

Mathematics Enhancement Programme (MEP)

PRIMARY Book 1

Support for Parents, Carers and Teachers

General Overview

Learning Objectives with Illustrative Examples

Key Facts and Glossary

Problem Solving Examples with solutions

Lesson Plans summary

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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 1*****LEARNING OBJECTIVES***

At the end of Book 1 we expect learners to

- *use numbers up to 20 with confidence*
- *put a set of numbers in increasing or decreasing order*
- *be able to add/subtract numbers up to 20, including number bonds up to and including 20*
- *understand the meaning and use of the equality sign (=) and the inequality signs (<, ≤, >, ≥) with numbers up to 20*
- *solve and illustrate simple addition and subtraction calculations*
- *understand the meaning of 'more' and 'less'*
- *understand the use and concept of mirror image of a shape*
- *measure straight lines (in cm)*
- *use money (pence) in simple calculations*
- *be able to identify shapes that are the same*
- *be able to identify squares, rectangles, triangles and circles*
- *understand calendars, including days of the week, months and years*
- *identify clock hours, including am/pm,*

Mathematics Enhancement Programme

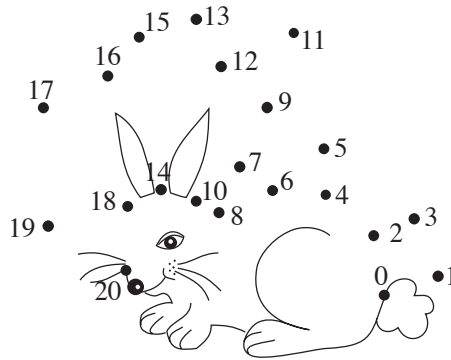
TEACHING SUPPORT: Book 1

LEARNING OBJECTIVES with ILLUSTRATIVE EXAMPLES (and Answers appended)

At the end of Book 1 we expect learners to be confident with the following concepts.

- *Use numbers up to 20 with confidence*
- *Put a set of numbers in increasing or decreasing order*

Example 1 a) Join up the **even** numbers in **increasing** order.



b) Write out the **odd** numbers in **decreasing** order.

- *Be able to add/subtract numbers up to 20, including number bonds up to and including 20*

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

$$a + b = 14 \quad a = \square \square \square \square \quad b = \square \square \square \square$$

a	2	9	1	12	14	10	5	8
b	10	7	14	8	1	3	11	

- *Understand the meaning and use of the equality sign (=) and the inequality signs (<, ≤, >, ≥) with numbers up to 20*

Example 3 Fill in the missing signs. (< less than; > more than; = equal to)

$5 \square 8$	$9 \square 14$	$16 \square 13$
$2 + 7 \square 3 + 6$	$4 + 5 \square 6 + 7$	$10 + 3 \square 1 + 11$
$8 - 1 \square 15 - 12$	$6 + 8 \square 17 - 3$	$4 + 14 \square 13 + 3$





- Solve and illustrate simple addition and subtraction calculations

Example 4 Fill in the missing numbers.

$$\begin{array}{cccc}
 7 + 7 = \boxed{} & 10 - 9 = \boxed{} & 8 + 5 = \boxed{} & 20 - \boxed{} = 15 \\
 7 + 8 = \boxed{} & 15 - 9 = \boxed{} & 8 + \boxed{} = 15 & 5 + 15 = \boxed{} \\
 6 + \boxed{} = 14 & 10 - \boxed{} = 5 & 10 - \boxed{} = 6 & 15 - \boxed{} = 10 \\
 9 + \boxed{} = 15 & \boxed{} - 15 = 5 & \boxed{} - 8 = 7 & 20 - 5 = \boxed{}
 \end{array}$$

- Understand the meaning of 'more' and 'less'

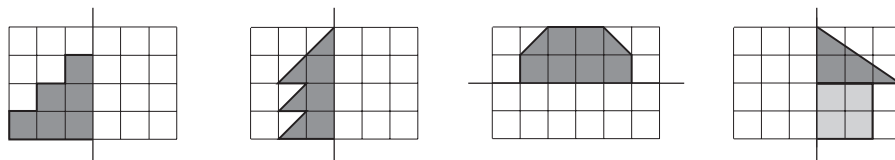
Example 5 Draw **less** objects and **more** objects than the number in the middle.

		
		4
		
		3

- Understand the use and concept of mirror image of a shape







Example 6 Put a mirror on the line. What does the picture look like?

Draw what you can see in the mirror.



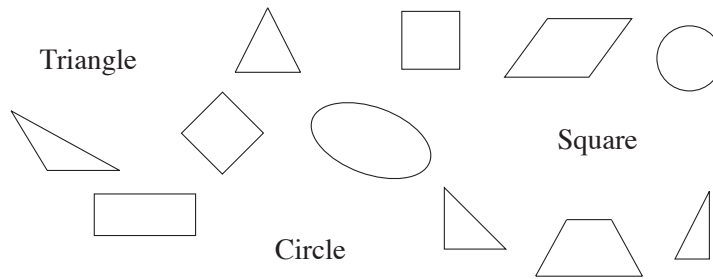
- Measure straight lines (in cm)
- Use money (pence) in simple calculations

Example 7 Colour in as much money as you need to pay for the sweets.

 <div style="border: 1px solid black; padding: 2px; display: inline-block;">20 p</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 10p 1p 1p 1p 1p 1p 1p 1p </div>	 <div style="border: 1px solid black; padding: 2px; display: inline-block;">15 p</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 10p 1p 1p 1p 1p 1p 1p 1p </div>
 <div style="border: 1px solid black; padding: 2px; display: inline-block;">12 p</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 10p 1p 1p 1p 1p 1p 1p 1p </div>	 <div style="border: 1px solid black; padding: 2px; display: inline-block;">18 p</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 10p 1p 1p 1p 1p 1p 1p 1p </div>
 <div style="border: 1px solid black; padding: 2px; display: inline-block;">16 p</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 10p 1p 1p 1p 1p 1p 1p 1p </div>	 <div style="border: 1px solid black; padding: 2px; display: inline-block;">19 p</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 10p 1p 1p 1p 1p 1p 1p 1p </div>

- **Be able to identify squares, rectangles, triangles and circles**

Example 8 Join up the names to the correct shapes.



- **Understand calendars, including days of the week, months and years**

Example 9

a) How many months are there in one year?

b) Which is the:

4th month

7th month

10th month?

c) Which month is:

February

July

November?

Example 10 Jim, Tom and Jane were born in the same year.

Jim's birthday is on 2nd June, Tom's birthday is on the 7th June and Jane's birthday is on the 10th June.

How many days are there between:

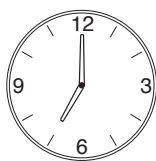
a) Jim's and Tom's birthdays

b) Tom's and Jane's birthdays

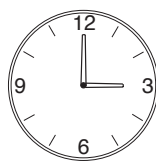
c) Jim's and Jane's birthdays?

- **Identify clock hours, including am/p**

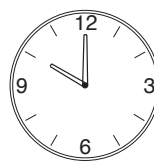
Example 11 Write down the time shown by each clock.



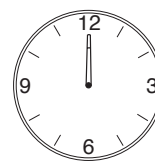
..... o'clock



..... o'clock



..... o'clock

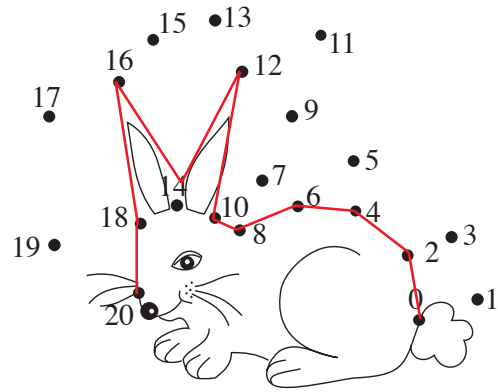


..... o'clock

LEARNING OBJECTIVES EXAMPLES: Answers

Example 1

- a) Join up the **even** numbers in **increasing** order.
- b) Write out the **odd** numbers in **decreasing** order.



19, 17, 15, 13, 11, 9, 7, 5, 3, 1

Example 2

Complete the table.

$$a + b = 14 \quad a = 14 - b \quad b = 14 - a$$

Write down the rules in different ways.

<i>a</i>	2	4	7	9	1	0	6	12	14	13	10	11	3	5	8
<i>b</i>	12	10	7	5	13	14	8	2	0	1	4	3	11	9	6

Example 3

Fill in the missing signs. (< less than; > more than; = equal to)

$5 \boxed{<} 8$

$9 \boxed{<} 14$

$16 \boxed{>} 13$

$2 + 7 \boxed{=} 3 + 6$

$4 + 5 \boxed{<} 6 + 7$

$10 + 3 \boxed{>} 1 + 11$

$8 - 1 \boxed{>} 15 - 12$

$6 + 8 \boxed{=} 17 - 3$

$4 + 14 \boxed{>} 13 + 3$

Example 4

Fill in the missing numbers.

$7 + 7 = \boxed{1} \boxed{4}$

$10 - 9 = \boxed{1}$

$8 + 5 = \boxed{1} \boxed{3}$

$20 - \boxed{5} = 15$

$7 + 8 = \boxed{1} \boxed{5}$

$15 - 9 = \boxed{6}$

$8 + \boxed{7} = 15$

$5 + 15 = \boxed{2} \boxed{0}$

$6 + \boxed{8} = 14$

$10 - \boxed{5} = 5$

$10 - \boxed{4} = 6$

$15 - \boxed{5} = 10$

$9 + \boxed{6} = 15$













$\boxed{2} \boxed{0} - 15 = 5$

$\boxed{1} \boxed{5} - 8 = 7$

$20 - 5 = \boxed{1} \boxed{5}$

Example 5

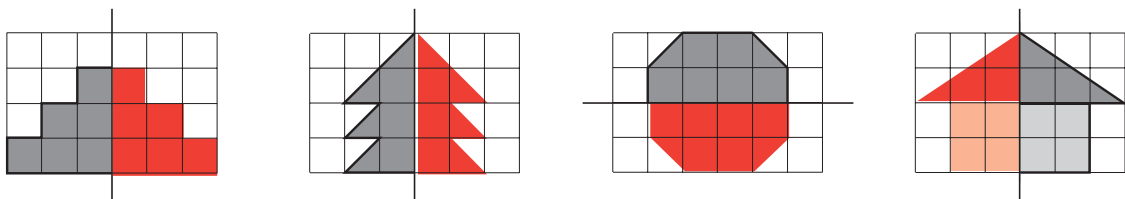
Draw **less** objects and **more** objects than the number in the middle.

Less		More
		
 3	 4	 5
		
 2	 3	 4

Example 6


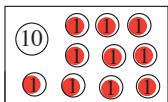
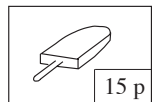
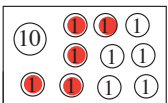
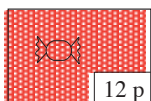
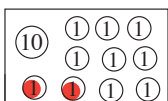
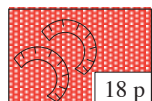
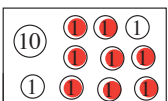
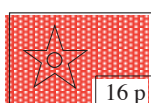
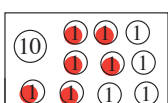

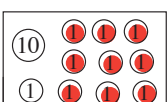
Put a mirror on the line. What does the picture look like?

Draw what you can see in the mirror.



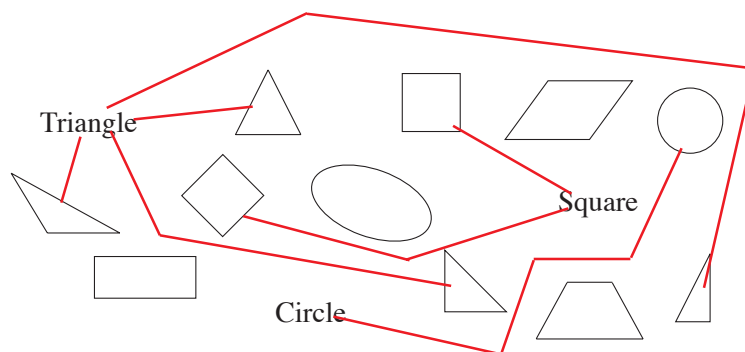
Example 7

Colour in as much money as you need to pay for the sweets.

 20 p		 15 p	
 12 p		 18 p	
 16 p		 19 p	

Example 8

Join up the names to the correct shapes.



Example 9

a) How many months are there in one year?

12

b) Which is the:

4th month

April

7th month

July

10th month?

October

c) Which month is:

February

2nd

July

7th

November?

11th

Example 10

Jim, Tom and Jane were born in the same year.

Jim's birthday is on 2nd June, Tom's birthday is on the 7th June and Jane's birthday is on the 10th June.

How many days are there between:

a) Jim's and Tom's birthdays

4

b) Tom's and Jane's birthdays

2

c) Jim's and Jane's birthdays?

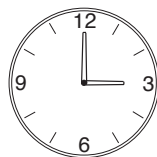
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Example 11

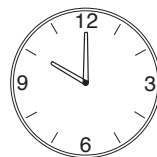
Write down the time shown by each clock.



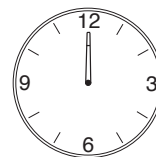
...7... o'clock



...3... o'clock



...10... o'clock



...12... o'clock

Mathematics Enhancement Programme: BOOK 1***KEY FACTS and GLOSSARY***

Calendar
Counting numbers
Direction
Equals
Even/odd
Increasing/decreasing sequences
Inequalities
Integers (or whole numbers)
Mirror lines
Number bonds
Number lines
Roman numerals
Shapes

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, $2 + 2 = 3 + 1 (= 4)$

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' (+ 3)

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

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 '≥' 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).

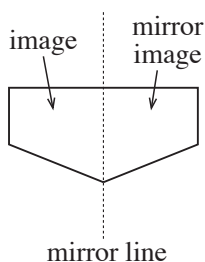
Similarly, '≤' means 'is more than or is equal to'.

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

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

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

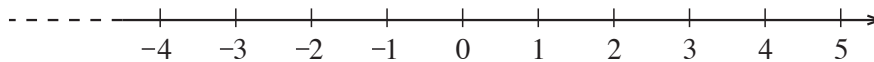
$$5 + 7 = 12, \quad 6 + 6 = 12, \quad 7 + 5 = 12, \quad 8 + 4 = 12, \quad 9 + 3 = 12,$$

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

Number lines

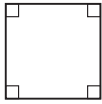
Numbers can be easily represented on a number line.

For example,

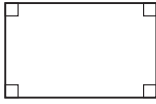
**Roman numerals**

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

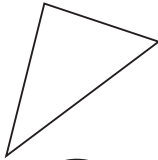
Shapes



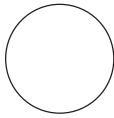
Square (all sides equal and four right angles)



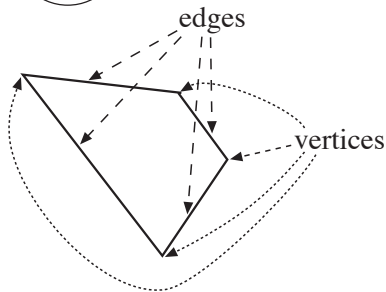
Rectangle (opposite sides equal and parallel and four right angles)



Triangle (3 straight sides)

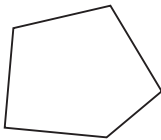


Circle

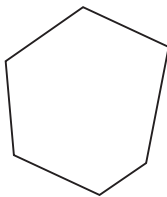


Quadrilateral - any shape with 4 straight sides (note that the sides are called *edges* and meet at *vertices*).

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



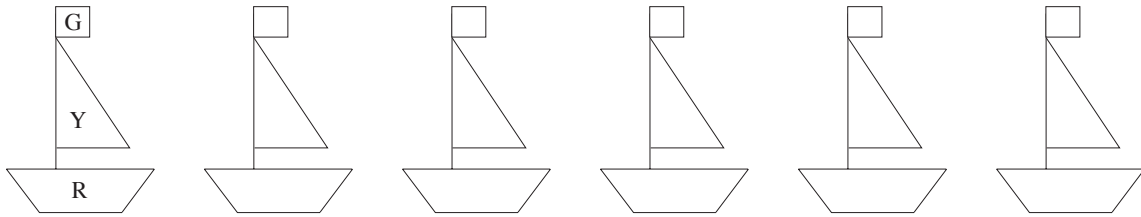
Pentagon - any shape with 5 straight edges (sides)



Hexagon - any shape with 6 straight edges (vertices)

PROBLEM SOLVING

1. Colour the boats in different ways. Use green, yellow and red.



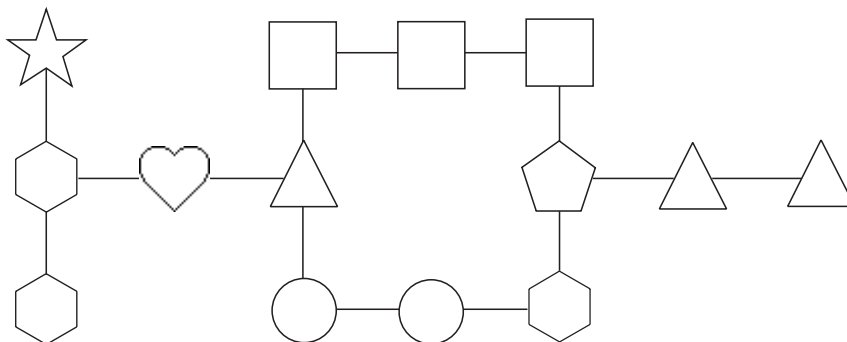
2. How many different results can be found? Use + or - signs.

a) $2 \square - 2 \square + 1 = \square$
 $2 \square - 2 \square + 1 = \square$
 $2 \square - 2 \square + 1 = \square$

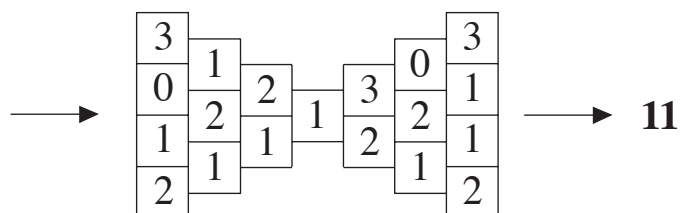
b) $3 \square - 2 \square + 1 = \square$
 $3 \square - 2 \square + 1 = \square$
 $3 \square - 2 \square + 1 = \square$
 $3 \square - 2 \square + 1 = \square$

3. Divide the number 9 into three parts. **Do not use 0.**

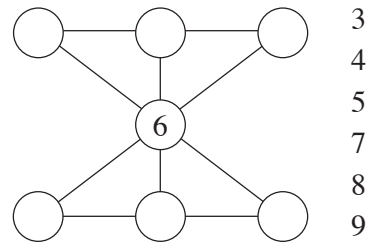
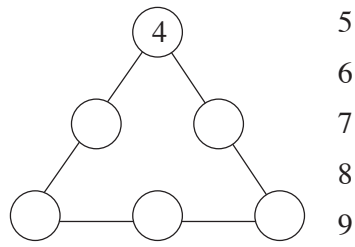
The same shape stands for the same number.



4. Find ways through the maze so that the sum of the numbers used is 11.



5. Write the numbers in the correct places so that the sum of the 3 numbers on each line will be 18.



6. Show different ways to share a red ball (R), a white ball (W) and a green ball (G) between Ann and Bob.

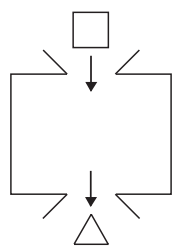
A	(R)								
B	(W)	(G)							

7. Complete the drawings to match the signs.

<input type="text"/> \geq <input type="text"/>	<input type="text"/> \geq <input type="text"/>	<input type="text"/> = <input type="text"/>	<input type="text"/> \geq <input type="text"/>

Write in the missing numbers.

8. What is the machine doing? Complete the table and write down the rule.



<input type="text"/>	4	5	8	3	9	6	7		
Δ	1	2	5					6	7

$\Delta =$ =

9. Which numbers could be hidden under the cards? (0, 1, 2, 3, 4, 5)

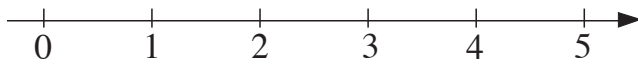
For example: $\square \leq 3$ gives \square : 0, 1, 2, 3



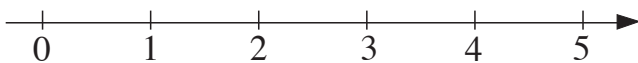
a) $\square < 5$ \square :



b) $\square \geq 2$ \square :

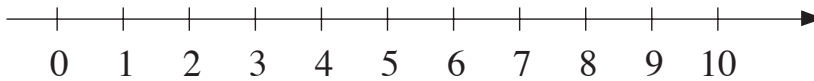


c) $2 \leq \square < 5$ \square :

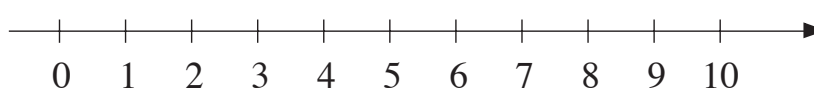


10. Write down the answers. Mark them with dots on the number line.

a) $10 - 3 > \bigcirc > 2 + 3$ \bigcirc :

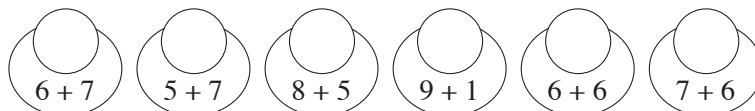
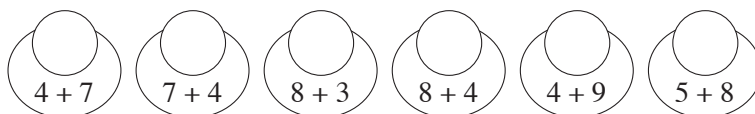


b) $1 + 2 < \triangle < 9 - 1$ \triangle :



11. Write the sums into the circles. Colour the shapes as shown.

Even: \bigcirc Y Odd: \bigcirc R Greater than 12: \smile Smaller than 12: \smile



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

$a + b = 14$ $a =$ $b =$

a	0		2			5	6			9			12		14
b		13		11	10			7	6		4	3		1	

13. Which numbers can be written instead of the letters so that the inequalities are correct?
Join each solution to the matching number line.

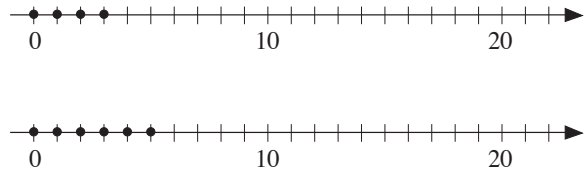
$13 + p \leq 16$ $p:$

$10 + a < 16$ $a:$

$16 - r > 12$ $r:$

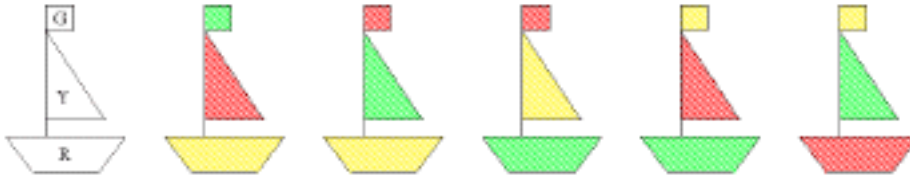
$b + b < 11$ $b:$

$s + 16 < 20$ $s:$



PROBLEM SOLVING - SOLUTIONS**1. Question and Solution**

Colour the boats in different ways. Use green, yellow and red.

*Notes*

This is an ideal question to encourage systematic thinking rather than just random colouring in. After completing the colouring-in of the first boat, ask,

"Is there another solution with G on the flag?"

This will give the 'GRY' solution. Continue with:

"Now colour the flag R; what solutions are there?"

This gives 'RGY' and 'RYG'. Continue:

"What other colour can the flag be?"

This gives R and eventually the solutions 'YRG' and 'YGR'.

2. Question and Solution

How many different results can be found? Use + or – signs.

$$\text{a) } 2 \begin{array}{|c|} \hline + \\ \hline \end{array} 2 \begin{array}{|c|} \hline + \\ \hline \end{array} 1 = \begin{array}{|c|} \hline 5 \\ \hline \end{array}$$

$$2 \begin{array}{|c|} \hline + \\ \hline \end{array} 2 \begin{array}{|c|} \hline - \\ \hline \end{array} 1 = \begin{array}{|c|} \hline 3 \\ \hline \end{array}$$

$$2 \begin{array}{|c|} \hline - \\ \hline \end{array} 2 \begin{array}{|c|} \hline + \\ \hline \end{array} 1 = \begin{array}{|c|} \hline 1 \\ \hline \end{array}$$

$$\text{b) } 3 \begin{array}{|c|} \hline + \\ \hline \end{array} 2 \begin{array}{|c|} \hline + \\ \hline \end{array} 1 = \begin{array}{|c|} \hline 6 \\ \hline \end{array}$$

$$3 \begin{array}{|c|} \hline + \\ \hline \end{array} 2 \begin{array}{|c|} \hline - \\ \hline \end{array} 1 = \begin{array}{|c|} \hline 4 \\ \hline \end{array}$$

$$3 \begin{array}{|c|} \hline - \\ \hline \end{array} 2 \begin{array}{|c|} \hline + \\ \hline \end{array} 1 = \begin{array}{|c|} \hline 2 \\ \hline \end{array}$$

$$3 \begin{array}{|c|} \hline - \\ \hline \end{array} 2 \begin{array}{|c|} \hline - \\ \hline \end{array} 1 = \begin{array}{|c|} \hline 0 \\ \hline \end{array}$$

Notes

Again, encourage learners to work systematically to find the solution. Note that there is one possible missing combination,

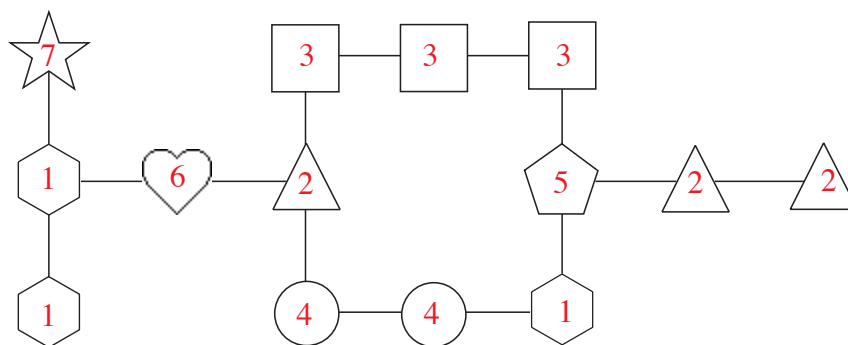
$$2 \begin{array}{|c|} \hline \square \\ \hline \end{array} 2 \begin{array}{|c|} \hline \square \\ \hline \end{array} 1$$

but this leads to the answer $\begin{array}{|c|} \hline \square \\ \hline \end{array}$. Discuss with the learners if you think that they will understand the concept of negative numbers (you could use temperature as an example, or land/sea level).

3. Question and Solution

Divide the number 9 into three parts. **Do not use 0.**

The same shape stands for the same number.



Notes

There are many ways to solve this problem ranging from using logic to trial and improvement. The first stage is to note that the top horizontal lines give

$$3 + 3 + 3 \quad (= 9)$$

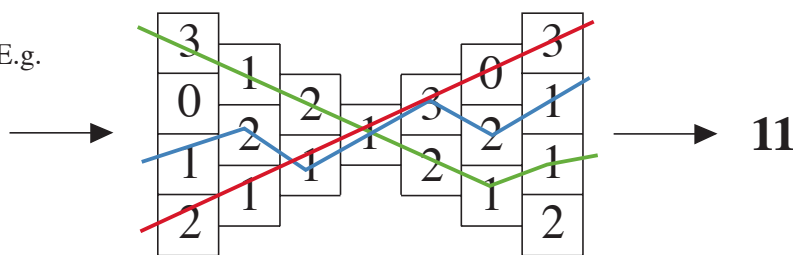
so $\square = 3$. The next stage is the crucial one. As there are three triples with 2 shapes the same, these must be $1 + 1 + 7$, $2 + 2 + 5$ and $4 + 4 + 1$ as there are no others. If you look at these digits you will see that the number 1 occurs three times. Now look at the three rows/ columns that must represent these combinations of numbers. You can see that only the hexagon occurs three times, so

$\text{Hexagon} = 1$ and the rest of the solution now follows.

4. Question and Solution

Find ways through the maze so that the sum of the numbers used is 11.

E.g.



Notes

Whilst you can use trial and improvement, a more systematic method is to consider the LHS and RHS. This gives the possible combinations,

LHS	RHS
$3 + 1 = 2 \quad (= 6)$	$3 + 0 + 3 \quad (= 6)$
$0 + 1 + 2 \quad (= 3)$	$3 + 0 + 1 \quad (= 4)$
$0 + 2 + 2 \quad (= 4)$	$3 + 2 + 1 \quad (= 6)$
$0 + 2 + 1 \quad (= 3)$	$3 + 2 + 1 \quad (= 6)$
$1 + 2 + 2 \quad (= 5)$	$2 + 2 + 1 \quad (= 5)$
$1 + 2 + 1 \quad (= 4)$	$2 + 2 + 1 \quad (= 5)$
$1 + 1 + 1 \quad (= 3)$	$2 + 1 + 1 \quad (= 4)$
$2 + 1 + 1 \quad (= 4)$	$2 + 1 + 2 \quad (= 5)$

Noting that there is 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

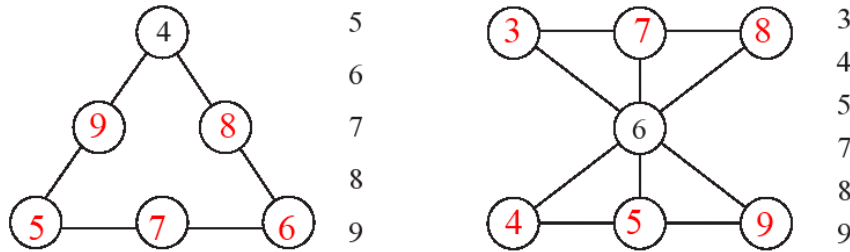
$$2 + 2 + 9 = 13$$

$$(6 + 4) \quad (5 + 5) \quad (3 + 6)$$

different routes!

5. Question and Solution

Write the numbers in the correct places so that the sum of the 3 numbers on each line will be 18.



Notes

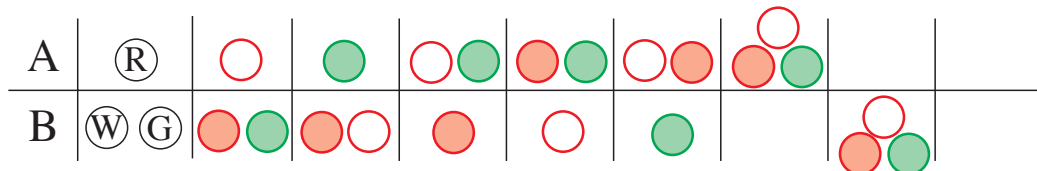
In the LHS diagram, we first need to find pairs of numbers that sum to $18 - 4 = 14$; we have

$$9 \text{ and } 5 \quad \text{and} \quad 8 \text{ and } 6$$

This leaves 7 to be placed in the centre circle on the horizontal row, and the two other circles must sum to $18 - 7 = 11$. So 5 and 6 will go in these circles and 9 and 8 in the remaining two circles on the sides.

6. Question and Solution

Show different ways to share a Red ball, a White ball and a Green ball between Ann and Rob.



Notes

This is another problem where a systematic approach is better than just randomly trying different answers.

You could ask,

"With just ONE ball for A, are there other answers?"

which should give the answers W/RG and G/RW.

Now ask,

"What happens if A has TWO balls?"

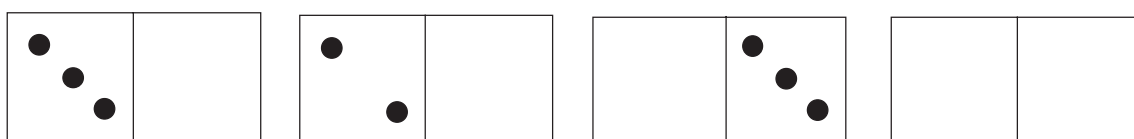
This is actually the same problem with B now having only ONE ball - hence there will be three answers, WG/R, RG/W and WR/G.

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

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

7. Question and Solution

Complete the drawings to match the signs.



$3 > 1$

$2 > 1$

$3 = 3$

$3 > 0$

Write in the missing numbers.

Notes

Note that $\square > \square$ means that the first number is 2 more than the second number.

The last part,

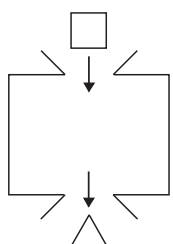
\square is 3 more than \square

can lead to many solutions, 3, 0 or 4, 1 or 5, 2, etc.

You could encourage the class to provide as many answers as possible.

8. Question and Solution

What is the machine doing? Complete the table and write down the rule.



\square	4	5	8	3	9	6	7	9	10
\triangle	1	2	5	0	6	3	4	6	7

$\square - 3$

$\triangle + 3$

Notes

This is another signpost for algebra. You first need to consider how to get from the \square row to the \triangle row.

You can see that 3 is subtracted in each column. So the machine takes away 3 from each of the numbers going into it. That is the straightforward part of the question.

We now need to write down this relationship, namely

$$\triangle = \square - 3$$

How do we get the \square values from the \triangle values? We add 3, so the relationship is

$$\square = \triangle + 3$$

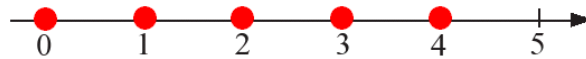
9. Question and Solution

Which numbers could be hidden under the cards? (0, 1, 2, 3, 4, 5)

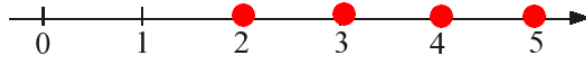
For example: $\boxed{\times} \leq 3$ gives $\boxed{\times} : 0, 1, 2, 3$



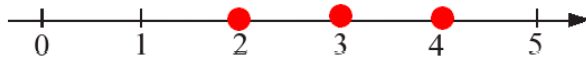
a) $\boxed{\times} < 5$ $\boxed{\times} : 4, 3, 2, 1, 0$



b) $\boxed{\times} \geq 2$ $\boxed{\times} : 2, 3, 4, 5$



c) $2 \leq \boxed{\times} < 5$ $\boxed{\times} : 2, 3, 4$



Notes

This question involves the beginnings of algebra, where you are asked to solve inequalities.

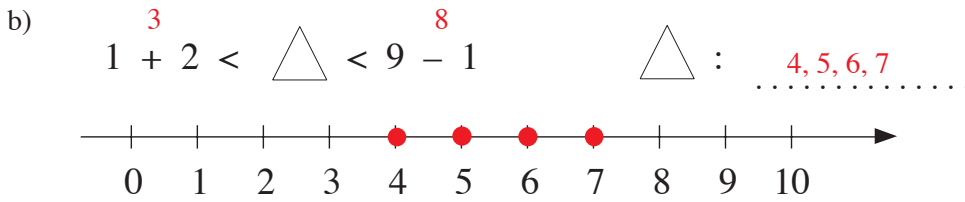
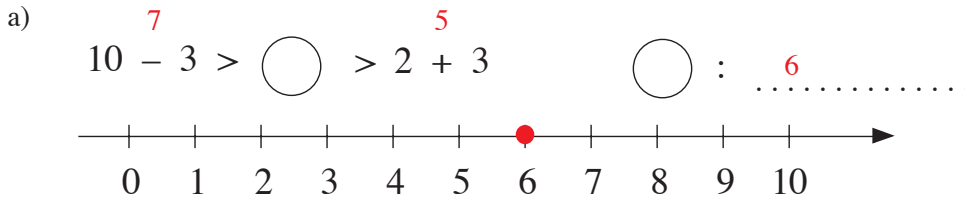
In a), we are asked for any number less than 5, so the answer is 0, 1, 2, 3, 4. (Of course, there are many more answers such as -1 , -2 , $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{2}$, etc. but the question restricts answers to 0, 1, 2, 3, 4, 5.)

In b), we are asked for any number greater than or equal to 2, so the answer is 2, 3, 4, and 5.

For c) we need numbers that are both greater than or equal to 2 *and* less than 5, giving 2, 3, 4.

10. Question and Solution

Write down the answers. Mark them with dots on the number line.



Notes

The crucial first stage is to calculate both the RHS and LHS of each statement.

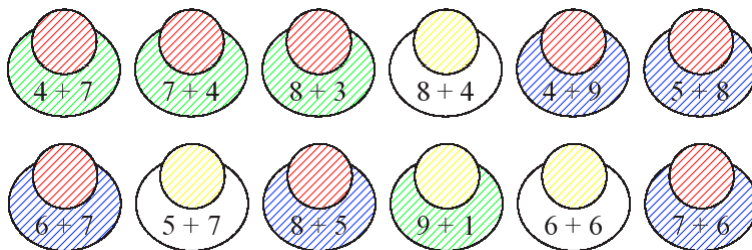
So, in a), $10 - 3 > \bigcirc > 2 + 3$ becomes $7 > \bigcirc > 5$ and hence $\bigcirc = 6$ as it is the only number that satisfies this statement.

Similarly in b), $1 + 2 < \triangle < 9 - 1$ becomes $3 < \triangle < 8$ and hence $\triangle = 4, 5, 6, 7$ as they all satisfy the statement.

11. Question and Solution

Write the sums into the circles. Colour the shapes as shown.

Even: \bigcirc Y Odd: \bigcirc R Greater than 12: \bigcirc Smaller than 12: \bigcirc



Notes

This is a straightforward question - but note that there are three totals of 12

$(8 + 4), (5 + 7), (6 + 6)$ and these are not coloured as the instructions are for 'Greater than 12' and 'Smaller than 12', so 'exactly 12' should not be coloured.

12. Question and Solution

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

$$a + b = 14 \quad a = 14 - b \quad b = 14 - a$$

a	0	1	2	3	2	5	6	7	8	9	10	11	12	13	14
b	14	13	12	11	12	9	8	7	6	5	4	3	2	1	0

Notes

Completion of the table for a and b is straightforward, being based on the number bonds for 14. The two equations are another staging point for later algebra. Try to get your learners to devise the rule (e.g. you subtract b from 14) and then translate this to $a = 14 - b$. Similarly for $b = 14 - a$.

13. Which numbers can be written instead of the letters so that the inequalities are correct? Join each solution to the matching number line.

$13 + p \leq 16$

$p: 0, 1, 2, 3$

$10 + a < 16$

$a: 0, 1, 2, 3, 4, 5$

$16 - r > 12$

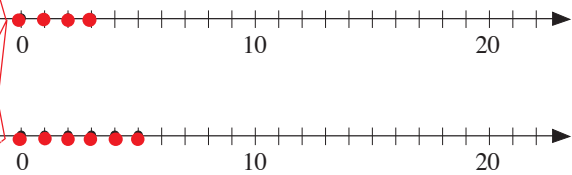
$r: 0, 1, 2, 3$

$b + b < 11$

$b: 0, 1, 2, 3, 4, 5$

$s + 16 < 20$

$s: 0, 1, 2, 3$

*Notes*

These questions look challenging, but one-by-one, there should not be problems. Here is the algebraic approach for the first inequality,

$$13 + p \leq 16$$

If you subtract 13 from both sides,

$$13 + p - 13 \leq 16 - 13$$

$$p \leq 3 \quad (\text{as } 13 - 13 = 0, 16 - 13 = 3)$$

that is,

$$p = 0, 1, 2, 3$$

You can check these answers in the statement:

$13 + 0 = 13 \leq 16$

$13 + 1 = 14 \leq 16$

$13 + 2 = 15 \leq 16$

$13 + 3 = 16 \leq 16$

The other points follow in a similar way.

Mathematics Enhancement Programme

TEACHING SUPPORT: Book 1

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 1*)

and make use of a range of resources:

- number cards (0 to 9)
- symbol cards ($=$, $<$, $>$, \leq , \geq , $+$, $-$, \times , \div , \neq)
- shape cards (\bigcirc , \triangle , \square , \pentagon , \hexagon / 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 Book1 resources.	
		1. Comparisons: ordering e.g. taller, shorter, longer; above, below, to the right/left, behind, between	
		2. Comparison of sets: more, less, equal, many, few.	
		3. Number pictures: less than, more than, equal to, not equal to, in contexts ($<$, $>$, $=$, \neq)	
Oct		4. Identifying, writing and using 0 and 1; number line $\begin{array}{c} + \quad + \\ 0 \quad 1 \end{array}$	
		5. Identifying, writing and using 2; number line $\begin{array}{c} + \quad + \quad + \\ 0 \quad 1 \quad 2 \end{array}$ Writing and using $-$, $+$, $=$	
		6. Comparisons: number pictures; balancing equations and inequalities; $2 > 1$	
		Half Term	
Nov		7. Writing and using 3; number line, practice ($<$, $>$, $+$, $-$, $=$)	
		8. Writing and using 4; number line, number bonds, practice ($<$, $>$, $+$, $-$, $=$)	
		9. Writing and using 5; number line, number bonds, practice ($<$, $>$, $+$, $-$, $=$)	
		10. Revision and practice (0–5)	
		11. Writing and using 6; number line, number bonds, practice ($<$, $>$, $+$, $-$, $=$)	
Dec		12. Writing and using 7; number line, number bonds, practice ($<$, $>$, $+$, $-$, $=$)	
		13. Writing and using 8; number line, number bonds, practice ($<$, $>$, $+$, $-$, $=$)	
		Christmas	
Jan		14. Revision and practice: numbers 0, 1, 2, 3, 4, 5, 6, 7, 8	
		15. Writing and using 9; number line, number bonds, practice ($<$, $>$, $+$, $-$, $=$)	
		16. Writing and using 10; number line, number bonds, practice ($<$, $>$, $+$, $-$, $=$)	
		17. Revision and practice: numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10	
Feb		18. <i>Test</i> . Recognise and distinguish shapes: circle, triangle, square	
		19. Calendar: days, weeks, months, seasons	
		Half Term	
Mar		20. Revision and practice (0–10) <i>Test</i>	
		21. Extending the number line: 0–20. Operations without crossing 10	
		22. Number bonds and sums to 11; practice	
		23. Number bonds and sums to 12; practice	
		24. Number bonds and sums to 13; practice	
Apr		25. Number bonds and sums to 14; practice	
		Easter	
		26. Number bonds and sums to 15; practice	
		27. Revision and practice: numbers 0–15. <i>Test</i>	
May		28. Number bonds and sums to 16 and 17; practice	
		29. Number bonds and sums to 18 and 19; practice	
		30. Number bonds and sums to 20; practice	
		31. Revision and practice: numbers 0–20 <i>Test</i>	
	Half Term		
Jun		32. Measurement: up to 20 cm. Shapes and reflections	
		33. Time: hours, days, months. Ordering, sets. Number sequences. Tables	
		34. Revision and practice. <i>Test</i>	
		35. Revision and practice	
Jul			

Book 1 Contents Page

Lessons 1 to 24

C: Core

E: Extension

Comparisons: To the right (left)	Lesson Plan 1
Comparisons: up, down; forwards, backwards; in front of, behind	Lesson Plan 2
Comparisons: ordering; taller, smaller; longer, shorter	Lesson Plan 3
Comparisons: ordering; e.g. above, below; in front of, behind, between; some combinatorial colouring <i>Sequences</i>	Lesson Plan 4
Comparison of sets: more, less, equal <i>Separating, sequences</i>	Lesson Plan 5
Comparison of sets: more, less, equal (logic set) <i><, = signs</i>	Lesson Plan 6
Comparison: more, less, equal (Cuisenaire rods) <i>The most, slowest, longest; measuring length</i>	Lesson Plan 7
Comparison of sets: more, less, equal <i>Not more, not less, not equal</i>	Lesson Plan 8
Less than, more than, equal to, not equal to <i><, >, ≤, ≥, =, ≠</i>	Lesson Plan 9
Less, more, less than or equal to, more than or equal to	Lesson Plan 10
Less than, more than, equal to, not equal to <i>Open, closed domains; combinations</i>	Lesson Plan 11
(not) less, (not)more, equal; more (less) than or equal to <i>Sequences, combinations</i>	Lesson Plan 12
Identifying and writing 0; knowing its place on number line	Lesson Plan 13
Identifying and writing 1; knowing its place on number line	Lesson Plan 14
Identifying, writing and using '1'	Lesson Plan 15
Identifying, writing and using '2'; number line	Lesson Plan 16
Identifying, writing and using '2'; number line <i>Comparisons</i>	Lesson Plan 17
Writing and using +, −, =	Lesson Plan 18
Writing and using +, −, =	Lesson Plan 19
Writing and using 0, 1, 2; operations; contextual problem	Lesson Plan 20
Comparisons: balancing equations and inequalities	Lesson Plan 21
Comparisons: equations, inequalities <i>Inverse operations</i>	Lesson Plan 22
Comparisons: equations, inequalities <i>Inverse operations</i>	Lesson Plan 23
Comparisons: equations, inequalities <i>Chain operations</i>	Lesson Plan 24

BOOK 1 Contents Page

Lessons 25 to 40

C: Core*E: Extension*

Writing and using 3, number line <i>Cardinal and ordinal numbers</i>	Lesson Plan 25
Writing and using 3, number line operations (to 3)	Lesson Plan 26
Writing and using 3, operations, number line <i>Sequences</i>	Lesson Plan 27
Using 3. Equations, inequalities	Lesson Plan 28
Writing and using 4; number line <i>Roman numbers. Cardinal and ordinal numbers</i>	Lesson Plan 29
Writing and using 4; number bonds, addition <i>Sequences; rules</i>	Lesson Plan 30
Writing and using 4; operations <i>Puzzles</i>	Lesson Plan 31
Using 4; equations, inequalities <i>Completing tables</i>	Lesson Plan 32
Writing and using 5; number line <i>Roman numbers. Cardinal and ordinal numbers</i>	Lesson Plan 33
Using 5; addition facts <i>Sequences</i>	Lesson Plan 34
Using 5; operations <i>Logic Problem</i>	Lesson Plan 35
Using 5; equations, inequalities <i>Problems in context</i>	Lesson Plan 36
Revision and practice (0–5) <i>Shapes</i>	Lesson Plan 37
Revision and practice (0–5) <i>Building shapes from unit cubes</i>	Lesson Plan 38
Revision and practice (0–5) <i>Shapes</i>	Lesson Plan 39
Revision (0–5)	Lesson Plan 40

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Lessons 41 to 64

C: Core

E: Extension

Writing and using 6, number line <i>Roman numbers; Cardinal and ordinal numbers</i>	Lesson Plan 41
Using 6, number bonds; additions <i>Sequences</i>	Lesson Plan 42
Using 6, operations	Lesson Plan 43
Using 3. Equations, inequalities <i>Problem in context</i>	Lesson Plan 44
Writing and using 7; number line <i>Roman numbers</i>	Lesson Plan 45
Using 7, number bonds; additions <i>Sequences</i>	Lesson Plan 46
Using 7; additions, subtractions <i>Problems in context</i>	Lesson Plan 47
Using 7; equations, inequalities <i>Problems in context</i>	Lesson Plan 48
Writing and using 8; number line <i>Roman numbers</i>	Lesson Plan 49
Using 8; addition facts	Lesson Plan 50
Using 8; addition and subtraction <i>Logic problem</i>	Lesson Plan 51
Using 8; equations, inequalities <i>Problem in context</i>	Lesson Plan 52
Revision and practice (0-8) <i>Creative problems</i>	Lesson Plan 53
Revision and practice (0-8)	Lesson Plan 54
Revision and practice (0-8) <i>Logic statements, shapes</i>	Lesson Plan 55
Revision (0-8) ; test	Lesson Plan 56
Writing and using 9; number line <i>Roman numbers</i>	Lesson Plan 57
Using 9, number bonds; square	Lesson Plan 58
Using 9; additions, subtractions <i>Problems in context</i>	Lesson Plan 59
Using 9. Equations, inequalities	Lesson Plan 60
Writing/using 10; number line; number bonds,(<,>,+,-,=) <i>3- and 4- element sums</i>	Lesson Plan 61
Using 10; number line; number bonds,(<,>,+,-,=) <i>Equations</i>	Lesson Plan 62
Writing and using 10; number line; number bonds <i>Problems in context</i>	Lesson Plan 63
Writing and using 10; number line; practice <i>Odd and even numbers</i>	Lesson Plan 64

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Lessons 65 to 88

C: Core

E: Extension

Revision and practice: numbers 0 to 10 <i>Roman numerals</i>	Lesson Plan 65
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Revision and practice (0 to 10) <i>Problems in context</i>	Lesson Plan 67
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Recognise and distinguish shapes: circle, triangle, square <i>Logic problem</i>	Lesson Plan 70
Recognise and distinguish shapes: circle, triangle, square <i>Problems in context</i>	Lesson Plan 71
Recognise and distinguish shapes <i>Spatial awareness</i>	Lesson Plan 72
Calendar: days, weeks, months <i>Numbers beyond 10</i>	Lesson Plan 73
Calendar: days, weeks, months, seasons <i>Numbers beyond 10</i>	Lesson Plan 74
Calendar: days, weeks, months, seasons <i>Numbers beyond 10</i>	Lesson Plan 75
Months, weeks, days <i>Numbers beyond 10</i>	Lesson Plan 76
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Revision and practice (0 to 10) <i>Measurement : capacity</i>	Lesson Plan 78
Revision and practice (0 to 10) <i>Inequalities</i>	Lesson Plan 79
Revision (0- 10) ; test	Lesson Plan 80
Extending the number line (0 to 20) <i>Counting in Context</i>	Lesson Plan 81
Extending numbers to 20 <i>10 + n</i>	Lesson Plan 82
Extending numbers to 20. Operations without crossing 10. <i>Logic puzzle</i>	Lesson Plan 83
Extending numbers to 20. Operations without crossing 10. <i>Crossing over 10 on a number line.</i>	Lesson Plan 84
Number bond and sums to 11, crossing over 10 <i>Roman numbers</i>	Lesson Plan 85
Addition facts and operations to 11 <i>Using a and b for unknown values</i>	Lesson Plan 86
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C: Core

E: Extension

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Number bonds and sums to 12 <i>Even, odd, 1-digit, 2-digit</i>	Lesson Plan 90
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Operations, equations with 12 <i>Length, area</i>	Lesson Plan 92
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Number bonds and sums to 14 <i>Problem in context</i>	Lesson Plan 98
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Number bonds and sums to 15 <i>Problem in context</i>	Lesson Plan 102
Operations and equations to 15 <i>Number lines</i>	Lesson Plan 103
Operations and equations to 15 <i>Problem in context</i>	Lesson Plan 104
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Revision and Practice (0 to 15) <i>Problem solving, Measuring</i>	Lesson Plan 106
Revision and Practice (0 to 15) <i>Problem solving</i>	Lesson Plan 107
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C: Core

E: Extension

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