)

11. There were 224 cars in a car park. During the next hour, 47 cars arrived and 81 cars left.

How many cars are now in the car park? ☐ *(2 marks)*

12. Calculate:

(a) $0.3 + 0.4 =$ ☐

(b) $1.4 + 2.7 =$ ☐

(c) $0.8 - 0.2 =$ ☐

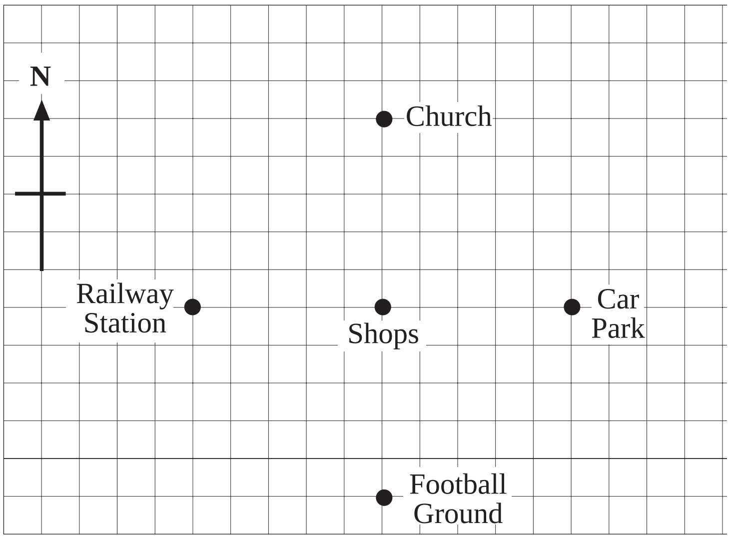
(d) $4.5 - 2.8 =$ ☐

(4 marks)

UNITS 1-5

Diagnostic Test A (Standard)

13. The diagram shows some landmarks.



Answer the following questions to do with the directions of the landmarks.

(a) What is *north* of the *shops*?

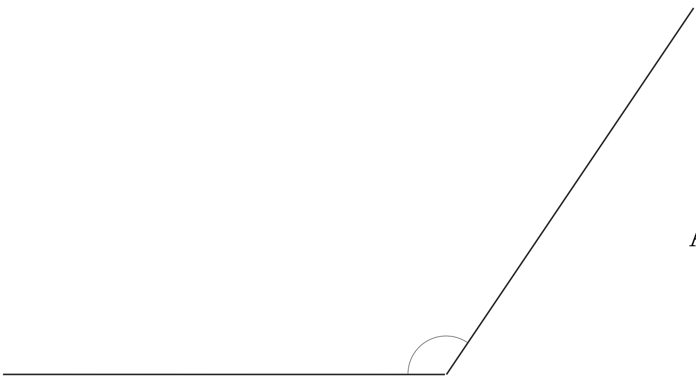
(b) What is *west* of the *shops*?

(c) The *car park* is ______ of the *shops*.

(d) The *football ground* is ______ of the *railway station.*

(4 marks)

14. (a) Measure the angle shown.



Angle = ______ °

(b) Is the angle *acute, obtuse* or *reflex* ?

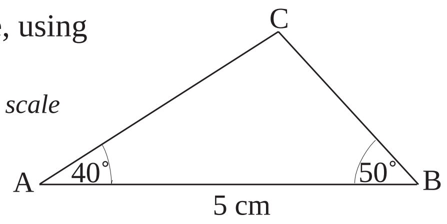
(2 marks)

UNITS 1-5

Diagnostic Test A (Standard)

15. (a) *Construct* (full size) the triangle shown opposite, using the space below.

Not to scale



Measure:

(b) the length AC,

(c) the angle C. °

(4 marks)

UNITS 1-5 **Diagnostic Test A** (Standard)

Marks

Unit	1	2	3	4	5	*Final total*
Question	1 - 2	3 - 7	8 - 9	10 - 12	13 - 15	
Totals						

Each unit has a total of 10 marks available.

UNITS 1-5 Diagnostic Test A (Standard) Answers

1.

	Car	*Bicycle*	*Bus*
Rachel	✓	×	×
Marcus	×	✓	×
Matthew	×	×	✓

B2

Car, Bicycle, Bus — B1 B1 B1 *(5 marks)*

2. (a) 4 (b) Football (c) 16 (d) $16 + 15 = 31$ — B1 B1 B1, M1 A1 *(5 marks)*

3. (a) 950, 1000 — B1 B1
   (b) 150, 100 — B1 B1 *(4 marks)*

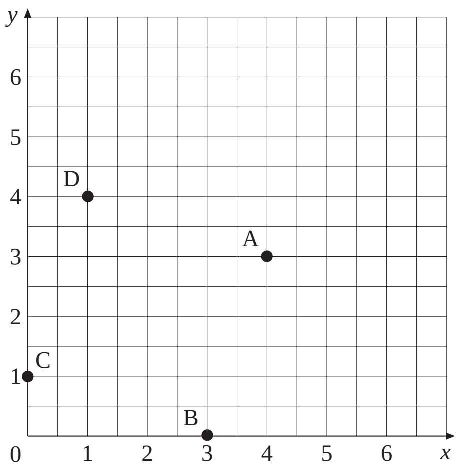
4. (a) 0.5 (b) 0.9 — B1 B1 *(2 marks)*

5. (a) 462 (b) 307 — B1 B1 *(2 marks)*

6. 60 or 6 tens — B1 *(1 mark)*

7. 89, 391, 409, 424 — B1 *(1 mark)*

8.



(a) Part A — B1
Part B — B1

(b) C (0, 1) — B1
D (1, 4) — B1

(c) square — B1 *(5 marks)*

9. (a) 120 cm — B1
   (b) 29 kg — B1
   (c) Karl — B1
   (d) Ben — B1
   (d) John — B1 *(5 marks)*

UNITS 1-5 Diagnostic Test A (Standard) Answers

10. (a) 36 (b) 152 (c) 48 (d) 74	B1 B1 B1 B1	*(4 marks)*
11. $224 + 47 - 81 = 190$	M1 A1	*(2 marks)*
12. (a) 0.7 (b) 4.1 (c) 0.6 (d) 1.7	B1 B1 B1 B1	*(4 marks)*
13. (a) Church	B1	
(b) Railway Station	B1	
(c) East	B1	
(c) South East (SE)	B1	*(4 marks)*
14. (a) $124°$ (b) obtuse	B1 B1	*(2 marks)*
15. (a) Construction	B2	
(b) 3.8 cm (allow 3.7 to 3.9)	B1	
(c) $90°$ (allow $88°$ to $92°$)	B1	*(4 marks)*

(TOTAL MARKS 50)

Assessment

45 +	Excellent – should be on *Academic Route*
40 - 45	Very good progress
30 - 40	Good progress: look carefully at mistakes
20 - 30	Steady progress, but you will need to work more carefully and/or make more effort
20 -	Struggling, so look carefully at your weak points to see where to target extra work

UNITS 1-5 **Diagnostic Test A** (Academic)

You have ONE HOUR to complete this test.
You are not allowed to use a calculator.

1. Rachel, Marcus and Matthew travel to school by car, bicycle or bus. Each one of them uses a different method of transport. Use the clues with the logic table below to find how each travels to school.

   Clue 1 : Rachel does not travel by bus.

   Clue 2 : Marcus does not travel by car or by bus.

	Car	*Bicycle*	*Bus*
Rachel			
Marcus			
Matthew			

   Complete these statements:

   Rachel travels to school by

   Marcus travels to school by

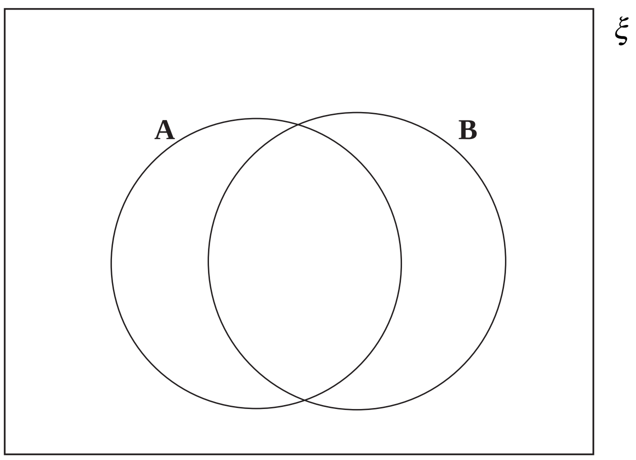
   Matthew travels to school by

(5 marks)

2. The sets A and B are given by:

$$A = \{ 1, 2, 3, 5, 7 \}$$
$$B = \{ 1, 3, 5, 7, 9 \}$$

   Put all the whole numbers from 1 to 9 inclusive in the appropriate places on the Venn diagram below:



UNITS 1-5

Diagnostic Test A (Academic)

Now answer these questions:

(a) what is in the intersection of A and B, { }

(b) what is not in either A or B? { }

(5 marks)

3. Write 958,

(a) to the nearest 10,

(b) to the nearest 100.

(2 marks)

4. What does the '6' represent in the number 562 ?

(1 mark)

5. Write 0.547 correct to

(a) 2 decimal places,

(b) 1 decimal place.

(2 marks)

6. Write these numbers in order, with the smallest first:

(a) 424, 391, 89, 409

(b) 0.48, 0.409, 0.41, 0.499, 0.437

(2 marks)

7. A number is given as 6300, correct to the nearest 100.

What is the *smallest* possible value of the actual number?

(2 marks)

UNITS 1-5

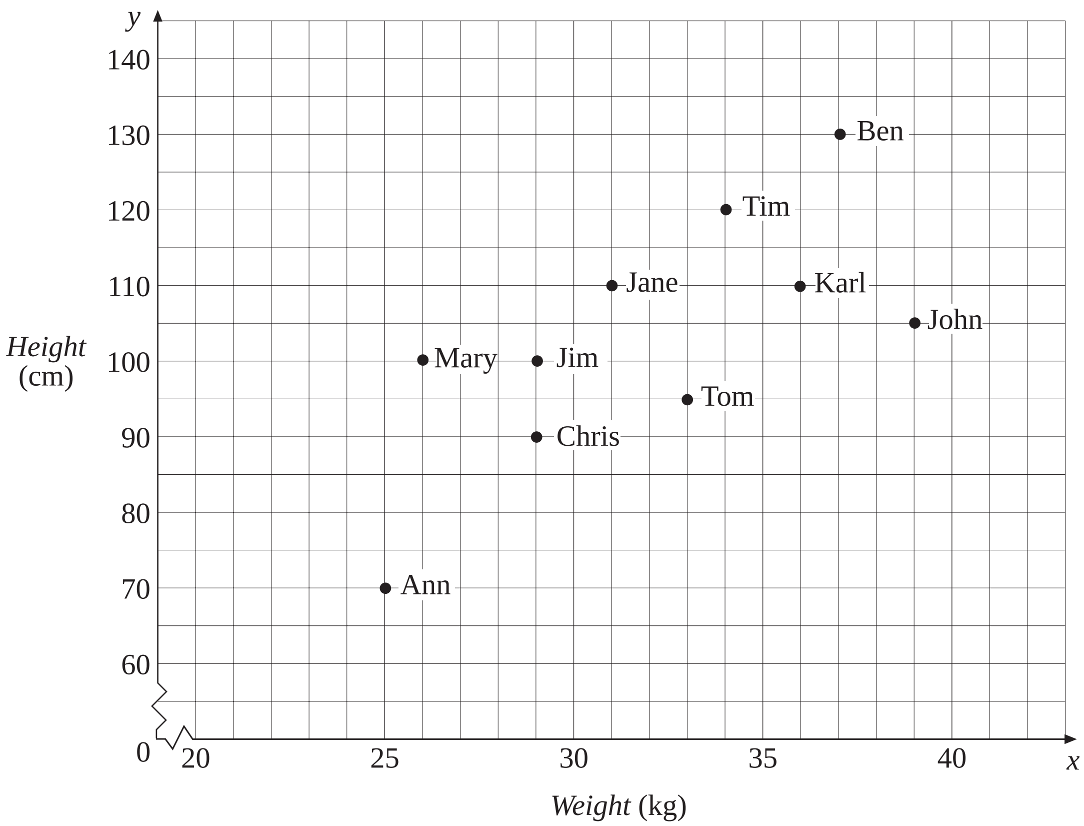
Diagnostic Test A (Academic)

8. Is the statement below *true* or *false*?

$0.209 > 0.21$

(1 mark)

9. The scatter graph below shows the heights and weights of some children.



(a) What height is Tim?

(b) What is Chris's weight?

(c) Who is the same height as Jane?

(d) Who is the tallest of these children?

(e) Who is the heaviest of these children?

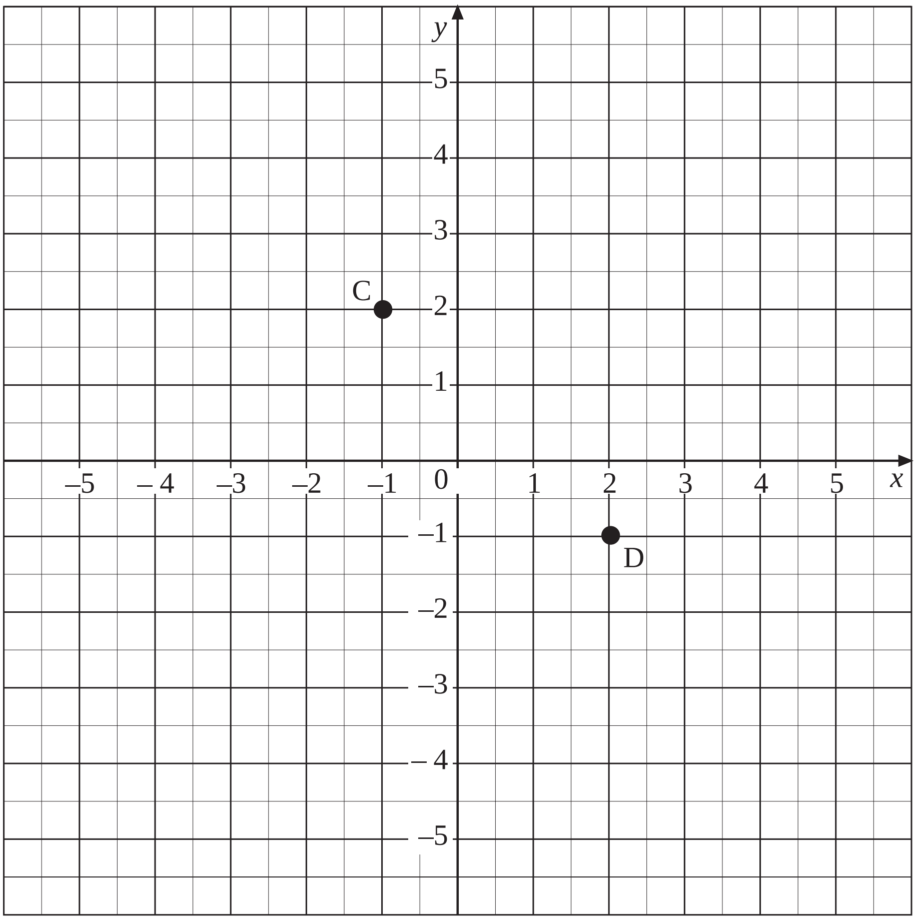
(5 marks)

UNITS 1-5

Diagnostic Test A (Academic)

10. (a) On the coordinate grid below, mark the points

A (– 1, – 4) and B (– 4, – 1)



(b) What are the coordinates of the points:

(i) C, (,) (ii) D ? (,)

(c) What is the name given to the shape ABCD ?

(5 marks)

11. Calculate:

(a) 27 + 125 =

(b) 241 – 167 =

(2 marks)

UNITS 1-5

Diagnostic Test A (Academic)

12. There were 224 cars in a car park. During the next hour, 47 cars arrived and 81 cars left.

    How many cars are now in the car park? [ ]

    (2 marks)

13. Calculate:

    (a) $1.4 + 2.7 =$ [ ]

    (b) $4.5 - 2.8 =$ [ ]

    (c) $3.56 + 2.69 =$ [ ]

    (d) $7.52 - 3.68 =$ [ ]

    (4 marks)

14. Jane bought two magazines, one costing £3.75 and the other costing £1.49.

    (a) What was the total cost? [ ]

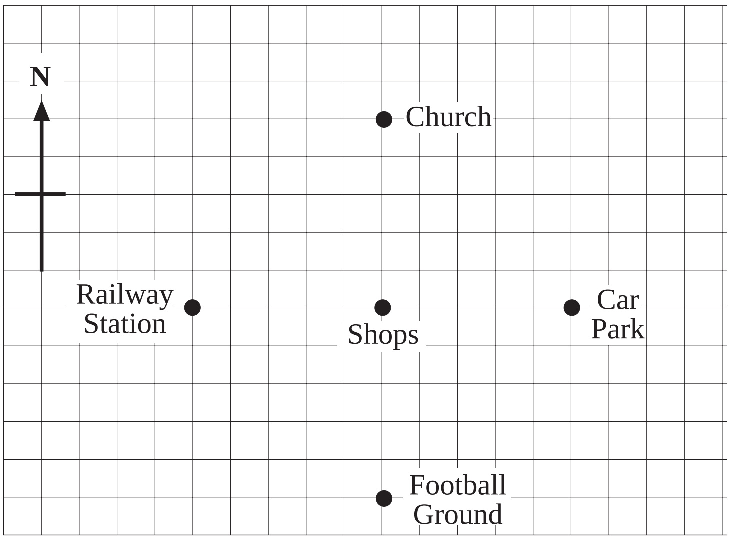
    (b) What change did she get from a £10 note? [ ]

    (2 marks)

UNITS 1-5

Diagnostic Test A (Academic)

15. The diagram shows some landmarks.



Answer the following questions to do with the landmarks and their directions relative to each other.

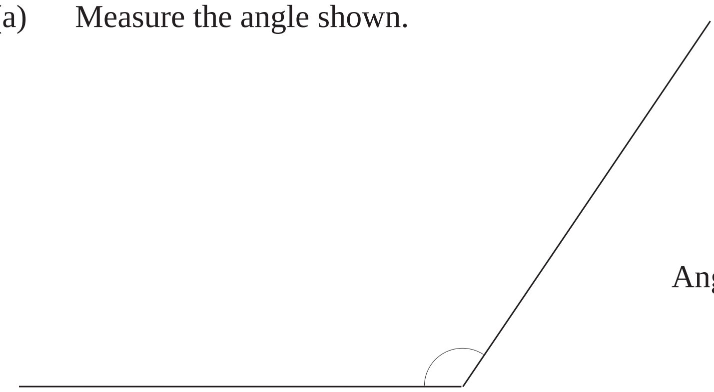
(a) The *car park* is [ ] of the *shops*.

(b) The *football ground* is [ ] of the *railway station.*

(c) [ ] is NW of the *car park.*

(3 marks)

16. (a) Measure the angle shown.



Angle = [ ] °

(b) Is the angle *acute, obtuse* or *reflex* ? [ ]

(2 marks)

UNITS 1-5

Diagnostic Test A (Academic)

17. How many degrees are there in $\frac{1}{2}$ turn? $\boxed{\quad}^\circ$

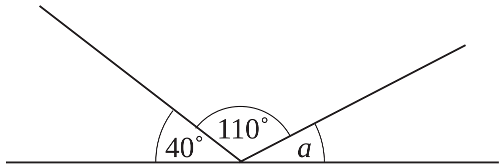
(1 mark)

18. How many degrees do you turn through if you turn anticlockwise from *south* to *northeast*? $\boxed{\quad}^\circ$

(1 mark)

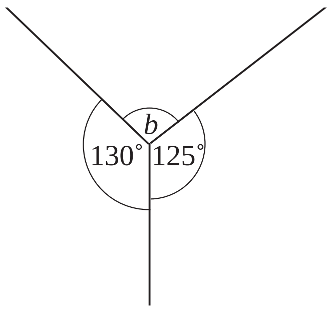
19. Find the unknown angle in each of these diagrams:

(a)



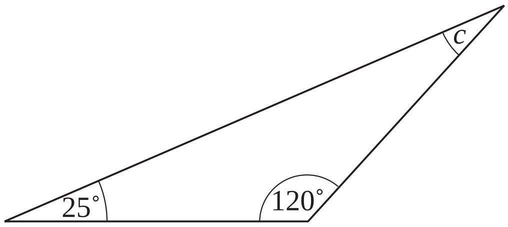
$a =$ $\boxed{\quad}^\circ$

(b)



$b =$ $\boxed{\quad}^\circ$

(c)



$c =$ $\boxed{\quad}^\circ$

(3 marks)

UNITS 1-5 **Diagnostic Test A** (Academic)

Marks

Unit	**1**	**2**	**3**	**4**	**5**	
Question	1 - 2	3 - 8	9 - 10	11 - 14	15 - 19	*Final total*
Totals						

Each unit has a total of 10 marks available.

UNITS 1-5 Diagnostic Test A (Academic) Answers

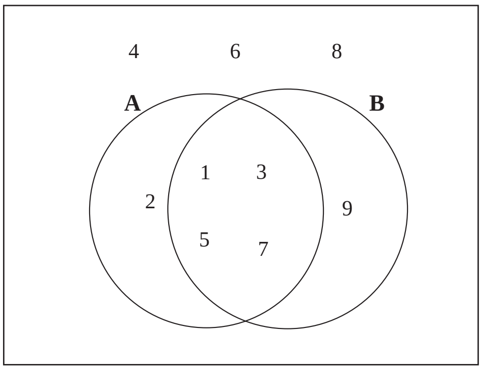
1.

	Car	*Bicycle*	*Bus*
Rachel	✓	✗	✗
Marcus	✗	✓	✗
Matthew	✗	✗	✓

B2

Car, Bicycle, Bus B1 B1 B1 *(5 marks)*

2.



ξ

(–1 for each mistake) B3

(a) { 1, 3, 5, 7 } B1

(b) { 4, 6, 8 } B1 *(5 marks)*

3. (a) 960 (b) 1000 B1 B1 *(2 marks)*

4. 60 or 6 tens B1 *(1 mark)*

5. (a) 0.55 (b) 0.5 B1 B1 *(2 marks)*

6. (a) 89, 391, 409, 424 B1

(b) 0.409, 0.41, 0.437, 0.48, 0.499, B1 *(2 marks)*

7. 6250 B2 *(2 marks)*

8. No B1 *(1 mark)*

9. (a) 120 cm B1

(b) 29 kg B1

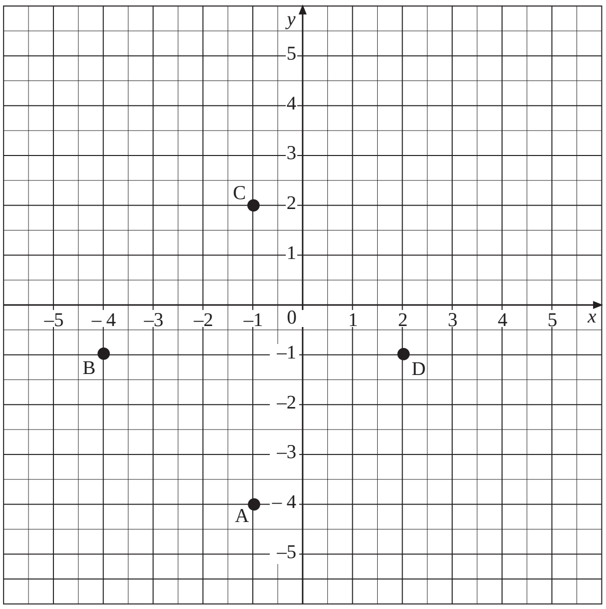
(c) Karl B1

(d) Ben B1

(d) John B1 *(5 marks)*

UNITS 1-5 Diagnostic Test A (Academic) Answers

10.



(a) point A B1

point B B1

(b) C (–1, 2) B1

D (2, –1) B1

(c) square B1 *(5 marks)*

11. (a) 152 (b) 74 B1 B1 *(2 marks)*

12. 224 + 47 − 81 = 190 M1 A1 *(2 marks)*

13. (a) 4.1 (b) 1.7 (c) 6.25 (d) 3.84 B1 B1 B1 B1 *(4 marks)*

14. (a) £5.24 (b) £4.76 B1 B1 *(2 marks)*

15. (a) East (b) SE (c) Church B1 B1 B1 *(3 marks)*

16. (a) 124 ° (b) obtuse B1 B1 *(2 marks)*

17. 180 ° B1 *(1 mark)*

18. 135 ° B1 *(1 mark)*

19. (a) 30 ° (b) 105 ° (c) 35 ° B1 B1 B1 *(3 marks)*

(TOTAL MARKS 50)

UNITS 1-5 Diagnostic Test A (Academic) Answers

Assessment	
45 +	Excellent – should be on *Express Route*
40 - 45	Very good progress
30 - 40	Good progress: look carefully at mistakes
20 - 30	Steady progress, but you will need to work more carefully and/or make more effort
20 -	Struggling, so look carefully at the mistakes in your work; you might be better advised to transfer to the *Standard Route*

UNITS 1-5 **Diagnostic Test A** (Express)

You have ONE HOUR to complete this test.
You are not allowed to use a calculator.

1. Rachel, Marcus and Matthew travel to school by car, bicycle or bus. Each one of them uses a different method of transport. Use the clues with the logic table below to find how each travels to school.

   Clue 1 : Rachel does not travel by bus.

   Clue 2 : Marcus does not travel by car or by bus.

	Car	*Bicycle*	*Bus*
Rachel			
Marcus			
Matthew			

   Complete these statements:

   Rachel travels to school by

   Marcus travels to school by

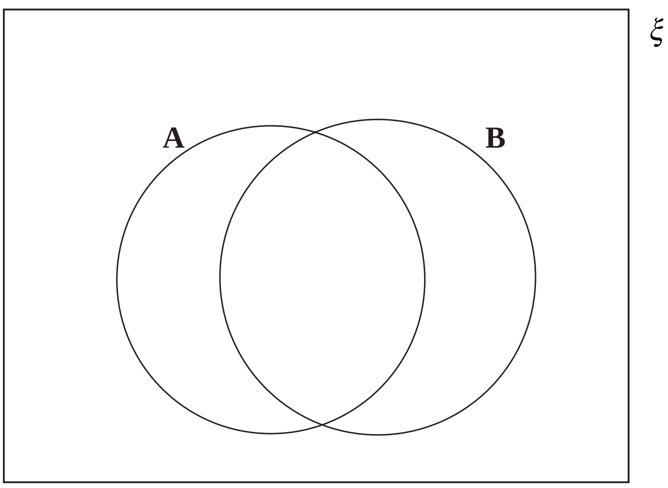
   Matthew travels to school by

(5 marks)

2. The sets A and B are given by:

$$A = \{1, 2, 3, 5, 7\}$$
$$B = \{1, 3, 5, 7, 9\}$$

   Put all the whole numbers from 1 to 9 inclusive in the appropriate places on the Venn diagram below:



UNITS 1-5

Diagnostic Test A (Express)

Now answer these questions:

(a) what is in the intersection of A and B, { }

(b) what is not in either A or B? { }

(5 marks)

3. Write 5.246

(a) to 3 decimal places,

(b) to 2 decimal places,

(c) to 1 decimal place.

(3 marks)

4. Write these numbers as figures:

(a) 9 thousandths,

(b) 53 thousandths.

(2 marks)

5. Write these numbers in order, with the smallest first:

(a) 424, 391, 89, 409

(b) 0.48, 0.409, 0.41, 0.499, 0.437

(2 marks)

6. A number is given as 6300, correct to the nearest 100.

What is the *smallest* possible value of the actual number?

(2 marks)

UNITS 1-5

Diagnostic Test A (Express)

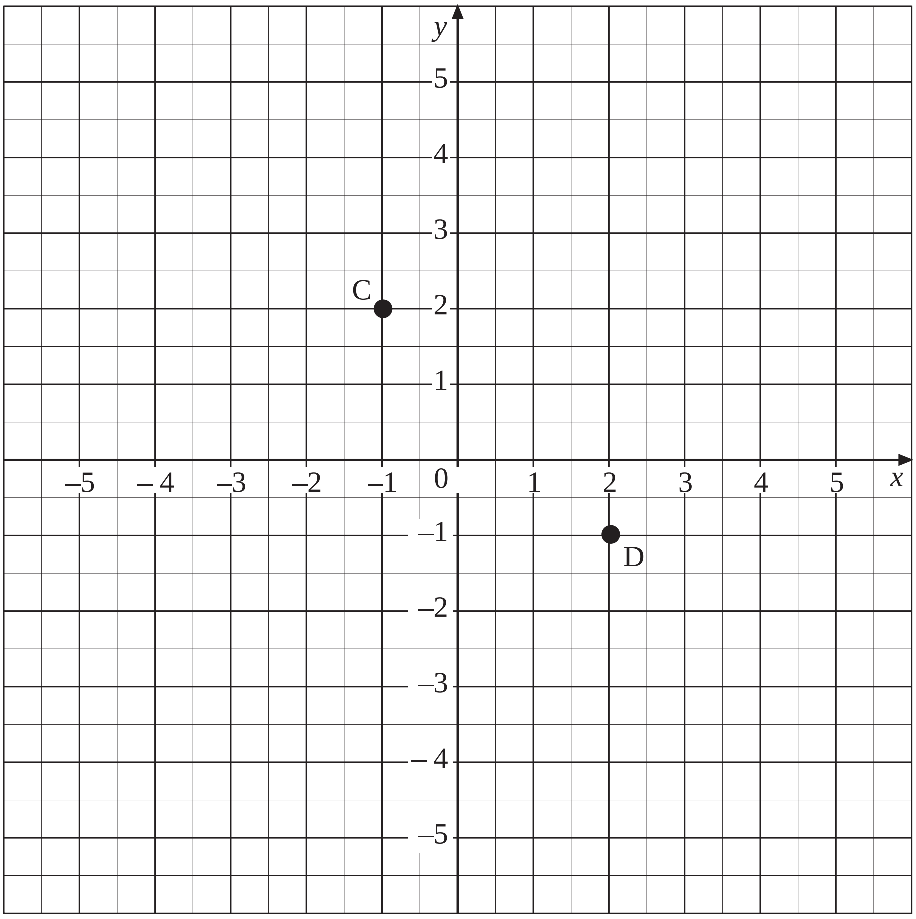
7. Is the statement below *true* or *false* ?

$$0.209 > 0.21$$

(1 mark)

8. (a) On the coordinate grid below, mark the points

A (– 1, – 4) and B (– 4, – 1)



(b) What are the coordinates of the points:

(i) C, (,) (ii) D ? (,)

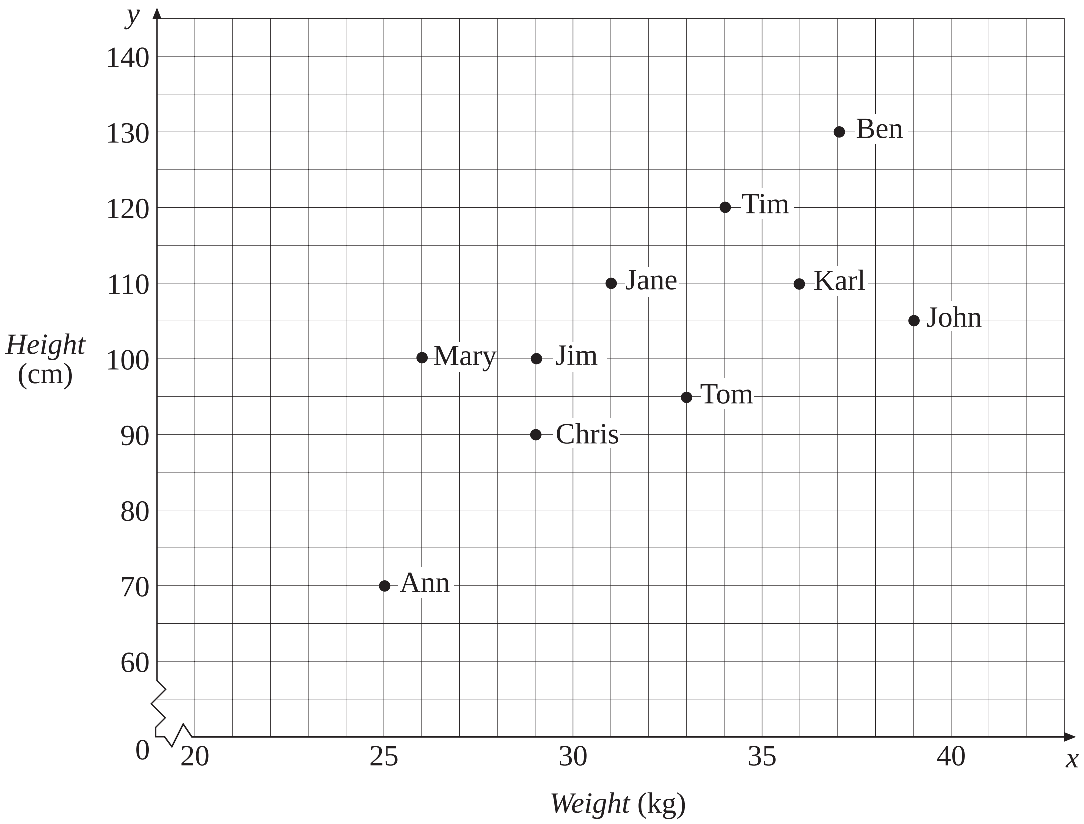
(c) What is the name given to the shape ABCD ?

(5 marks)

UNITS 1-5

Diagnostic Test A (Express)

9. The scatter graph below shows the heights and weights of some children.



(a) Who is the same height as Jane?

(b) Who is the tallest of these children?

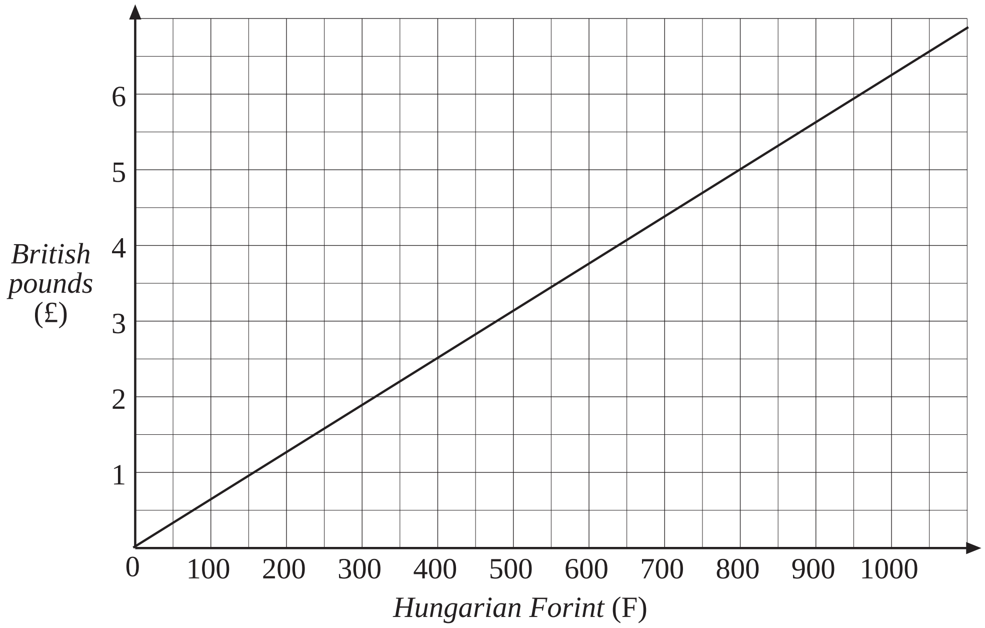
(c) Who is the heaviest of these children?

(3 marks)

UNITS 1-5

Diagnostic Test A (Express)

10. The graph below can be used to convert British pounds (£) to Hungarian Forints (F).



Convert:

(a) £4 to Forints, ☐ Forints

(b) 950 F to pounds. £ ☐

(2 marks)

11. Calculate:

(a) $27 + 125 =$ ☐

(b) $241 - 167 =$ ☐

(2 marks)

12. There were 224 cars in a car park. During the next hour, 47 cars arrived and 81 cars left.

How many cars are now in the car park? ☐

(2 marks)

UNITS 1-5

Diagnostic Test A (Express)

13. Calculate:

(a) 1.4 + 2.7 =

(b) 4.5 − 2.8 =

(c) 3.56 + 2.69 =

(d) 7.52 − 3.68 =

(4 marks)

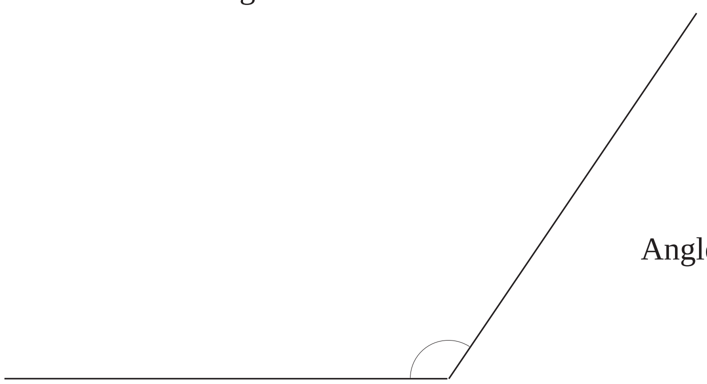
14. Jane bought two magazines, one costing £3.75 and the other costing £1.49.

(a) What was the total cost?

(b) What change did she get from a £10 note?

(2 marks)

15. (a) Measure the angle shown.



Angle = °

(b) Is the angle *acute*, *obtuse* or *reflex* ?

(2 marks)

16. How many degrees are there in $\frac{1}{2}$ turn? °

(1 mark)

17. How many degrees do you turn through if you turn anticlockwise from *south* to *northeast*?

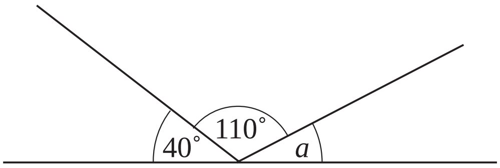
(1 mark)

UNITS 1-5

Diagnostic Test A (Express)

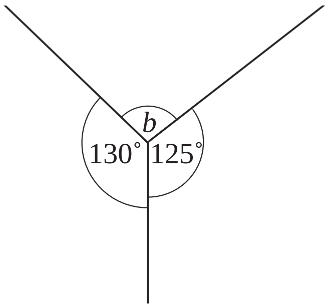
18. Find the unknown angle in each of these diagrams:

(a)



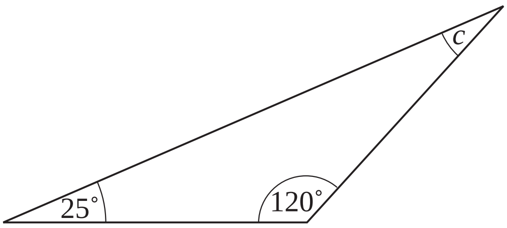
$a =$ °

(b)



$b =$ °

(c)

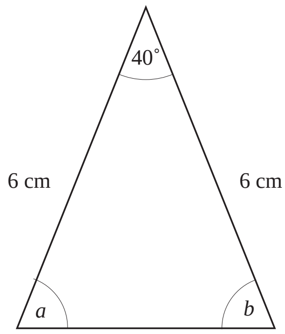


$c =$ °

(3 marks)

19. Find the unknown angle in each of these diagrams:

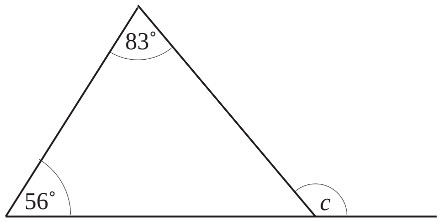
(a)



$a =$ °

$b =$ °

(b)



$c =$ °

(3 marks)

UNITS 1-5 **Diagnostic Test A** (Express)

Marks

Unit	**1**	**2**	**3**	**4**	**5**	
Question	1 - 2	3 - 7	8 - 10	11 - 14	15 - 19	*Final total*
Totals						

Each unit has a total of 10 marks available.

UNITS 1-5 Diagnostic Test A (Express) Answers

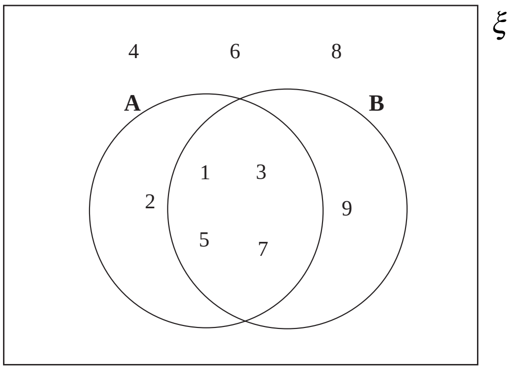
1.

	Car	*Bicycle*	*Bus*
Rachel	✓	✕	✕
Marcus	✕	✓	✕
Matthew	✕	✕	✓

B2

Car, Bicycle, Bus B1 B1 B1 *(5 marks)*

2.



(–1 for each mistake) B3

(a) { 1, 3, 5, 7 } B1

(b) { 4, 6, 8 } B1 *(5 marks)*

3. (a) 5.247 (b) 5.25 (c) 5.2 B1 B1 B1 *(3 marks)*

4. (a) 0.009 (b) 0.053 B1 B1 *(2 marks)*

5. (a) 89, 391, 409, 424 B1

(b) 0.409, 0.41, 0.437, 0.48, 0.499 B1 *(2 marks)*

6. 6250 B2 *(2 marks)*

7. No B1 *(1 mark)*

8. Diagram on next page

(a) point A B1

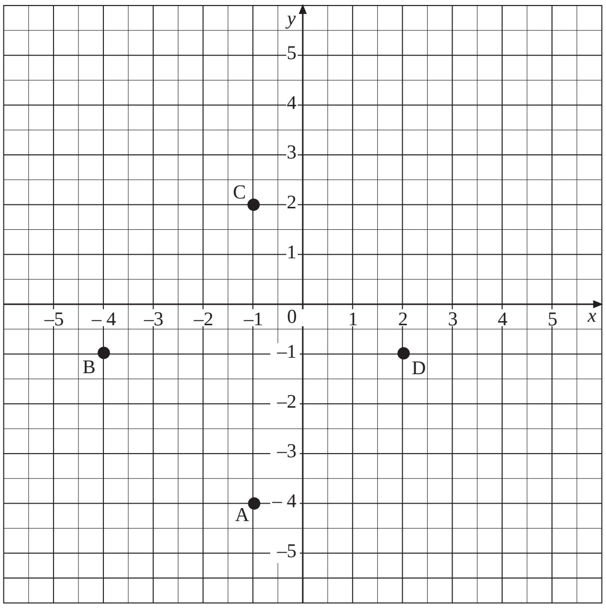
point B B1

(b) C (–1, 2) B1

D (2, –1) B1

(c) square B1 *(5 marks)*

UNITS 1-5 Diagnostic Test A (Express) Answers



9.	(a) Karl		B1	
	(b) Ben		B1	
	(c) John		B1	*(3 marks)*
10.	(a) 640 Forints	(allow 635 to 645)	B1	
	(b) £5.94	(allow £5.90 to £6)	B1	*(2 marks)*
11.	(a) 152 (b) 74		B1 B1	*(2 marks)*
12.	$224 + 47 - 81 = 190$		M1 A1	*(2 marks)*
13.	(a) 4.1 (b) 1.7 (c) 6.25 (d) 3.84		B1 B1 B1 B1	*(4 marks)*
14.	(a) £5.24 (b) £4.76		B1 B1	*(2 marks)*
15.	(a) 124 ° (b) obtuse		B1 B1	*(2 marks)*
16.	180 °		B1	*(1 mark)*
17.	135 °		B1	*(1 mark)*
18.	(a) 30 ° (b) 105 ° (c) 35 °		B1 B1 B1	*(3 marks)*
19.	(a) $a = b = 70$ °		B1 B1	
	(b) $c = 139$ °		B1	*(3 marks)*

(TOTAL MARKS 50)

UNITS 1-5 Diagnostic Test A (Express) Answers

Assessment

45 +	Excellent progress
40 - 45	Very good progress
30 - 40	Good progress: look carefully at mistakes
20 - 30	Steady progress, but you will need to work more carefully and/or make more effort
20 -	Struggling, so look carefully at the mistakes in your work; you might be better advised to transfer to the *Academic Route*