Mathematics Enhancement Programme (MEP)

PRIMARY Year 2

Support for Parents, Carers and Teachers

Yearly Objectives with Examples

Key Facts and Glossary

Problem Solving Examples

Overview of Contents

Detailed Contents

Mathematics Enhancement Programme

TEACHING SUPPORT

GENERAL OVERVIEW

This initiative, the *Mathematics Enhancement Programme, Primary Project*, has been developed by the Centre for Innovation in Mathematics Teaching (CIMT) at Plymouth University to enhance the mathematical progress of learners in primary schools. It is based on evidence of good practice from mathematically high performing countries.

MEP aims to support these KEY STRATEGIES for effective mathematics teaching and learning:

1. **Lesson** well prepared (teacher knows the lesson plan well and is aware of problems/difficulties that are likely to occur), resources are at hand, board prepared in advance, learners have their own resources on desk.

2. **Seating**: learners have eye contact with the teacher and can get to the board quickly and easily.

3. **Whole-class interactive teaching** predominates, with planned intervals of individual and paired work. Learners on task and given the chance to demonstrate, answer, explain to the class.

4. **Friendly, non-confrontational atmosphere** where learners learn from and support others and have fun! Mistakes used as teaching points. Encouragement given to those who have difficulty and praise given when deserved. Learners are encouraged to appreciate the good work of others.

5. **Spiral curriculum** with continual revision; learning by heart encouraged, with progression in small, logical steps.

6. **Visualisation** and **manipulatives** are used in the early years and less able learners. Relating contexts to learners' experiences, demonstrate on number lines, modelling to help understanding.

7. **Exercises** reviewed interactively with the whole class at the time. Learners give the solutions, not the teacher, and rest of the class agrees/disagrees or suggests alternative solutions. Learners are expected to correct their own work. Teacher gives hints only if the whole class is stuck.

8. **Challenges** or **extension work** set for able learners, or they help less able neighbours.

9. Introductory and Reinforcement tasks to help ensure that no children are left behind.

10. **Correct notation, layout** and **language** used at all times. Teacher acts as a model for learners to follow (on board and orally), repeating/showing a learner's explanation more clearly and succinctly where necessary.

11. **Good pace** and **varied activities** related to the concept being taught. Time limits set for individual/paired work. Time allowed for learners to explain and for whole class discussion.

12. Assessment, formative and summative, based on the key objectives in the National Curriculum

The course is fully resourced with:

- Learner Practice Books, with detailed lesson plans for teachers
- Number cards, shape cards and number lines
- Interactive resources for reinforcement, revision and extension

Resources are freely available at: http://www.cimt.org.uk/projects/mepres/primary/

Mathematics Enhancement Programme

TEACHING SUPPORT: Book 2

LEARNING OBJECTIVES

At the end of Book 2 we expect learners to

- *use numbers in addition and subtraction calculations up to hundreds with confidence*
- *use and remember multiplication facts up to* 10×10
- *identify and calculate simple fractions, e.g. half, quarter, three quarters, etc.*
- *use measurements (cm and m) in contexts*
- *use units of money (£ and p) in contexts*
- *use capacity (litres and cl) in contexts*
- *use mass (g and kg) in contexts*
- *understand and identify similar shapes*
- *identify lines of symmetry and construct mirror images*
- *identify events that are 'certain', 'possible but not certain' or 'impossible'.*

Mathematics Enhancement Programme

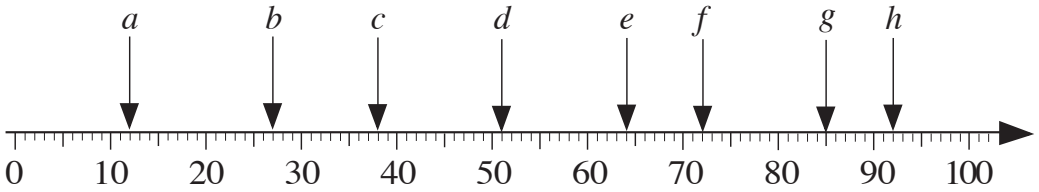
TEACHING SUPPORT: Book 2

LEARNING OBJECTIVES with ILLUSTRATIVE EXAMPLES (and Answers appended)

At the end of Book 2 we expect learners to be confident with the following concepts.

- ***Use numbers in addition and subtraction up to hundreds with confidence***

Example 1 At which numbers have we written the letters? Fill in the boxes.



$a =$ $b =$ $c =$ $d =$

$e =$ $f =$ $g =$ $h =$

Example 2 Complete the table. Write down the rule in different ways.

A	10	40	25	50	30	65	70				
B	0	30	15					70	80	90	

Example 3 List the numbers which make the statement true.

a) $40 < \square < 47$ $\square$: . . . . . .

b) $30 + 20 <$ ○ $< 10 + 50$ ○ : . . . . . .

Example 4 Calculate each sum. Write out the answers in **increasing** order.

20 + 5	35 + 10	5 + 7	
40 + 30	60 + 40	40 + 40	20 + 40

. . . . . .

- ***Use and remember multiplication facts up to*** 10×10

Example 5 Fill in the missing numbers.

a) $2 \times \square = 18$
$5 \times \square = 10$
$8 \times \square = 16$
$20 \div \square = 10$
$\square\square \div 2 = 7$
$66 \div \square = 33$

b) $5 \times \square = 15$
$5 \times \square = 35$
$\square \times 6 = 30$
$\square\square \div 5 = 9$
$20 \div \square = 4$
$\square \div 5 = 0$

c) $3 \times \square = 24$
$3 \times \square = 3$
$\square \times 8 = 24$
$18 \div \square = 2$
$27 \div \square = 9$
$\square\square \div 3 = 1$

Example 6 Find a rule.

Complete the table.

Write the rule in different ways.

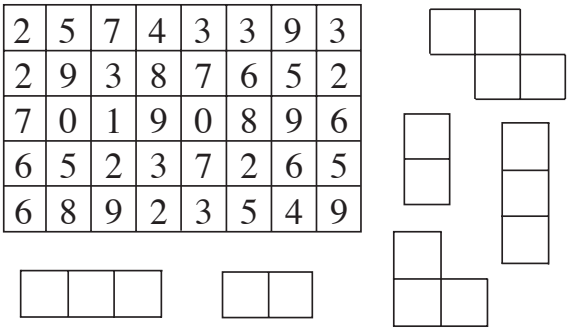
■	2	7	12	8		9	3	11		5		1
▲	4	5	2		10				5	6	7	9
●	8	35		24	90	18	18	33	40		70	

● = ▲ = ■ =

Example 7 Colour the shapes on the grid and write the numbers in the shapes.

The **product** of the numbers in each shape is 36.

2	5	7	4	3	3	9	3
2	9	3	8	7	6	5	2
7	0	1	9	0	8	9	6
6	5	2	3	7	2	6	5
6	8	9	2	3	5	4	9



Example 8 Practise multiplication.

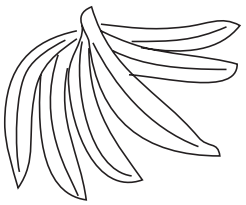
a) $\square = 6 \times 9$
$\square = 10 \times 2$
$\square = 10 \times 1$
$\square = 6 \times 6$
$\square = 7 \times 2$
$\square = 3 \times 0$

b) $\square = 10 \times 3$
$\square = 0 \times 9$
$\square = 4 \times 8$
$\square = 8 \times 6$
$\square = 1 \times 9$
$\square = 2 \times 1$

c) $\square = 2 \times 0$
$\square = 1 \times 3$
$\square = 0 \times 4$
$\square = 5 \times 7$
$\square = 7 \times 3$
$\square = 10 \times 5$

- ***Identify and calculate simple fractions, for example, half, quarters, three quarters, etc.***

Example 9 There are 6 bananas in this bunch. Draw the bananas and fill in the number.

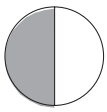


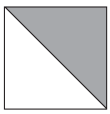
a) **1 half** of the bunch . . . . . ☐

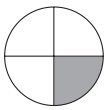
b) **1 third** of the bunch . . . . . ☐

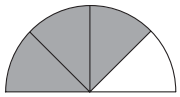
c) **1 sixth** of the bunch . . . . . ☐

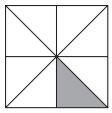
Example 10 Write below each shape what part of it is shaded.

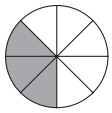
a)  .....

b)  .....

c)  .....

d)  .....

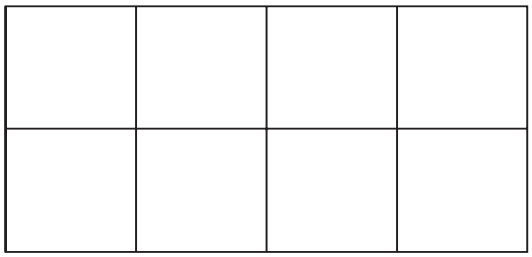
e)  .....

f)  .....

Example 11 a) We have planted *red* roses in **2 eighths** of the garden. Colour it *red*.

b) We have planted *blue* forget-me-nots in **3 eighths** of the garden. Colour it *blue*.

c) We have planted grass in **2 eighths** of the garden. Colour it *green*.

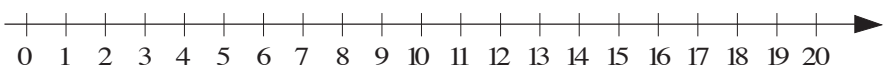


d) Our house is built on the remaining part of the garden. Draw it in.

What part of the garden does the house take up? . . . . . .

Example 12 Join up the values to the corresponding points on the number line.

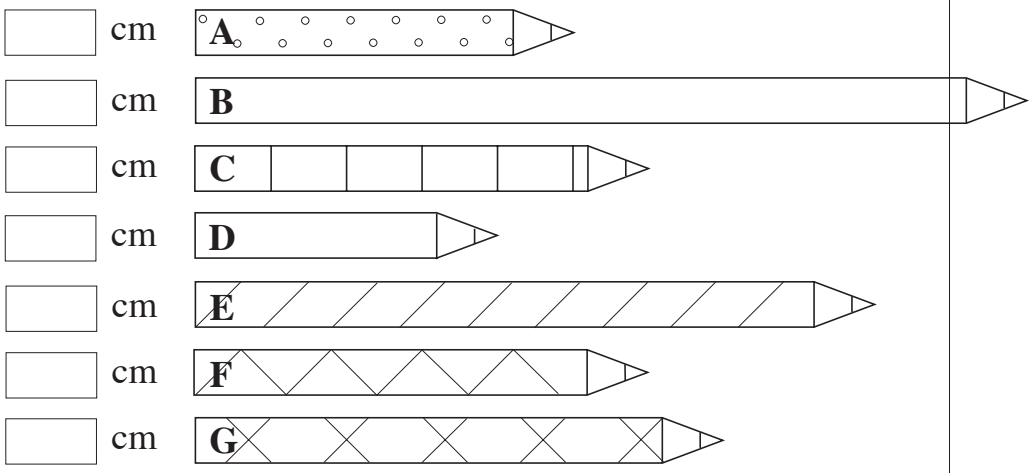
1 fifth of 15	2 times 8	2 halves of 6



2 quarters of 8	1 half of 0	3 quarters of 20

- ***Use measurements (cm and m) in contexts***

Example 13 a) Measure each pencil and write down its length in cm.



Pencil letter

b) Which is the longest pencil? . . . . . .

c) Which is the shortest pencil? . . . . . .

d) Which pencils are **not** longer than Pencil C? . . . . . .

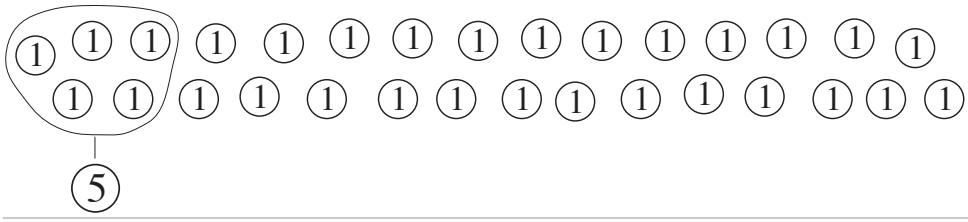
e) Which pencils are **not** shorter than Pencil C? . . . . . .

Example 14 Fill in the missing numbers and units.

1 metre	**50 cm**
40 cm + ☐	20 cm + ☐
80 cm + ☐	84 cm – ☐
☐ + 25 cm	☐ + 42 cm
☐ + 61 cm	☐ – 33 cm
99 cm + ☐	1 cm + ☐

- ***Use units of money (£ and p) in contexts***

Example 15 Exchange these thirty 1 pence coins for 5 pence coins. Continue the drawing.



30 1 pence coins can be exchanged for ☐ 5 pence coins because

☐ × 5 pence = 30 pence

30 cents contains 5 pence ☐ times.

Example 16 In Lee's piggy bank, there was 38 pence Lee put in 7 pence each day for the next 6 days.

How much money does Lee have now?

Calculation: . . . . . .

Answer:. . . . . .

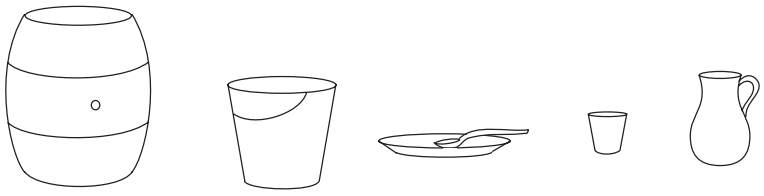
Example 17 Which of these could you buy? Draw pictures and write additions.

£1 50 p 70 p 20 p

= 90 p	= £1 50 p	= £2 10 p	= £1 20 p

- ***Use capacity (litres and cl) in contexts***

Example 18 Join up each measure of capacity to a suitable container.



50 cl | 10 litres | 2 cl | 100 litres | 2 litres | 20 cl

Example 19 Join up the quantities to the correct statement.

2 litres 40 cl
3 litres 60 cl
2 litres
6 litres – 12 cl
4 litres

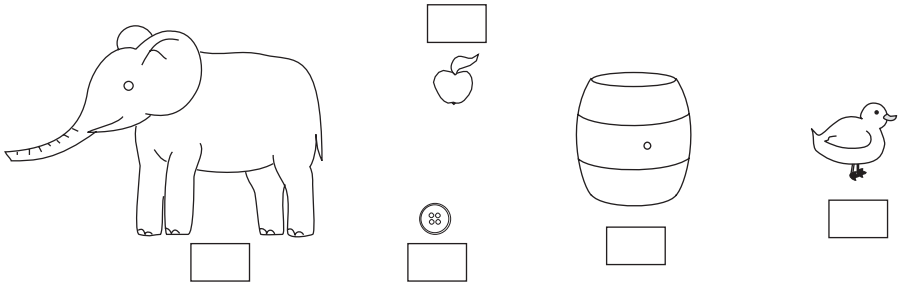
Less than 3 litres

Not less than 3 litres

1 litre 60 cl
4 litres – 80 cl
3 litres 20 cl
4 litres 30 cl
5 litres 20 cl – 3 litre 10 cl

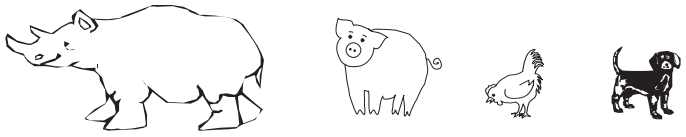
- ***Use mass (g and kg) in contexts***

Example 20 Which weighs more? Draw arrows towards the one which is heavier.



Write in the boxes the standard unit you would use to weigh them. (g, kg)

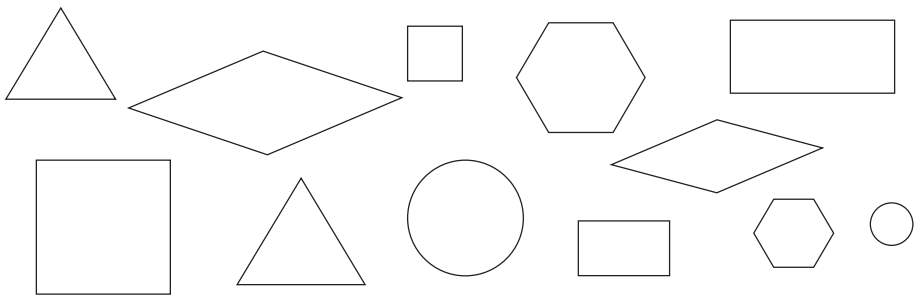
Example 21 Join up each picture to a suitable measure.



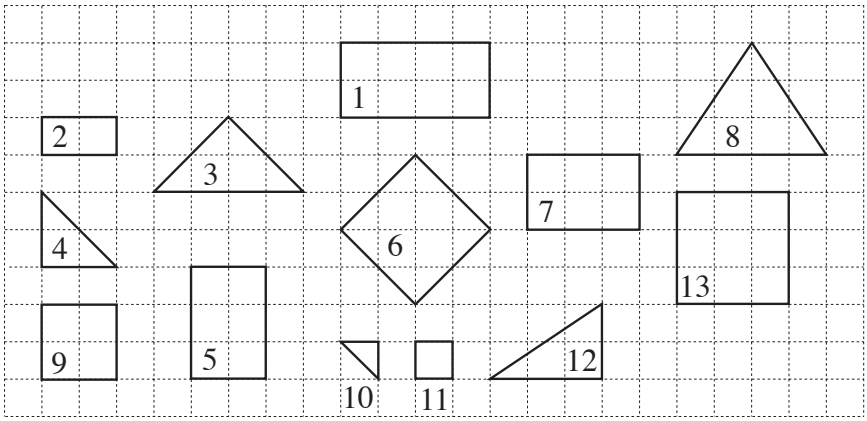
1 kg	5 kg	100 kg	25 kg

- ***Understand and identify similar shapes***

Example 22 Colour similar pairs of shapes in the same colour.



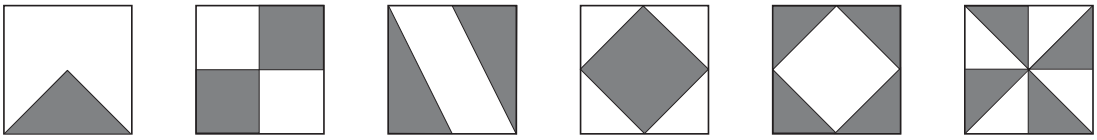
Example 23 Colour **similar** shapes in the same colour. Which 2 shapes are the **same**?



- ***Identify lines of symmetry and construct mirror images***

Example 24 Which pictures are **symmetrical**? Draw the possible **mirror lines** in blue.

Write below each picture how many **mirror lines** you have drawn.



. . . .

- ***Identify events that are 'certain', 'possible but not certain' or 'impossible'.***

Example 25 I am going to throw a dice once. How certain can I be of the result?

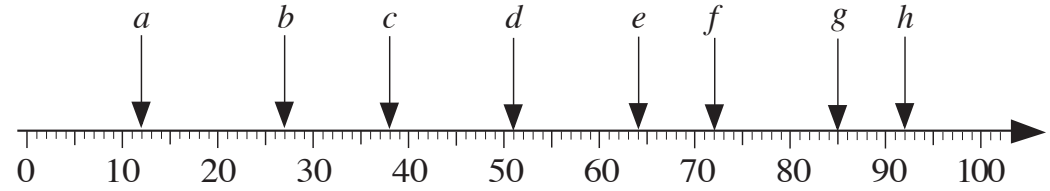
Join up the statements at the sides to the correct labels in the middle.

I will throw a 4.	**Certain**	I will throw a number < 3.
I will throw a 2 or a 6.	**Possible, but not certain**	I will throw a number < 1.
I will throw a 1 and a 5.		I will throw an even number.
I will throw a 7.	**Impossible**	I will throw a number < 9.

LEARNING OBJECTIVES EXAMPLES: Answers

Example 1

At which numbers have we written the letters? Fill in the boxes.



$a =$ 1 2 $b =$ 2 7 $c =$ 3 8 $d =$ 5 1

$e =$ 6 4 $f =$ 7 2 $g =$ 8 5 $h =$ 9 2

Example 2

Complete the table. Write down the rule in different ways.

A	10	40	25	50	30	65	70	80	90	100
B	0	30	15	40	20	55	60	70	80	90

B = A − 10

A = B + 10

10 = A − B

Example 3

List the numbers which make the statement true.

a) $40 < \square < 47$ $\square$: 41, 42, 43, 44, 45, 46

b) $30 + 20 <$ ● $< 10 + 50$ ● : 51, 52, 53, 54, 55, 56, 57, 58, 59

Example 4

Calculate each sum. Write out the answers in **increasing** order.

70	25	100	45	80	12	60
40 + 30	20 + 5	60 + 40	35 + 10	40 + 40	5 + 7	20 + 40

12, 25, 45, 60, 70, 80, 100

Example 5

Fill in the missing numbers.

a)
$2 \times \boxed{9} = 18$
$5 \times \boxed{2} = 10$
$8 \times \boxed{2} = 16$
$20 \div \boxed{2} = 10$
$\boxed{1}\boxed{4} \div 2 = 7$
$66 \div \boxed{2} = 33$

b)
$5 \times \boxed{3} = 15$
$5 \times \boxed{7} = 35$
$\boxed{5} \times 6 = 30$
$\boxed{4}\boxed{5} \div 5 = 9$
$20 \div \boxed{5} = 4$
$\boxed{0} \div 5 = 0$

c)
$3 \times \boxed{8} = 24$
$3 \times \boxed{1} = 3$
$\boxed{3} \times 8 = 24$
$18 \div \boxed{9} = 2$
$27 \div \boxed{3} = 9$
$\boxed{3}\boxed{6} \div 3 = 1$

Example 6

Find a rule.

Complete the table.

■	2	7	12	8	9	9	3	11	8	5	10	1
▲	4	5	2	3	10	2	6	3	5	6	7	9
●	8	35	24	24	90	18	18	33	40	30	70	9

Write the rule in different ways.

● = ▩ × ▲ ▲ = ● ÷ ▩ ■ = ● ÷ ▲

Example 7

Colour the shapes on the grid and write the numbers in the shapes.

The **product** of the numbers in each shape is 36.

2	5	7	4	3	3	9	3
2	9	3	8	7	6	5	2
7	0	1	9	0	8	9	6
6	5	2	3	7	2	6	5
6	8	9	2	3	5	4	9

$\boxed{4}\boxed{3}\boxed{3}$ $\boxed{4}\boxed{9}$

$\boxed{2}\boxed{3}$ $\boxed{2}\boxed{3}$ $\boxed{6}$ $\boxed{6}$ $\boxed{3}$ $\boxed{2}$ $\boxed{6}$ $\boxed{2}$ $\boxed{2}\boxed{9}$

Example 8

Practise multiplication.

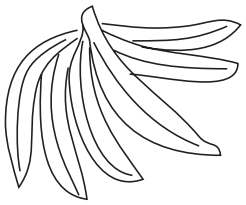
a)
$\boxed{54} = 6 \times 9$
$\boxed{20} = 10 \times 2$
$\boxed{10} = 10 \times 1$
$\boxed{36} = 6 \times 6$
$\boxed{14} = 7 \times 2$
$\boxed{0} = 3 \times 0$

b)
$\boxed{30} = 10 \times 3$
$\boxed{0} = 0 \times 9$
$\boxed{32} = 4 \times 8$
$\boxed{48} = 8 \times 6$
$\boxed{9} = 1 \times 9$
$\boxed{2} = 2 \times 1$

c)
$\boxed{0} = 2 \times 0$
$\boxed{3} = 1 \times 3$
$\boxed{0} = 0 \times 4$
$\boxed{35} = 5 \times 7$
$\boxed{21} = 7 \times 3$
$\boxed{50} = 10 \times 5$

Example 9

There are 6 bananas in this bunch. Draw the bananas and fill in the number.



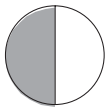
a) **1 half** of the bunch 3

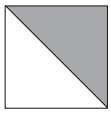
b) **1 third** of the bunch 2

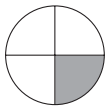
c) **1 sixth** of the bunch 1

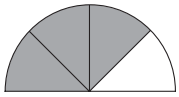
Example 10

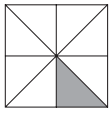
Write below each shape what part of it is shaded.

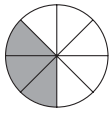
a) 
1 half

b) 
1 half

c) 
1 quarter

d) 
3 quarters

e) 
1 eighth

f) 
3 eighths

Example 11

a) We have planted *red* roses in **2 eighths** of the garden.

Colour it *red*.

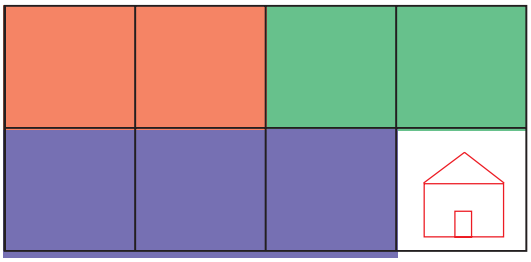
b) We have planted *blue* forget-me-nots in **3 eighths** of the garden.

Colour it *blue*.

c) We have planted grass in **2 eighths** of the garden.

Colour it *green*.

e.g.

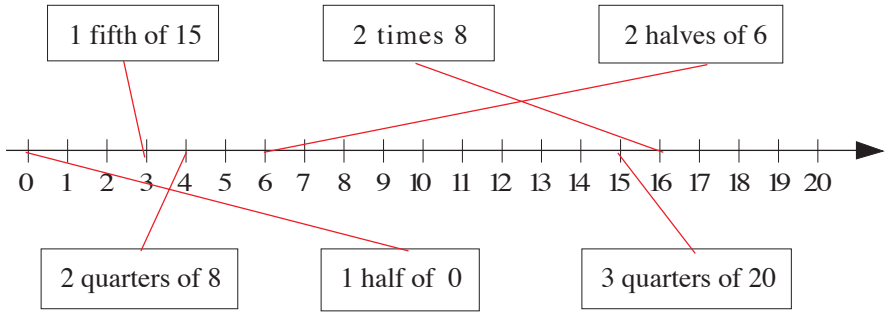


d) Our house is built on the remaining part of the garden. Draw it in.

What part of the garden does the house take up? . . . . . 1 eighth . . . . .

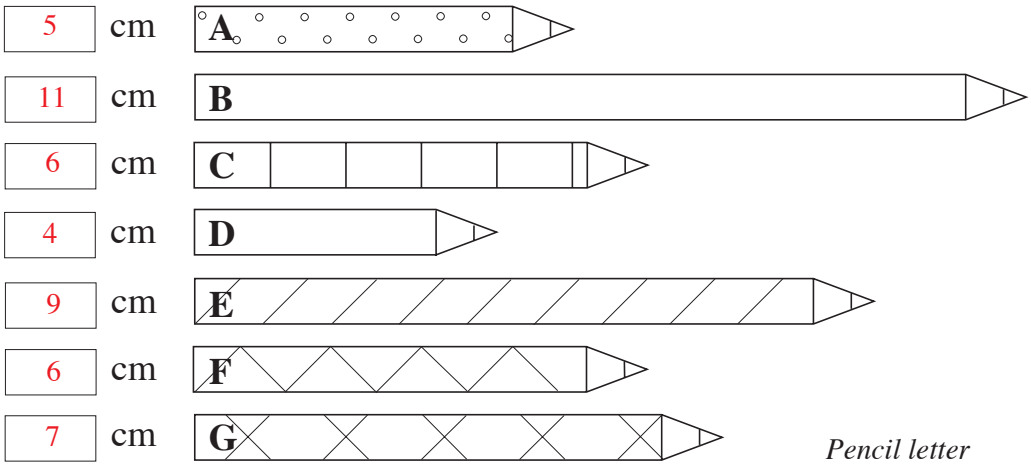
Example 12

Join up the values to the corresponding points on the number line.



Example 13

a) Measure each pencil and write down its length in cm.



Pencil letter

b) Which is the longest pencil? ... B ...

c) Which is the shortest pencil? ... D ...

d) Which pencils are **not** longer than Pencil C? ... A, D, F ...

e) Which pencils are **not** shorter than Pencil C? ... B, E, F, G ...

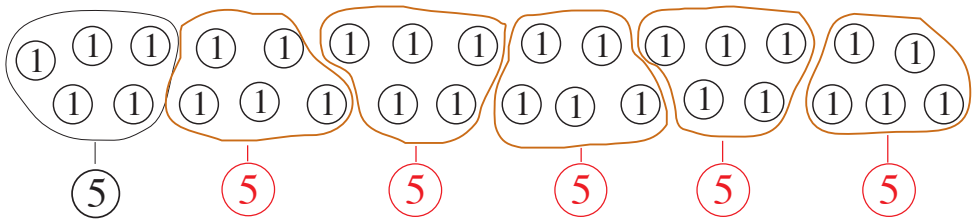
Example 14

Fill in the missing numbers and units.

1 metre		**50 cm**	
40 cm +	60 cm	20 cm +	30 cm
80 cm +	20 cm	84 cm –	34 cm
75 cm	+ 25 cm	8 cm	+ 42 cm
39 cm	+ 61 cm	83 cm	– 33 cm
99 cm +	1 cm	1 cm +	49 cm

Example 15

Exchange these thirty 1 pence coins for 5 pence coins. Continue the drawing.



30 1 pence coins can be exchanged for [6] 5 pence coins because

[6] × 5 pence = 30 pence

30 cents contains 5 pence [6] times.

Example 16

In Lee's piggy bank, there was 38 pence Lee put in 7 pence each day for the nextt 6 days.

How much money does Lee have now?

Calculation: 38 + 6 × 7 = 80

Answer: Lee now has 80 p.

Example 17

Which of these could you buy? Draw pictures and write additions.

£1 50 p 70 p 20 p

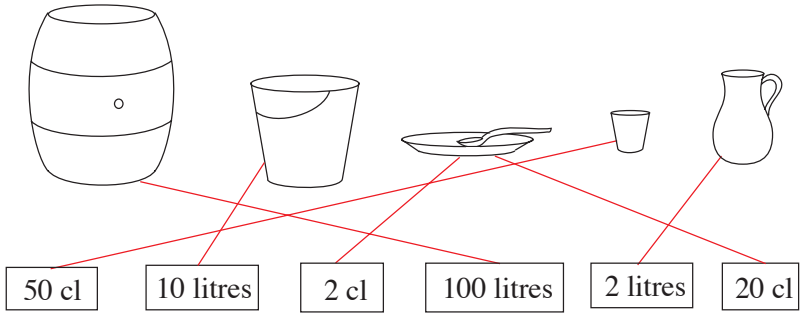
There are many other correct answers.

1 apple 2 bananas 70p + 20p = 90 p	1 hot dog 1 apple £1 + 50p = £1 50 p	3 packets crisps 70p + 70p + 70p = £2 10 p	1 apple 1 packet crisps 50p + 70p = £1 20 p

---

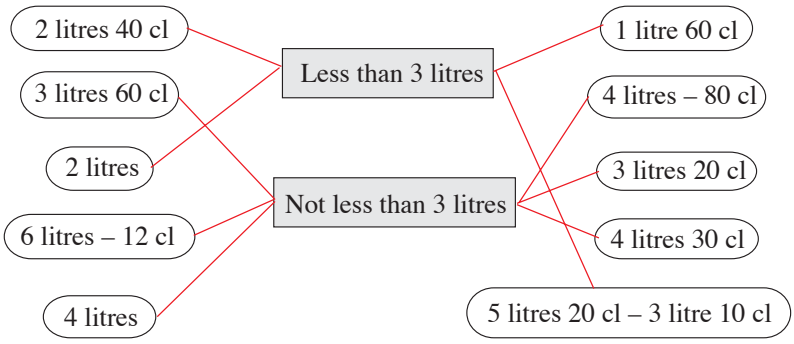
Example 18

Join up each measure of capacity to a suitable container.



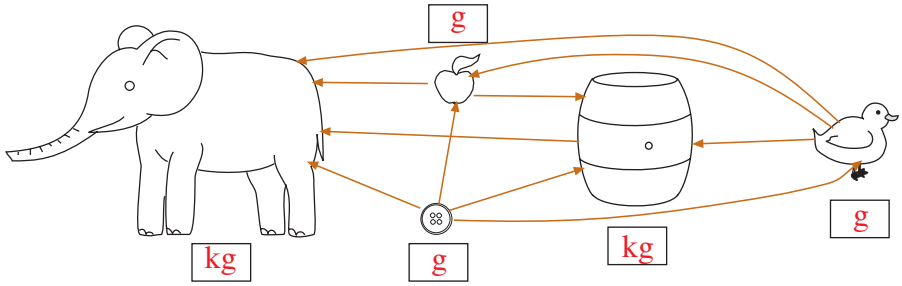
Example 19

Join up the quantities to the correct statement.



Example 20

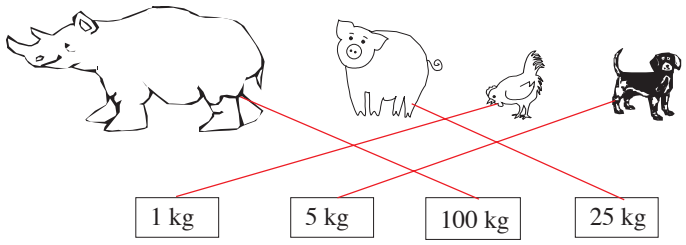
Which weighs more? Draw arrows towards the one which is heavier.



Write in the boxes the standard unit you would use to weigh them. (g, kg)

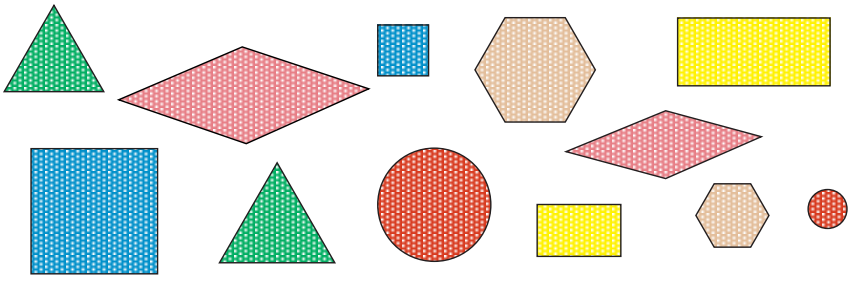
Example 21

Join up each picture to a suitable measure.



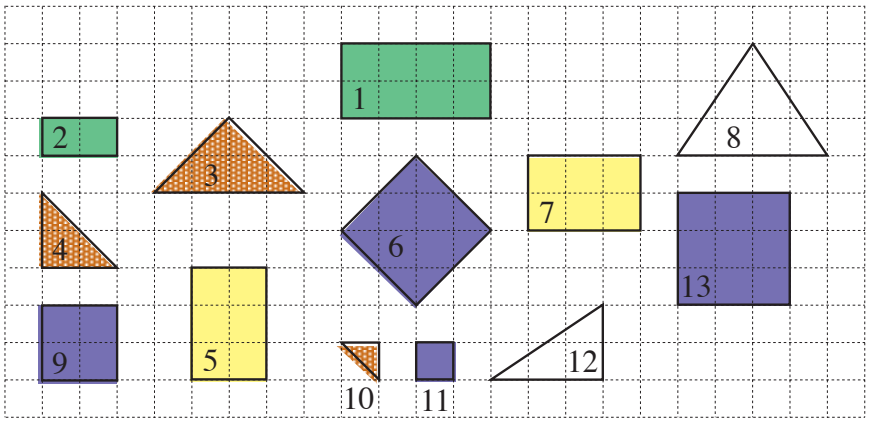
Example 22

Colour similar pairs of shapes in the same colour.



Example 23

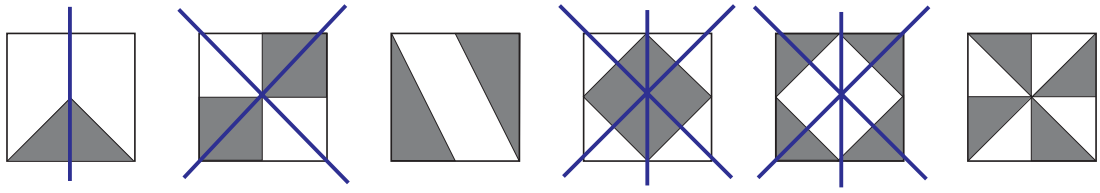
Colour **similar** shapes in the same colour. Which 2 shapes are the **same**? 5 and 7



Example 24

Which pictures are **symmetrical**? Draw the possible **mirror lines** in blue.

Write below each picture how many **mirror lines** you have drawn.

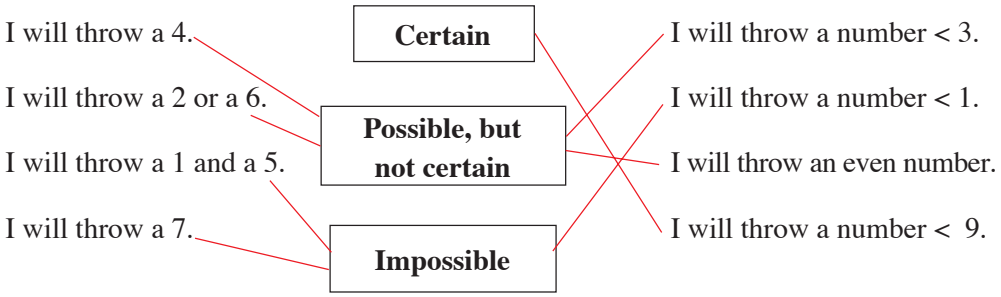


1 2 0 4 4 0

Example 25

I am going to throw a dice once. How certain can I be of the result?

Join up the statements at the sides to the correct labels in the middle.



Mathematics Enhancement Programme: BOOK 2

KEY FACTS and GLOSSARY

Calendar

There are 7 DAYS in a WEEK:

Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday

and 28, 29, 30 or 31 DAYS in a MONTH:

January	31 days
February	28 (29 in a Leap Year) days
March	31 days
April	30 days
May	31 days
June	30 days
July	31 days
August	31 days
September	30 days
October	31 days
November	30 days
December	31 days

There are 4 SEASONS in a YEAR: Spring, Summer, Autumn, Winter

Counting numbers

This is the set of numbers 1, 2, 3, 4, 5, 6, ...

These are also called the *natural numbers* (or *positive integers*)

Direction left and right; above and below; in front and behind

Equals

Equals means 'the same as'. We use the sign =

For example, $2 + 2 = 3 + 1 \left(= 4\right)$

Even/odd

2, 4, 6, 8, 10, 12, 14, 16, 18, ... are EVEN numbers (they can each be divided exactly by 2)

1, 3, 5, 7, 9, 11, 13, 15, 17, 19, ... are ODD numbers (they cannot be divided exactly by 2)

Increasing/decreasing sequences

1, 4, 7, 10, 13, 16, ... is an increasing sequence with the rule 'add 3' $\left(+ 3\right)$

15, 13, 11, 9, 7, ... is a decreasing sequence with the rule 'subtract 2' $\left(- 2\right)$

Inequalities

We use *inequality signs* when we compare two numbers: that is,

5 is greater than 3 is written as $5 > 3$

2 is less than 4 is written as $2 < 4$

So the symbol '>' means 'is greater than'

and '<' means 'is less than'.

The symbol '$\geq$' means 'is less than or is equal to'.

For example, if $\square \geq 4$, then $\square$ can be 4, 5, 6, ... (assuming that $\square$ is a counting number).

Similarly, '$\leq$' means 'is more than or is equal to'.

For example, if $\square \leq 6$, then $\square$ can be 6, 5, 4, 3, 2 or 1 (assuming that $\square$ is a counting number).

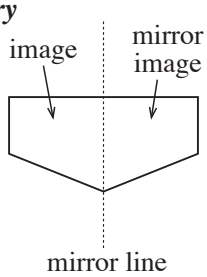
Integers (or whole numbers)

This is the set of whole numbers, both positive and negative.

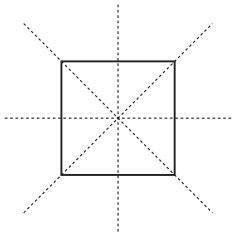
For example, $..., -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, ...$

Mirror lines and symmetry

The whole shape has one line of symmetry.



Four lines of symmetry are shown here.



Multiplication tables

Illustrated here for numbers up to 10×10.

X	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

Number bonds

The term 'number bonds' usually refers to the addition of two single-digit positive numbers,

For example, number bonds adding to 12 are

$0 + 12 = 12$, $1 + 11 = 12$, $2 + 10 = 12$, $3 + 9 = 12$, $4 + 8 = 12$,

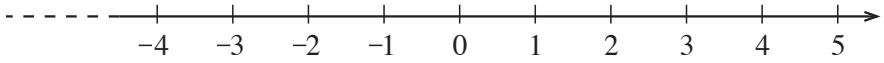
$5 + 7 = 12$, $6 + 6 = 12$, $7 + 5 = 12$, $8 + 4 = 12$, $9 + 3 = 12$,

$10 + 2 = 12$, $11 + 1 = 12$, $12 + 0 = 12$

Number lines

Numbers can be easily represented on a number line.

For example,



Product

The product is the result of multiplying two numbers.

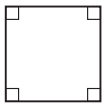
For example, 6 is the product of 2 and 3 and so we write $2 \times 3 = 6$

Roman numerals

1	I		11	XI
2	II		12	XII
3	III		13	XIII
4	IV	(this means 1 before 5)	14	XIV
5	V		15	XV
6	VI		16	XVI
7	VII		17	XVII
8	VIII		18	XVIII
9	IX	(this means 1 before 10)	19	XIX
10	X		20	XX

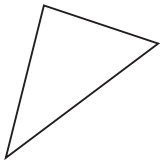
This continues in the same way, with 50 represented by the letter L and 100 by C.

Shapes

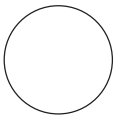


Square (all sides equal and four right angles)

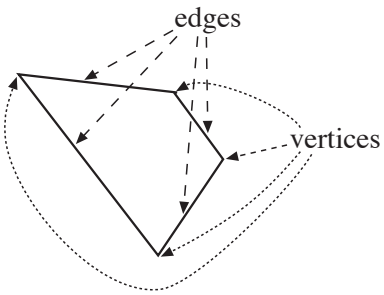
Rectangle (opposite sides equal and parallel and four right angles)



Triangle (3 straight sides)

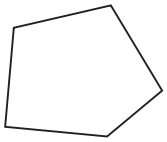


Circle

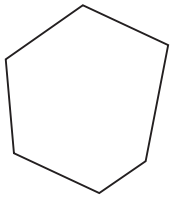


Quadrilateral - any shape with 4 straight sides (note that the sides are called *edges* and meet at *vertices).*

(Note that all squares are rectangles and all rectangles are quadrilaterals.)



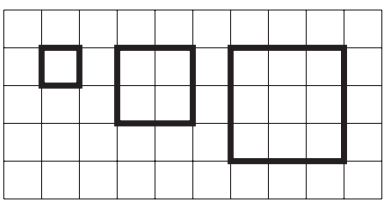
Pentagon - any shape with 5 straight edges (sides)



Hexagon - any shape with 6 straight edges (vertices)

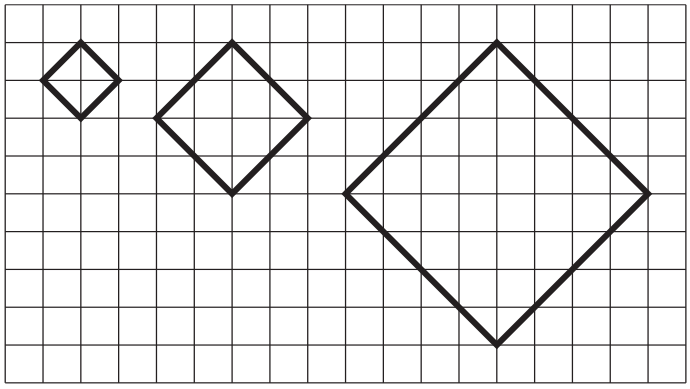
Similarity

(a)



These shapes are similar.

(b)



These shapes are similar.

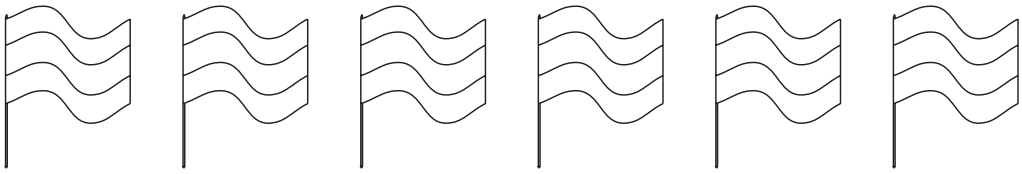
(The sides are in the same ratio, that is, 1 : 1 in (a) and 1 : 2 (i.e, 2 : 4 and 3 : 6) in (b).

PROBLEM SOLVING

1. Complete the table. Write down the rule in different ways.

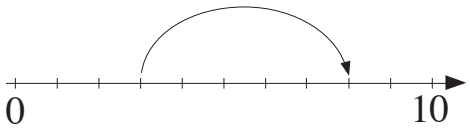
a	4	5	2	1	3	4	2			8		2		0
b	3	5	1	6	5			3	1		9	2	10	
c	3	0	7	3		4	6	6	1	1	0			

2. Colour the flags in different ways, using red, white and green.
On each flag, a colour may be used once and only once.

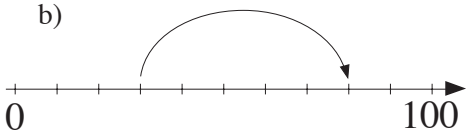


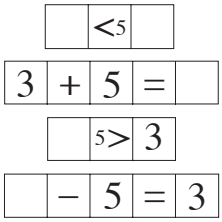
3. Write equations and inequalities about each jump along the number line.

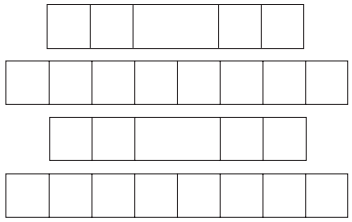
a)



b)

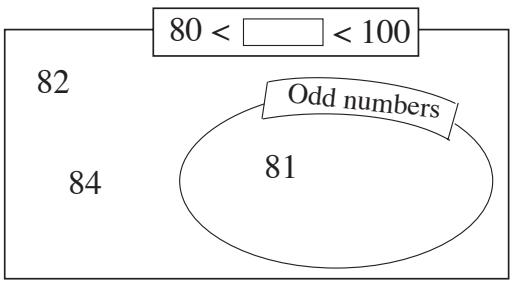




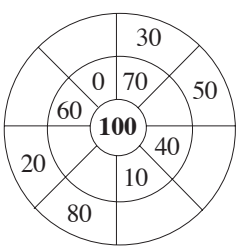


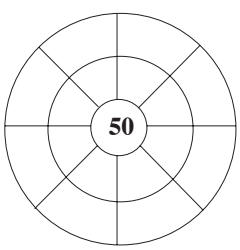
4. Which numbers make the inequality rue?

Write them in the correct places on the diagram.



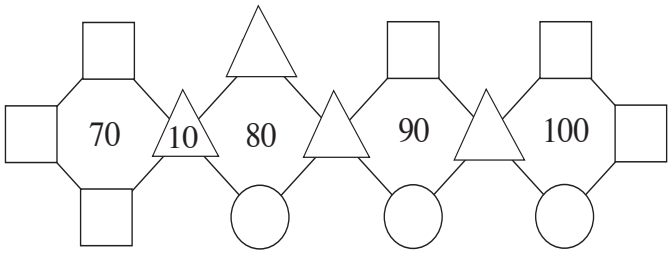
5. Fill in the missing numbers.





6. The same shape means the same number.

The sum of the 4 numbers at the corners equals the middle number.

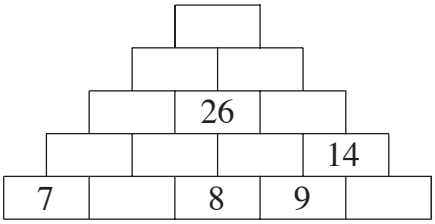


7. *I thought of a number. I multiplied it by 3, then divided by 6 and got 2.*

What was the number I first thought of?

8. Each number is the **sum** of the 2 number directly below it

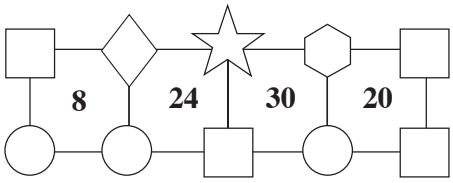
Fill in the missing numbers.



9. The same shape means the same number. Choose from 1, 2, 3, 4 or 5.

The middle number is the **product** of the 4 numbers around it.

Fill in the missing numbers.



10. Use the digits 1, 2, 3 and 4 to make pairs of 2-digit numbers.
Each digit can be used only once in every pair, but can be in any order.

An example of such a pair is: 21 and 34.

a) Which pairs have the largest **sum**?

□□ + □□ = □□

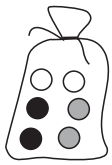
and □□ + □□ = □□

b) Which pairs have the smallest difference?

□□ − □□ = □□

and □□ − □□ = □□

11. There are 2 white, 2 black and 2 striped marbles in a bag.
The bag is tied with cord and you cannot see inside.



Join up the statements on the left to the labels on the right.

How certain can I be that if, with my eyes shut:

a) I take out 1 marble, it will be black.

b) I take out 2 marbles, they will be the same colour.

c) I take out 2 marbles, they will be different colours.

d) I take out 5 marbles, at least 2 of them will be the same colour.

e) I take out 4 marbles, they will all be different colours.

Certain

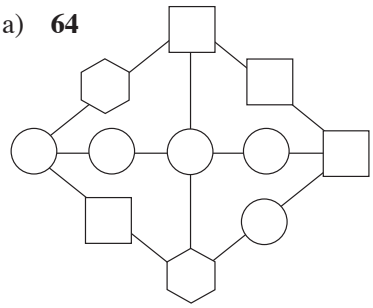
Possible but not certain

Impossible

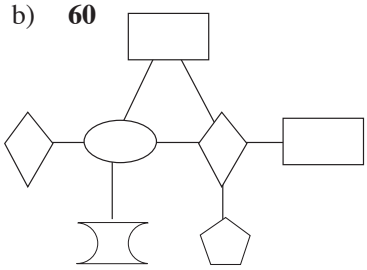
12. The same shape stands for the same 1-digit number greater than 1.

Fill in the numbers if the **product** of the numbers along each line equals:

a) **64**



b) **60**



PROBLEM SOLVING - SOLUTIONS

1. *Question and Solution*

Complete the table. Write down the rule in different ways.

a	4	5	2	1	3	4	2	1	8	8	1	2	0	0 *
b	3	5	1	6	5	2	2	3	1	1	9	2	10	5
c	3	0	7	3	2	4	6	6	1	1	0	6	0	5

Notes

The first four columns give the clue to the 'rule' that is being used. You could make suggestions to the class if they do not quickly see the rule; for example, they could add up each column. Hopefully they will deduce the rule and complete the table.

The crucial part of this question, though, is writing the rule; in its simplest form this is

$$a + b + c = 10$$

but you could also have

$$a = 10 - (b + c) \quad \text{or} \quad b = 10 - (a + c), \text{ etc.}$$

$$a + b = 10 - c, \quad \text{etc.}$$

* Note that the final column has 11 possible answers:

0	0	0	0	0	0	0	0	0	0	0
0	1	2	3	4	5	6	7	8	9	10
10	9	8	7	6	5	4	3	2	1	0

This could be a discussion point with the class review.

---

2. *Question and Solution*

Colour the flags in different ways, using red, white and green.

On each flag, a colour may be used once and only once.

Notes

It is important to encourage your students to be systematic rather than to guess.

For example, if you choose the first colour as RED, then there is a choice of WHITE or GREEN, giving two possibilities.

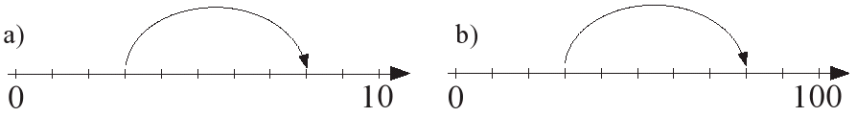
Similarly, starting with WHITE, and starting with GREEN, giving SIX possibilities, namely

R	R	W	W	G	G
W	G	R	G	R	W
G	W	G	R	W	R

---

3. *Question and Solution*

Write equations and inequalities about each jump along the number line.



3 <5 8	30 <50 80
3 + 5 = 8	30 + 50 = 80
8 >5 3	80 >50 30
8 − 5 = 3	80 - 50 = 30

Notes

Students should write in the numbers at the points marked on each line, i.e.

a) 1, 2, 3, 4, 5, 6, 7, 8, 9

b) 20, 30, 40, 50, 60, 70, 80, 90

This question reinforces the different ways of showing an equation/inequality to illustrate this jump.

Note also that the statement in part b) is essentially the same as in part a) except that 3 is replaced by 30, 5 by 50 and 8 by 80, as the jump is now from 30 to 80 rather than 3 to 8.

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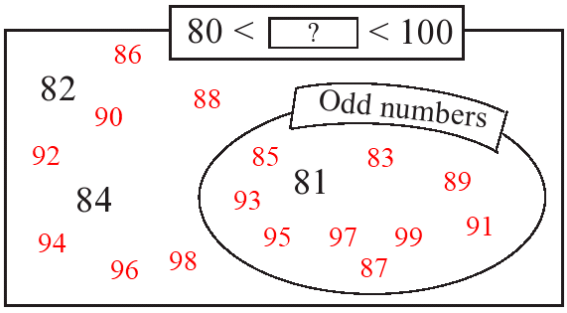
4. *Question and Solution*

Which numbers make the inequality true?

Write them in the correct places on the diagram.



Notes

This diagram is known as a Venn diagram; these are very useful ways of illustrating different sets of numbers. (The Venn diagram is named after the Rev John Venn who introduced them in a paper published in 1880.) The interior of the oval part of the diagram symbolically represents the elements of the set, while the exterior represents elements that are not members of the set.

The numbers that must be put in the Venn diagram are given by

$$80 < \quad ? \quad < 100$$

which means 81, 82, 83, . . . , 98, 99 (? is a whole number greater than 80 and less than 100.)

All the odd numbers, that is,

$$81,\ 83,\ 85,\ 87,\ 89,\ 91,\ 93,\ 95,\ 97,\ 99$$

are placed *inside* the oval shape as they are odd numbers between 80 and 100.

The remaining (even) numbers,

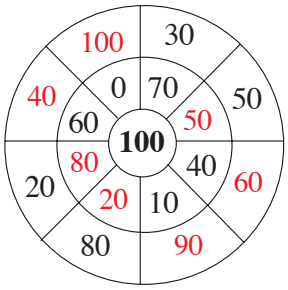
$$82,\ 84,\ 86,\ 88,\ 90,\ 92,\ 94,\ 96,\ 98$$

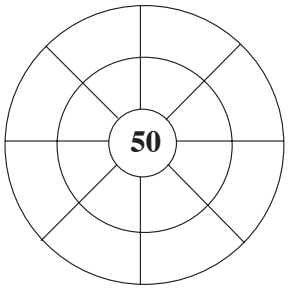
are placed *outside* the oval.

---

5. *Question and Solution*

Fill in the missing numbers.





Notes

The RULE for the first diagram is

'outer number' + 'inner number' = 100

This leads to the answers above.

For the second diagram, we could use the RULE

'outer number' + 'inner number' = 50

which gives many possible answers, for example,

25 + 25 = 50, 10 + 40 = 50, 0 + 50 = 50, 20 + 30 = 50, etc.

Enterprising students might, though, choose a different RULE; for example

'outer number' - 'inner number' = 50

giving

60 – 10 = 50, 100 – 50 = 50, etc.

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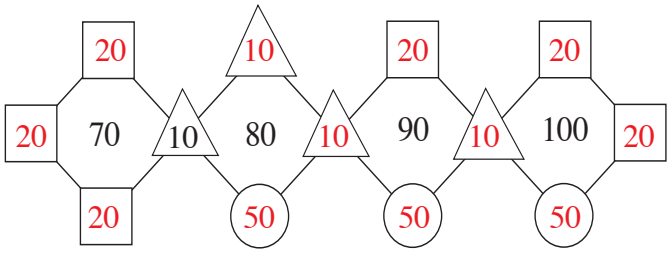
6. *Question and Solution*

The same shape means the same number.

The sum of the 4 numbers at the corners equals the middle number.



Notes

Agaiin, this is really an algebraic problem but we can use logic to determine the solution.

Considering the '70' on the LHS,

$\square + \square + \square + 10 = 70$

$\square + \square + \square = 60$

3 lots of $\square = 60 \Rightarrow \square = 60 \div 3 \Rightarrow \square = 20$

Noting that there is $\boxed{1}$ in the middle, we can look for combinations to give a total of 10, that is

$$6 + 4$$

$$5 + 5$$

$$4 + 6$$

(a total of 3 on the RHS or LHS will not give a solution as there are no totals of 7). This will give a total of

$$\underset{(6+4)}{2} + \underset{(5+5)}{2} + \underset{(3+6)}{9} = 13$$

different routes!

---

7. *Question and Solution*

I thought of a number. I multiplied it by 3, then divided by 6 and got 2.
What was the number I first thought of? $\boxed{4}$

Notes

We can deduce the answer by working backwards from the final answer, 2, and using the 'reverse' operations; that is,

$$2 \times 6 = 12$$

$$12 \div 3 = 4$$

So the answer is 4.

(*Check*: $4 \times 3 = 12$, $12 \div 6 = 2$)

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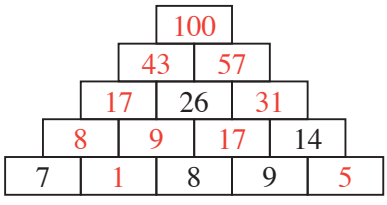
8. *Question and Solution*

Each number is the **sum** of the 2 numbers directly below it

Fill in the missing numbers.



Notes

Start with the bottom right hand space where the missing number can be easily calculated as 5 $(14 = 9 + 5)$. Also, $8 + 9 = 17$, so 17 can be inserted.

Next, $26 - 17 = 9$ and 9 is written to the left of 17; $9 - 8 = 1$, so 1 can be inserted on the bottom row.

As $7 + 1 = 8$, 8 can be inserted on the second to bottom row. This row is now complete.

For the LHS of the middle row, $8 + 9 = 17$ so 17 is inserted.

For the RHS of the middle row, $17 + 14 = 31$ so 31 is inserted.

In a similar way, the next row is given by $17 + 26 = 43$ and $26 + 31 = 57$.

Finally, the topmost number is given by $43 + 57 = 100$.

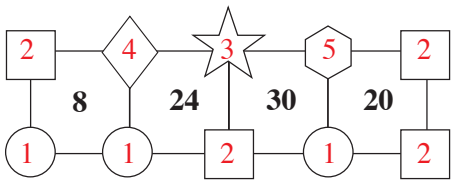
---

9. *Question and Solution*

The same shape means the same number. Choose from 1, 2, 3, 4 or 5.

The middle number is the **product** of the 4 numbers around it.

Fill in the missing numbers.



Notes

The method here is to use the factors of the numbers given. (A factor is a whole number which divides exactly into a whole number, leaving no remainder.)

Starting with the '20', there are only two ways of writing the factors with two the same, that is,

$$20 = 2 \times 2 \times 5 \times 1 \quad \text{or} \quad 20 = 1 \times 1 \times 5 \times 4$$

But if $\square = 1$, then $\hexagon$ and $\bigcirc = 5$ and 4, but this would not work in the first '8'.

Hence we take

$$\square = 2$$

and in the '8', we use $8 = 2 \times 4 \times 1 \times 1$, giving

$$\bigcirc = 1 \text{ and } = 4$$

Now consider the '24', using $24 = 4 \times 1 \times 2 \times 3$.

Clearly,

$$= 3$$

and for '30', using $30 = 3 \times 2 \times 1 \times 5$, so

$$\hexagon = 5$$

Finally we can check the '20' with

$$20 = 5 \times 1 \times 2 \times 2$$

So we have the solution,

$\square = 2$, $\bigcirc = 1$, $\diamond = 4$, $\star = 3$ and $\hexagon = 5$

10. *Question and Solution*

Use the digits 1, 2, 3 and 4 to make pairs of 2-digit numbers.
Each digit can be used only once in every pair, but can be in any order.

An example of such a pair is: 21 and 34.

a) Which pairs have the largest **sum**?

	3	2	+	4	1	=	7	3
and	3	1	+	4	2	=	7	3

b) Which pairs have the smallest

	3	1	−	2	4	=		7
and			−			=		

Now ask,

"What happens if A has TWO balls?"

Notes

This is actually the same problem with B now having only ONE ball - hence there will be three answers, WG/R, RG/W and WR/G.

Note that this leaves one column with *no* entry.

Sometimes extra spaces or insufficient spaces for answers are given, to make learners think!

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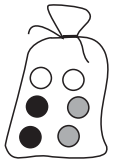
11. *Question and Solution*



There are 2 white, 2 black and 2 striped marbles in a bag.
The bag is tied with cord and you cannot see inside.

Join up the statements on the left to the labels on the right.

How certain can I be that if, with my eyes shut:

a) I take out 1 marble, it will be black.

b) I take out 2 marbles, they will be the same colour.

c) I take out 2 marbles, they will be different colours.

d) I take out 5 marbles, at least 2 of them will be the same colour.

e) I take out 4 marbles, they will all be different colours.

Certain

Possible but not certain

Impossible

Notes

This question introduces your students to the beginnings of probability. They have to read the statements carefully and decide which of

Certain | Possible but not certain | Impossible

is most appropriate in each case.

a) This is Possible but not certain as there are also white and striped marbles.

b) Again, this is Possible but not certain as I could take out 2 WHITE or 2 BLACK or 2 STRIPED marbles but also 1 BLACK and 1 WHITE.

c) This is also Possible but not certain as explained in b).

d) As there are only 3 colours, if I take out 5 marbles I am certain to have two of the same colour (in fact I will have 2 colour repeats). Here this event is Certain.

e) The marbles taken out cannot all be of different colours as there are only 3 colours and I am taking out 4 marbles. Hence the event is Impossible.

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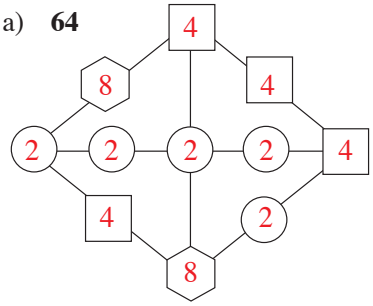
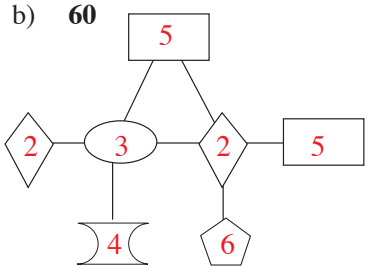
12. *Question and Solution*

The same shape stands for the same 1-digit number greater than 1.
Fill in the numbers if the **product** of the numbers along each line equals:

a) **64**



b) **60**



Notes

This question can be answered using logic and rigour.

a) The $\square$ must be 4 as only $4 \times 4 \times 4 = 64$ (topmost diagonal on RHS)

It is also clear that $\bigcirc \times \bigcirc \times \bigcirc \times \bigcirc \times 4 = 64$.

$$\bigcirc \times \bigcirc \times \bigcirc \times \bigcirc = 64 \div 4 = 16$$

So $\bigcirc = 2$ and we can see that $\hexagon = 8$.

b) As $\diamond$ is repeated is must be 2, giving $\mathrel{\rotatebox{90}{$\bigcirc$}}$ and $\square$ as 3 and 5.

In fact, we can determine the solutions that work, namely

$\diamond = 2$, $\mathrel{\rotatebox{90}{$\bigcirc$}} = 3$, $\square = 5$, $\supset\subset = 4$, $\pentagon = 6$

or

$\diamond = 2$, $\mathrel{\rotatebox{90}{$\bigcirc$}} = 5$, $\square = 3$, $\supset\subset = 4$ but $\pentagon = 10$

Mathematics Enhancement Programme

TEACHING SUPPORT: Book 2

INTRODUCTION TO LESSON PLANS

Detailed Lesson Plans* have been developed to be used as guidance for *MEP Primary* teaching. They are based on

4 × 45 minute lessons per week for 35 weeks

The online Revision Questions are for you to use for learners' practice and revision, perhaps for the fifth lesson of the week or for homework.

The Lesson Plans have been adapted from the Eastern European approach to mathematics teaching. The first few weeks of the course provide introductory activities to help you assess the capabilities of your class and to bring them together at a suitable starting point for the systematic treatment.

The course provides a very strong mathematical foundation, dealing with topics in depth and in a logical sequence, and using appropriate notation. It provides the necessary background in mathematical logic, aiming to give enhanced attainment in national tests and a solid framework for higher level work.

The Lesson Plans make reference to:

- Practice Books (e.g. *Practice Book 2*)

and make use of a range of resources:

- number cards (0 to 9)
- symbol cards (=, <, >, ≤, ≥, +, −, ×, ÷, ≠)
- shape cards (◯, △, □, ⬠, ⬡ / large and small / black and white
- number lines (−9 to 0, 0 to 9, 10 to 20, 0 to 100)
- number strips or rods or plastic cubes stuck together
- dominoes
- toy money
- coloured counters
- coloured sticks/straws

Reference is made to a number of A2 posters *. We would also like you to encourage learners to collect their own materials for use in maths lessons (e.g. pebbles, shells, buttons, sweets, trinkets) to make maths more relevant to them individually.

* online at http://www.cimt.org.uk/projects/mepres/primary/index.htm

Year	Week beginning	Wk	*Order of Topics*
	Sept		Familiarisation with Book2 resources.
		1.	Revision: numbers to 20. Addition and subtraction
		2.	Addition and subtraction in context; missing signs
		3.	Measurement: length, capacity, mass
	Oct	4.	Plane shapes: use of logic sets. Simple combinatoric problems
		5.	Addition with equal numbers: preparation for multiplication and division
		6.	Extending number line to 100. Writing and reading numbers on the number line; ordering; money
			Half Term
	Nov	7.	Number sequences: adding, subtracting in 10's and 5's
		8.	Counting by 10, 5, 2; addition with 10's
		9.	Ordering 2-digit numbers; creating 2-digit numbers from 3 or 4 digits
		10.	Addition/subtraction with whole tens, and 1-digit numbers to whole tens
		11.	Addition/subtraction of 1-digit (and 2-digit) to 2-digit numbers without tens crossing
	Dec	12.	Addition/subtraction of 1-digit (and 2-digit) numbers to 2-digit numbers with tens crossing
		13.	Revision and practice: numbers 0 to 100. Addition/subtraction of 2-digit numbers
			Christmas
	Jan	14.	Measurement: estimation and units up to 1 m (100 cm)
		15.	Geometry: rectangle, square
		16.	Capacity: litres and centilitres
		17.	Mass: estimation, comparison
	Feb	18.	Revision and practice
		19.	Multiplication and division in context (2, 5 and 10). Multiplication tables 10, 2 and 5
			Half Term
		20.	Multiplication and division table for 3
	Mar	21.	Revision and practice
		22.	Multiplication and division table for 4. Relationship with 2 (and 8)
		23.	Decomposing numbers into sums and products
		24.	Geometry: reflection, enlargement
		25.	Multiplication and division table for 6. Relationship with 3 and 2 (and 9)
	Apr		**Easter**
		26.	Multiplication and division table for 9
		27.	Operations in context
	May	28.	Multiplication and division tables for 7 and 8
		29.	Fractions: half, quarter, three quarters, etc.
		30.	Division with remainders in context
		31.	Revision and practice. Probability: dice
			Half Term
	Jun	32.	Division by 2, 3, ..., 9
		33.	Extending the number line: counting above 100
		34.	Hundreds, tens and units
		35.	Revision and practice. Puzzles and challenges
	Jul		

Book 2 Contents Page
Lessons 113 to 140