Introduction

The *Key Stage 3 Mathematics* series covers the new National Curriculum for Mathematics (*SCAA: The National Curriculum Orders*, DFE, January 1995, 0 11 270894 3). Detailed curriculum references are provided. Each pack is designed to be flexible and can be used in a variety of ways:

- A complete course for Level 4 – The worksheets can be used to provide complete coverage of: Number and Algebra; Shape, Space and Measures; and Handling Data. The problem-solving tasks provide experience for the pupils in Using and Applying Mathematics.
- Individual lessons – The teacher can explain the tasks and provide the worked examples, either on the board, as overhead transparencies or as photocopied sheets for the students. Students should then attempt the exercises.
- Teacher's lesson notes – The notes and examples are useful for new teachers and can form the basis of lesson plans.
- Absent students – The notes, examples and exercises can be used by students during long-term absence or to help students catch up after absence.
- Teacher's absence – If a teacher is absent, a double-sided worksheet (notes and examples on one side, exercises on the other) can be provided for students. This will allow the students to continue with learning the curriculum.
- Examination revision – The notes and examples can be issued to students shortly before the examination for revision purposes.

The pack includes:

- Notes and worked examples
- Exercises
- Coursework tasks for AT1 – Using and Applying Mathematics
- Examination papers containing National Curriculum-type questions
- Using and Applying Mathematics problem-solving tasks
- Pupil's record form
- Answers.

Using the notes and examples

Pupils should fold the worksheet so that the answers cannot be seen. They can then read the notes, try the questions, and then check their answers.

Exam papers

Each paper is set on four sides of A4 paper. This will allow the exam paper to be placed on one sheet of A3, in order to remove the onerous task of writing and stapling exam papers. If all three papers are set, the contents of Number and Algebra, Shape, Space and Measures, and Handling Data will have been covered at Level 4.

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Each question is related to a specific part of the National Curriculum as indicated on the chart on pages 59-60.

It is also possible to use each exam paper as homework sheets in preparation for the end of Key Stage 3 examinations.

Pupil's record form

This allows the success of pupils to be recorded using the results on the exercises and exam questions. Either a tick/cross system or a mark system may be used.

End of term activities

The puzzle 'Magic squares', on page 24 and the game 'Trapped', on page 46 (which requires considerable thought to find the best strategy) are included for enjoyment.

Using and Applying Mathematics

Two problem-solving activities are provided on pages 10 and 18. They require similar methods. Attempt the boat problem before the soldiers problem (see pages 62 and 63 for solutions).

Stafford Burndred
March 1995

Exam paper 1

Time allowed: 45 minutes

1 Sarah has some number cards:

5	8	3

a How should she arrange them to make the largest number?

b How should she arrange them to make the smallest number?

c She is given a blank card. What number should she write on the blank card to make the largest number?

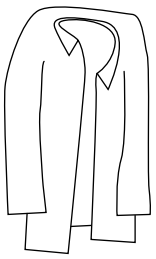
5	8	3	

d What is the largest number that she can make from these four cards?

2 Mr Jones, the grocer bought 100 eggs at 8p each and sold them in boxes of ten for 90p a box. How much profit did he make? Show your working. Do not use a calculator. _____

3 a i John works in a golf ball factory. He has 84 golf balls. He must put them into packets of 3. How many packs will he need? Show your working. _____

ii David says, "If you use the 'bonus' packs you will only need 21 packs." How many golf balls fit into one 'bonus' pack? _____



Blouse £7

Tie £4

Skirt £6

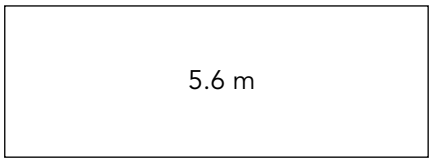
b i Paul bought nine ties. How much did he pay?_____

ii Susan spent the same amount of money as Paul. She bought skirts. How many skirts did she buy?_____

iii Marie had £33. She wanted to buy five blouses. Explain the difficulty she had when she tried to pay the bill. _____

Show all of your working.

4 You have two planks of wood. One is 5.6 m long. The other is 4.6 m long.



You need: 2 pieces of wood 2.7 m long
1 piece of wood 1.8 m long
and several pieces of wood 0.6 m long.

a What is the maximum number of pieces of wood you can obtain?_____

b Show on the diagram below how you would split the wood.
(1 cm represents 1 m.)

5 Jenny bought 32 crates. Each crate holds 48 cans of cola.

Mark says, "If you give one can to each person you have enough drinks for about 15 000 people."

David says, "There are enough cans for about 1200 people."

a Who is nearer to the correct answer? _____

b What mistake do you think Mark made? _____

c What mistake do you think David made?

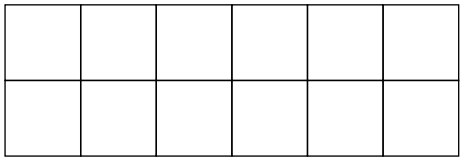
_____

d What is your estimate of the number of people if each receives one can?

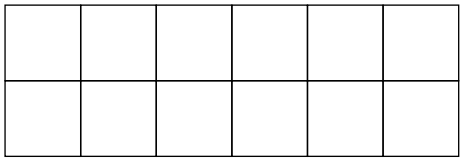
_____

Do not use a calculator. Show your working.

6 a i Shade $\frac{2}{3}$ of this shape

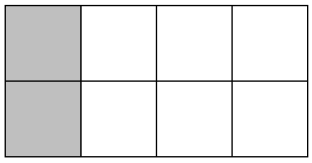


ii Shade $\frac{5}{6}$ of this shape



b Look at your answers to part a. Which is greater, $\frac{2}{3}$ or $\frac{5}{6}$? _____
Explain how you decided. _____

c i What percentage of this shape is shaded?



_____

ii What percentage of this shape is not shaded?

_____

iii Add the answer to i to the answer to ii. What do you get? _____
Why? _____

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7 a Look at this pattern:

Draw the next pattern.

Explain in your own words how this pattern is formed. _____

_____

b Here is another shape: 

Draw three more shapes to make a pattern.

Explain how your pattern is formed. _____

_____

8 Look at this pattern:

1 x 2 + 3 = 5

2 x 3 + 5 = 11

3 x 4 + 7 = 19

4 x 5 + 9 = 29

☐ x 6 + ☐ = 41

6 x ☐ + ☐ = ☐

☐ x ☐ + ☐ = ☐

a Fill in the missing numbers.

b Describe the pattern. _____

_____

_____

c What is the tenth line in the pattern? _____

d What is the twenty-first line of the pattern? _____

e Write down a rule for the pattern.

_____

9 An instruction changes the number 7 into the number 18.

Melanie says the instruction could be "double the number and add 4".
Andrea says the instruction could be "add two, then double the number".
Natalie says the instruction could be "add 25 then halve the number".

a Whose instructions work?_____

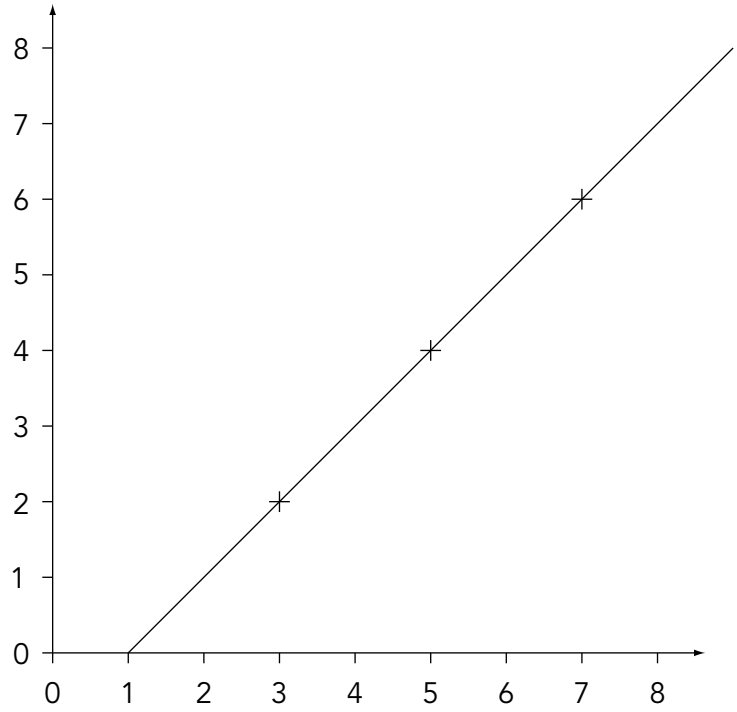
b Whose instructions do not work? _____

c What result do the wrong instructions give? _____

Exam paper 2

Time allowed: 30 minutes

1 Three points are marked on the line with crosses.



A is the point (7,6)

B is the point (5,4)

C is the point (3,2)

a Mark the points A, B, C.

b What do you notice about the co-ordinates of each point?

_____

c The point P is on the line and an equal distance from A and B.

i Mark the point.

ii Give the co-ordinates of P. (,)

d Another point is on the line. What is the missing co-ordinate? (12,)

e Give the co-ordinates of any point below the line. (,)

f The point Q is above the line.
Fill in a possible co-ordinate for this point. (, 15)

g Explain how you worked out your answer. _____

_____

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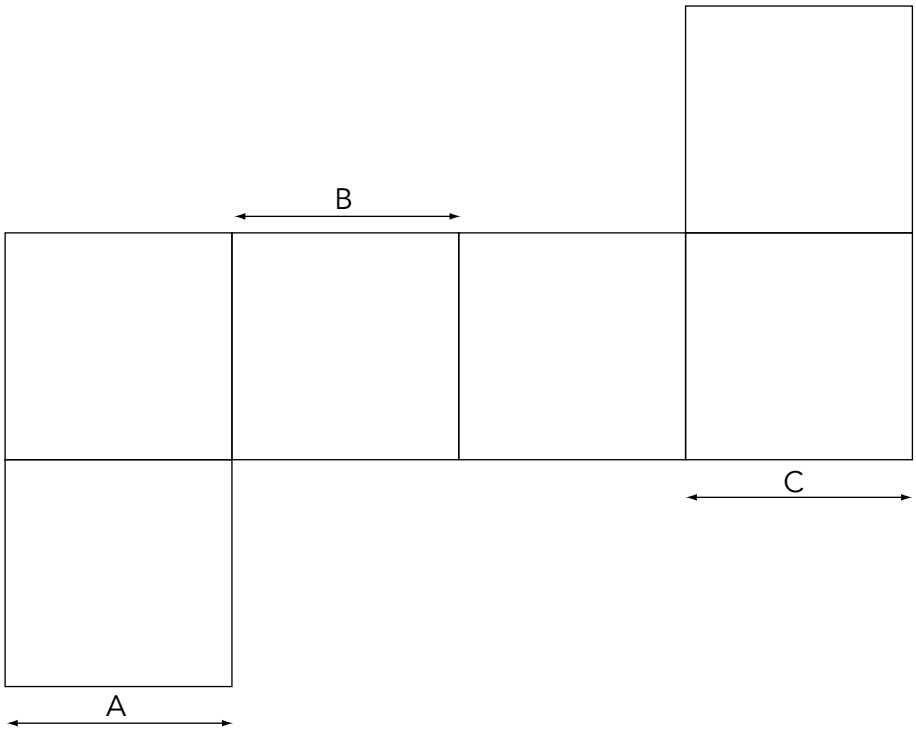
2 This is a net:



a When it is folded it makes a 3-D shape. What is the name of the shape?

_____

b When it is folded where will edge A fit? Write A on the edge where it fits.

c When it is folded where will edge B fit? Write B on the edge where it fits.

d When it is folded where will edge C fit? Write C on the edge where it fits.

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3 John and Sarah are asked to draw the parallelogram ABCD in a different position.

a Is John's attempt correct? _____

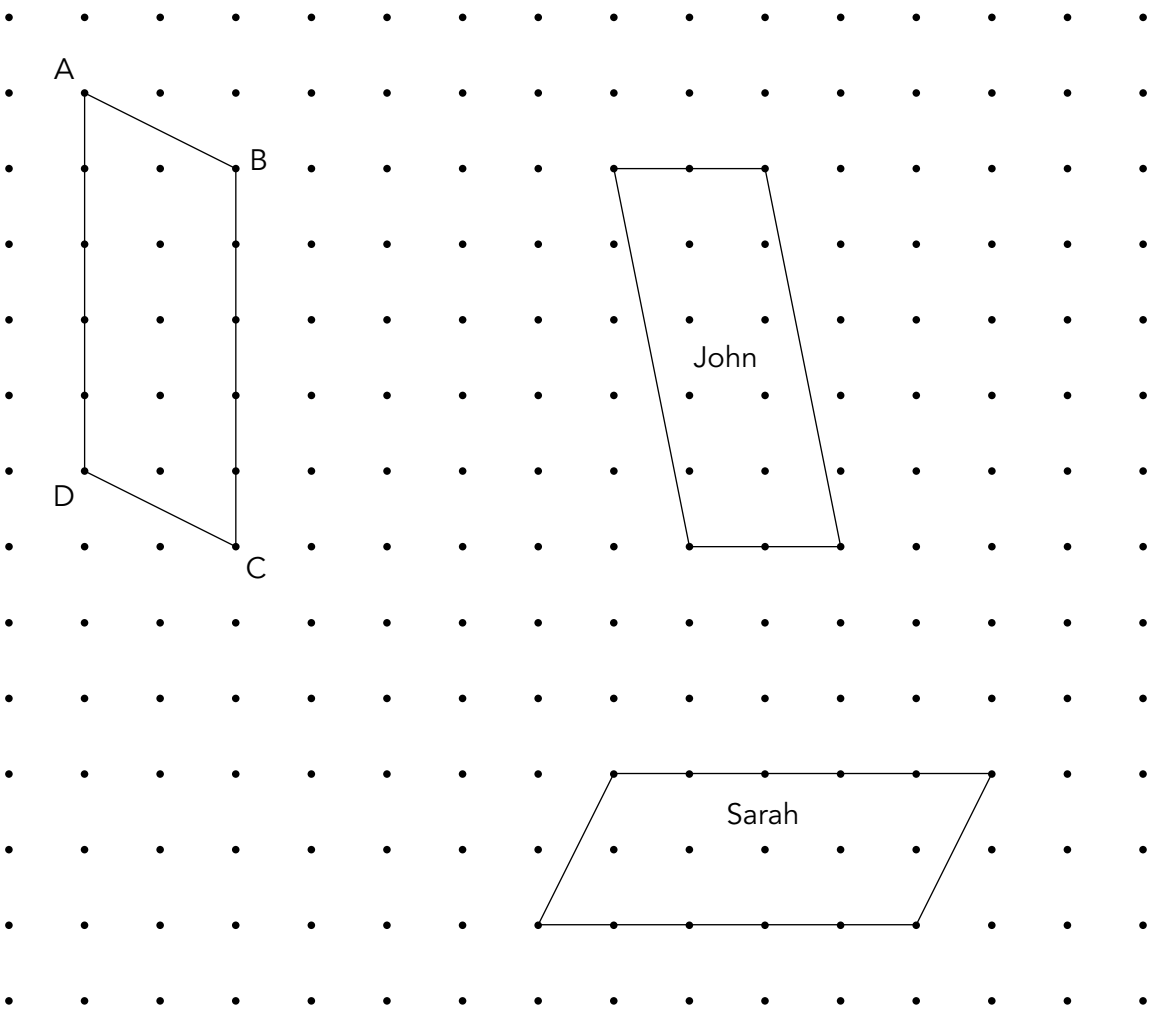
Give a reason for your answer.

_____

b Is Sarah's attempt correct? _____

Give a reason for your answer.

_____



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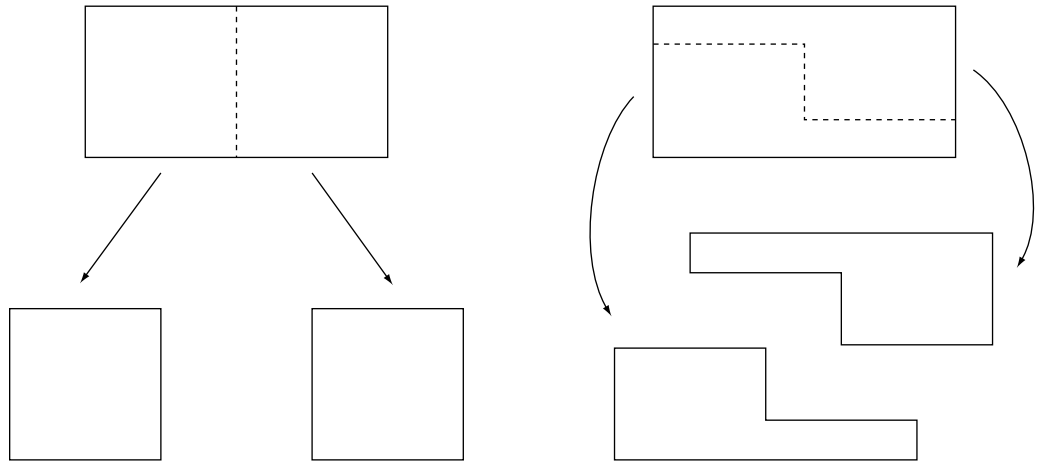
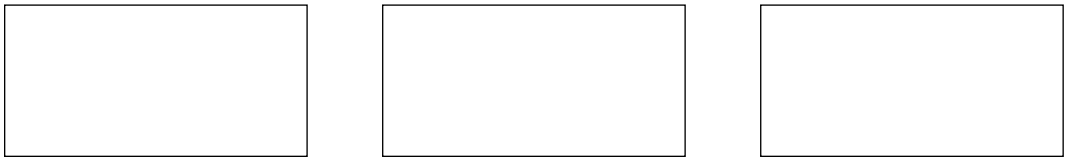
4 This is a rectangle. If the shape is cut along the dotted line it produces two congruent shapes.

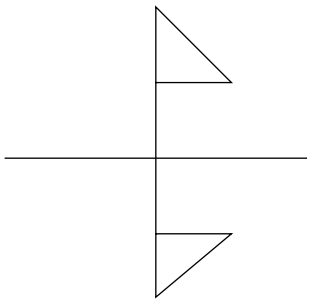


Show three other places where it could be cut. Indicate with a dotted line.



5 a Complete the shape below to produce a shape with rotational symmetry order 4.

b How can you check that the shape you have drawn has rotational symmetry order 4?



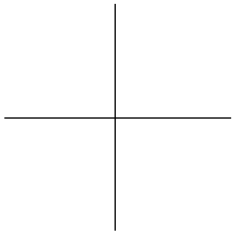
_____

_____

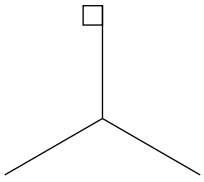
_____

_____

c Complete this shape to produce a shape with rotational symmetry order 2.



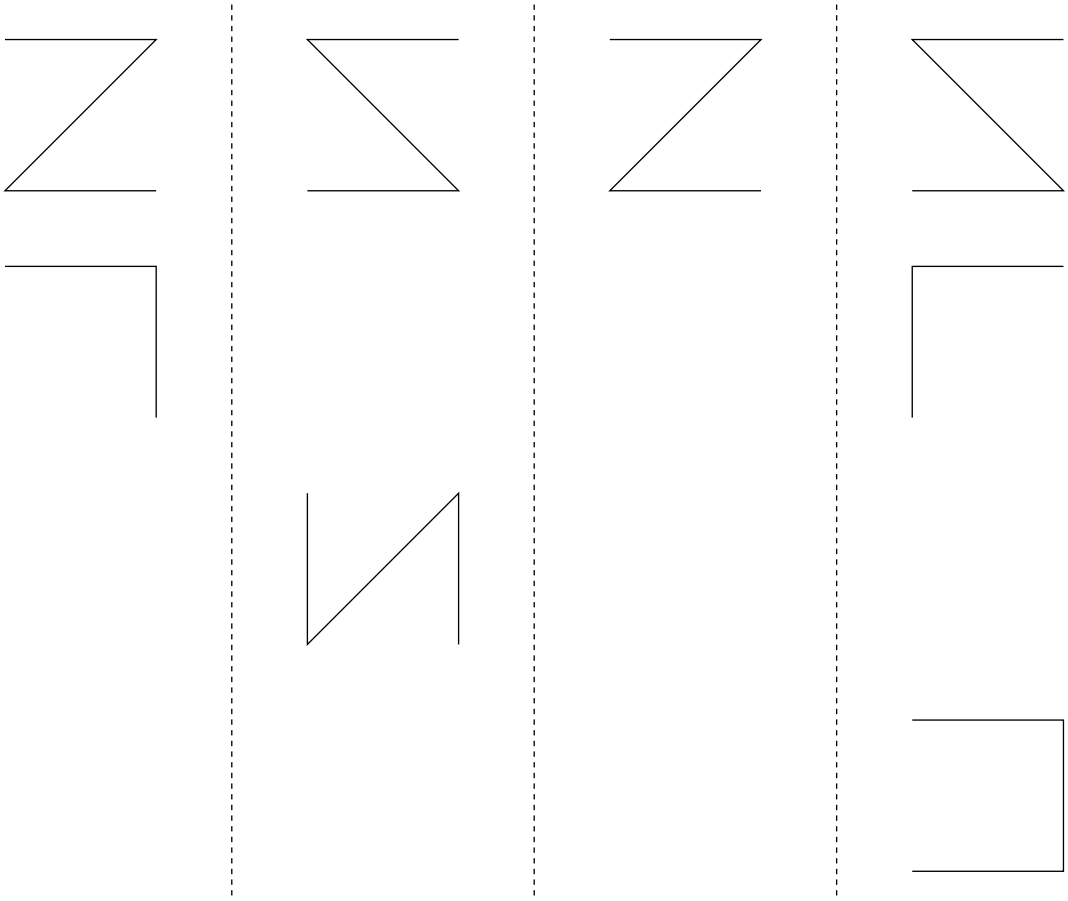
d Complete this shape to produce a shape with rotational symmetry order 3.



Exam paper 3

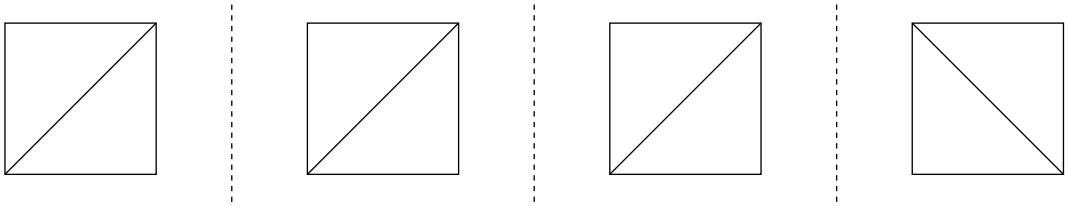
Time allowed: 45 minutes

1 a The Z shape has been reflected in each mirror. Complete the other three diagrams.



b Three of these pictures are correct. One is wrong. Which picture is wrong? Explain what is wrong. _____

_____



2 In each of the following lists of words, one word is the odd one out. Underline the odd one out and explain why.

a millilitre, centilitre, gram, litre _____

b millimetre, litre, kilometre, metre, centimetre _____

c gram, tonne, metre, kilogram _____

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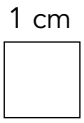
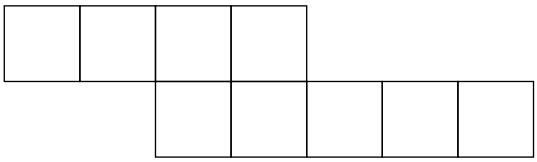
3 You have 9 squares. Each square is 1 cm long.



You can make many different shapes. The squares must touch each other along a whole side. This shape has a perimeter of 18 cm:



a Rearrange the squares to make a perimeter of 16 cm. Draw the diagram.

b Show how you would arrange the squares to make the smallest perimeter. What is the perimeter? _____

c Show how you would arrange the squares to make the largest perimeter. What is the largest perimeter? _____

d Can you rearrange the squares to make a perimeter of 17cm? Draw the shape if you can. If not, explain why not. _____

4 These are the ages of students on a bus:

13	16	18	8	8	12	9	13	17	12
7	9	14	16	17	13	11	9	10	13

Susan has recorded the information in the table below.

Age	Tally	Frequency
7-9	𝍸 |	6
10-12	||||	4
13-15	𝍸	5
16-18	||||	4
	Total	19

How do you know Susan has made an error in her table? _____

_____

Can you find her error? _____

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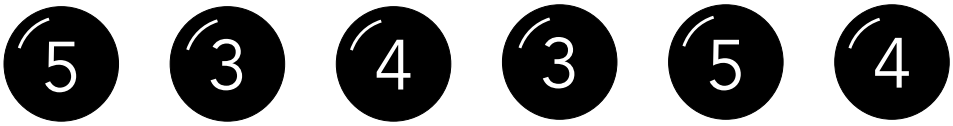
5 There were 7 children in a classroom. 6 of them were wearing badges showing their ages:

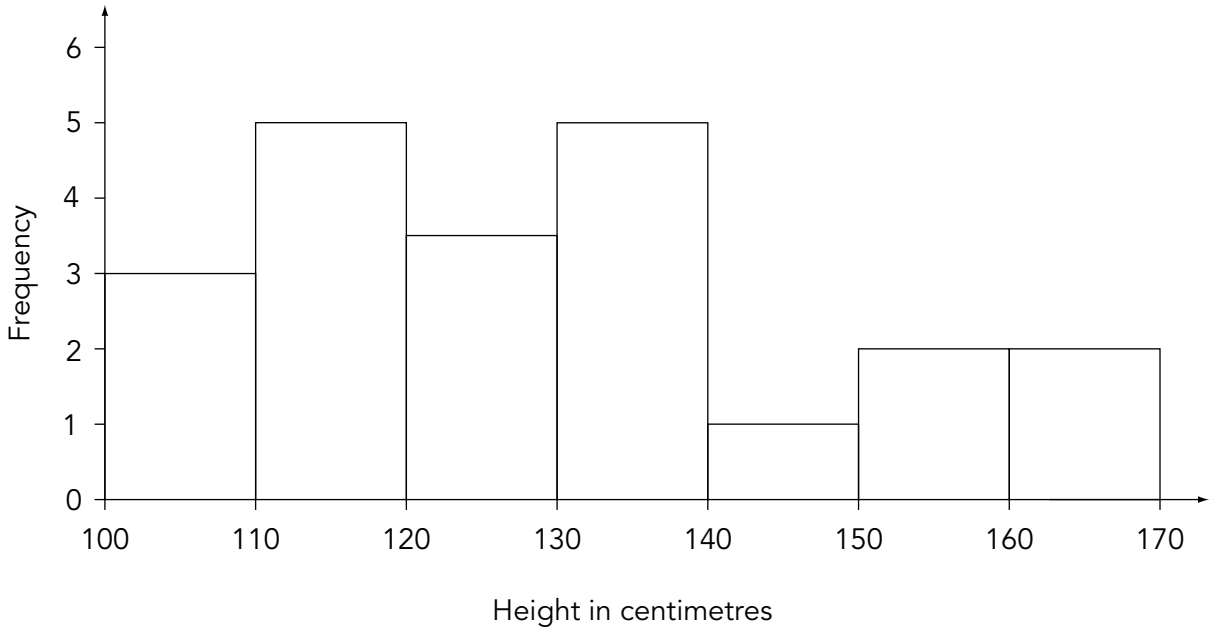


The mode of the group was 5.

The median of the group was 4.

What was the age of the seventh pupil? _____

6 This frequency diagram shows the heights of children in a room. There are 22 children altogether.



a Look at the diagram carefully. There is a mistake. What is the mistake?

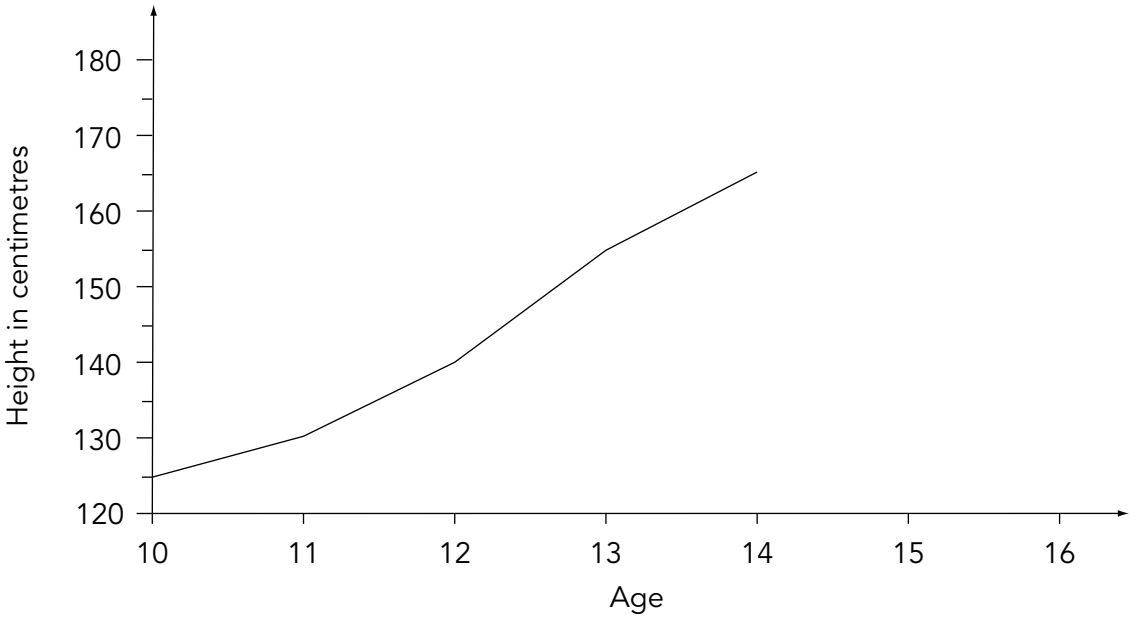
_____

_____

Correct the mistake.

b How many children are between 130 cm and 140 cm tall?_____

7 This line graph shows David's height in centimetres.



a At what age was David 130 cm tall? _____

b How tall was David at age 12? _____

c How tall was David at age 14? _____

d David was 175 cm tall at age 15 and 180 cm tall at age 16.
Complete the line graph.

8 These are the rules for two games:

Game 1 A coin is tossed. John wins if the coin lands on heads, Sarah wins if the coin does not land on heads.

Game 2 A die is thrown. David wins if the die lands on 4. Anna wins if the die does not land on 4.

a In game 1, does John have an even chance of winnning? _____
Explain your answer.

_____

_____

b In game 2, does David have an even chance of winning?_____
Give a reason for your answer.

_____

_____

National Curriculum references

Number and Algebra Level 4	Topic title	Exam paper	Question
Pupils use their understanding of place value to multiply and divide whole numbers by 10 or 100.	Place value Multiplication facts	1 1	1 2
In solving number problems, pupils use a range of mental and written methods of computation with the four operations, including mental recall of multiplication facts up to 10 x 10.	Multiplication facts Solving problems without a calculator	1 1	2 3
They add and subtract decimals to two places.	Addition and subtraction of decimals	1	4
In solving problems with or without a calculator, pupils check the reasonableness of their results by reference to their knowledge of the context or to the size of the numbers.	Calculation checks	1	5
They recognise approximate proportions of a whole and use simple fractions and percentages to describe these.	Fractions and percentages	1	6
Pupils explore and describe number patterns, and relationships including multiple, factor and square.	Number patterns 1 Number patterns 2	1 1	7 8
They have begun to use simple formulae expressed in words.	Formulae expressed in words	1	9
Pupils use and interpret co-ordinates in the first quadrant.	Co-ordinates in the first quadrant	2	1

Shape, Space and Measures Level 4			
Pupils make 3-D mathematical models by linking given faces or edges, draw common 2-D shapes in different orientations on grids, and identify congruent shapes and orders of rotational symmetry.	3-D models Common 2-D shapes Congruent shapes Rotational symmetry	2 2 2 2	2 3 4 5
They reflect simple shapes in a mirror line.	Reflection	3	1
They choose and use appropriate units and instruments, interpreting, with appropriate accuracy, numbers on a range of measuring instruments.	Measurement	3	2
They find perimeters of simple shapes, find areas by counting squares, and find volumes by counting cubes.	Perimeter, area and volume	3	3

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Handling Data Level 4	Topic title	Exam paper	Question
Pupils collect discrete data and record them using a frequency table.	Frequency tables	3	4
They understand and use the mode and median.	Median and mode	3	5
They group data, where appropriate, in equal class intervals, represent collected data in frequency diagrams and interpret such diagrams.	Frequency diagrams	3	6
They construct and interpret simple line graphs.	Line graphs	3	7
They understand and use simple vocabulary associated with probability, including 'fair', 'certain' and 'likely'.	Probability	3	8

Using and Applying Mathematics Level 4		Page
Pupils are developing their own strategies for solving problems and are using these strategies both in working within mathematics and in applying mathematics to practical contexts.	The boat problem The soldiers problem	10 18
They present information and results in a clear and organised way, explaining the reasons for their presentation.	The boat problem The soldiers problem	10 18
They search for a pattern by trying out ideas of their own.	The soldiers problem	18

Pupil's record form

Name: _____ Form:_____

Teacher: _____ Test marks: _____

	Exercises completed	Exam paper	Exam questions answered
Number and Algebra			
Place value	☐	1	1 ☐
Multiplication facts	☐	1	2 ☐
Solving problems without a calculator	☐	1	3 ☐
Addition and subtraction of decimals	☐	1	4 ☐
Calculation checks	☐	1	5 ☐
Fractions and percentages	☐	1	6 ☐
Number patterns 1	☐	1	7 ☐
Number patterns 2	☐	1	8 ☐
Formulae expressed in words	☐	1	9 ☐
Co-ordinates in the first quadrant	☐	2	1 ☐
Shape, Space and Measures			
3-D models	☐	2	2 ☐
Common 2-D shapes	☐	2	3 ☐
Congruent shapes	☐	2	4 ☐
Rotational symmetry	☐	2	5 ☐
Reflection	☐	3	1 ☐
Measurement	☐	3	2 ☐
Perimeter, area and volume	☐	3	3 ☐
Handling Data			
Frequency tables	☐	3	4 ☐
Median and mode	☐	3	5 ☐
Frequency diagrams	☐	3	6 ☐
Line graphs	☐	3	7 ☐
Probability	☐	3	8 ☐

Answers

Place value (page 4)

1 One hundred thousand and one

2 Twenty-four thousand, nine hundred and ninety-nine

3 250 000

4 a Seventy-two thousand, three hundred and sixty-eight
b Four thousand, seven hundred and twenty-six
c Two hundred and three thousand, six hundred and fifty-two
d Seven hundred and fifty-two thousand, four hundred and seventy-three
e Eight hundred and twenty-nine thousand, eight hundred and seventy-eight

5 a 732 = smallest, 8049 = largest
b 1729 = smallest, 12 736 = largest
c 4593 = smallest, 689 372 = largest
d 1001 = smallest, 80 030 = largest
e 1479 = smallest, 6862 = largest

6 a 472, 573, 731, 861, 862
b 301, 600, 804, 899, 901
c 2004, 3809, 5328, 6112, 7401
d 2999, 3711, 5008, 6800, 7203
e 797, 986, 3284, 7010, 8729

Multiplication facts (page 6)

1	a	72	b	4	c	3	d	5	e	7			
	f	8	g	15	h	9	i	54					
2	a	700	b	2800	c	34	d	£8	e	£2.70			
3	460		4	4800	5	1600	6	£24	7	£1.60	8	£2.40	

Solving problems without a calculator (page 8)

1	855	2	719	3	1153	4	465	5	254	6	225		
7	576	8	469	9	592	10	9	11	9	12	13		
13	56	14	24	15	4	16	63	17	189	18	7	19	6

Addition and subtraction of decimals (page 9)

1	74·36	2	770·2	3	10·83	4	63·4	5	23·55	6	36·54
7	83·84	8	52·33	9	3·21	10	12·23	11	11·68	12	3·61
13	44·58	14	16·7	15	15·03	16	£16.39	17	£10.10	18	£17.55
19	£3.06	20	£9.26	21	4·64 m	22	£7.89				

The boat problem (page 10)

man and chicken

man

man and grain

man and chicken

man and fox

man

man and chicken

Calculation checks (page 12)

1	a	3	b	6	c	6	d	9	e	8	f	17	g	43
	h	54	i	47	j	43	k	37	l	48	m	127	n	275
	o	569	p	30	q	40	r	199	s	49	t	90	u	10

2 a 40 x 60 = 24 000 b Correct c 5 x 20 = 100
d 300 x 9 = 2700 e Correct

3 c 4 c 5 b 6 d 7 a

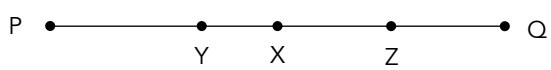
8 c 9 b 10 d 11 a

Fractions and percentages (page 14)

1 Two sections 2 One section red, five sections blue

3 Any 12 squares 4 Any 6 full squares

5



Number patterns 1 (page 16)

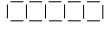
1 13, 15 Add 2 to the previous number.

2 20, 15 Take away 5 from the previous number.

3 $\frac{1}{8}$, $\frac{1}{9}$ Add 1 to the denominator.

4 55, 89 Add the previous two numbers together.

5  Triangle numbers.

6  Add a box.

7  Add one more row, two more columns each time.

8 eg 6, 12, 18

9 1, 2, 3, 4, 6, 8, 12, 24

10 1, 2, 3, 6, 9, 18

Number patterns 2 (page 17)

1 Multiply by 3 2 Add 2 3 Multiply by 3 then add 2

4 Multiply by 2 5 Subtract 2 6 Multiply by 6 then subtract 3

7 a 50, 5, 7000 b 30, 800, 80, 3000, 8, 30 000
c 4, 6, 2, 8, 0, 10 d 16, 4, 1, 256

8 Divide the first number by 4, multiply the second number by 4.

The soldiers problem

An additional four journeys is needed for each extra soldier.

Number of journeys = (4 x number of soldiers) + 1

Number of soldiers	Number of moves
1	5
2	9
3	13
4	17
5	21

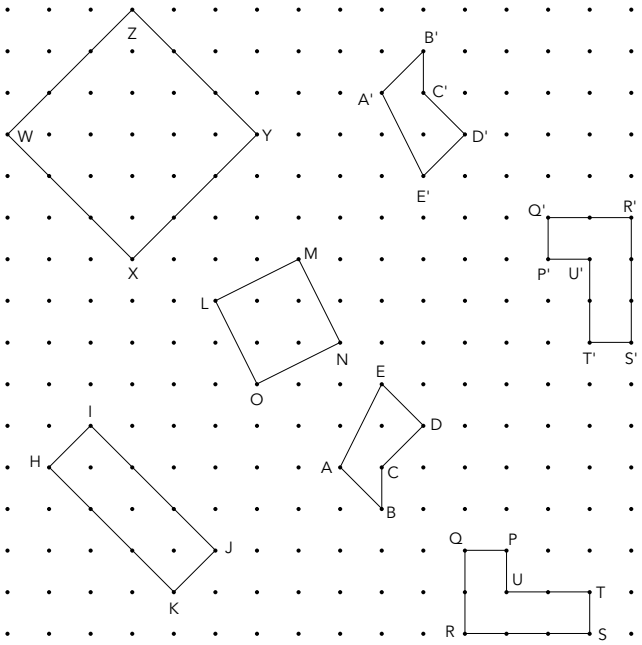
Formulae expressed in words (page 20)

1	a	£9.43	b	£7.72	c	£5.56	d	£7.16			
2	a	19	b	13	c	29	d	55			
3	a	5	b	8	c	14	d	18			

Co-ordinates in the first quadrant (page 22)

1	a	(2,9)	b	(2,17)	c	(10,17)	d	(1,6)	e	(1,2)	f (13,2)
2	(10,9)		3	(13,6)	4	(6,13)	5	(7,4)			

Common 2-D shapes (page 26)



Congruent shapes (page 28)

A and L	B and G	C and J	D and O	E and Q
F and R	H and M	I and P	K and N	

Rotational symmetry (page 30)

A	4	B	2	C	None	D	3	E	2
F	5	G	6	H	∞	I	2	J	4
K	4	L	None	M	2	N	None		

Measurement (page 34)

1 95 km/h 2 56 kg

3 a metre rule b 30 cm ruler
c stop watch d clock or stop watch

Perimeter, area and volume (page 36)

1 A 6 cm, 2 cm^2 B 16 cm, 7 cm^2 C 16 cm, 16 cm^2
D 16 cm, 9 cm^2 E 16 cm, 9 cm^2 F 20 cm, 10 cm^2
G 18 cm, 8 cm^2 H 14 cm, 7 cm^2

2 A 6 cm^3 B 36 cm^3 C 36 cm^3 D 30 cm^3

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Frequency tables (page 38)

1 4, 10, 15, 9, 2 Total = 40

2 3, 6, 5, 4, 2 Total = 20

Median and mode (page 40)

1 a 1·85 b 1·93

2 a 14 b 13

3 a 2 b 3

4 a 4 b 3

5 a 114 b 120

Frequency diagrams (page 42)

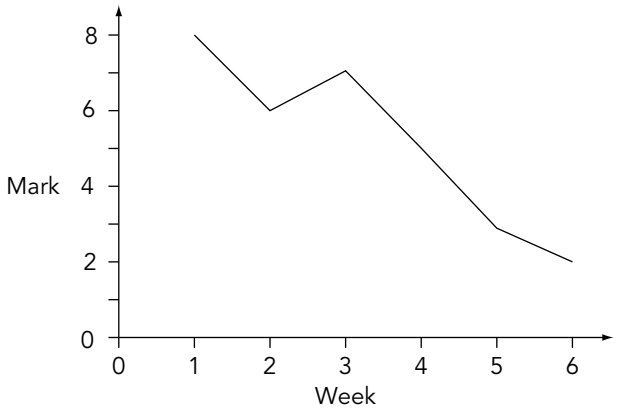
1 a 2 b 3 c 2
d 140,150 e 160,170 f 20

2 a 5 b 5 c 24

Line graphs (page 44)

1 a 65 b 200 c January
d May, June, July, August, September, October e January, February, December

2



Probability (page 45)

1 a less b even c more d less e even
f more g more h even i less j even

3 No. Lucy has one number and Matt has five numbers.

Exam paper 1 (page 47)

1 a 853 b 358 c 9 d 9853 (1 mark each)

2 100 x 8 = 800 or £8 paid 10 x 90 = 900 or £9
900 - 800 = 100p or £1 profit (3 marks)

3 a i $3\overline{)8^{2}4}$ $\quad 28$ (2 marks)

ii 21 + 21 + 21 + 21 = 84 or $21\overline{)84}$ $\quad 4$ Answer = 4 (2 marks)

b i 9 x 4 = £36 ii 36 ÷ 6 = 6 (1 mark each)

iii 5 x 7 = £35 ie not enough money (2 marks)

4 a 7 (not 8) b Any correct method (2 marks each)

5 a David (1 mark)
b 30 x 500 or 300 x 50 or too many noughts (1 mark)
c 30 x 40 or used 40 instead of 50 (1 mark)
d 1500 (1 mark)

6 a i Any 8 squares ii Any 10 squares (1 mark each)
b $\frac{5}{6}$ is greater. Correct explanation (2 marks)
c i 25% ii 75% (1 mark each)
iii 100% A whole is 100% (2 marks)

7 a  One more row, one more column each time. (2 marks)

b Any correct pattern and explanation (2 marks)

8 a $\boxed{5} \times 6 + \boxed{11} = 41$ (1 mark)

$6 \times \boxed{7} + \boxed{13} = \boxed{55}$ (1 mark)

$\boxed{7} \times \boxed{8} + \boxed{15} = \boxed{71}$ (1 mark)

b Numbers in columns 1 and 2 go up by 1.
Numbers in column 3 go up by 2.
Numbers in column 4 go up by 6, 8, 10, 12, 14, 16. (3 marks)

c 10 x 11 + 21 = 131 (1 mark)
d 21 x 22 + 43 = 505 (1 mark)
e line x (line + 1) + (2 x line) + 1 or similar (3 marks)

9 a Melanie and Andrea (2 marks)
b Natalie (1 mark)
c 16 (1 mark)

Total 50 marks

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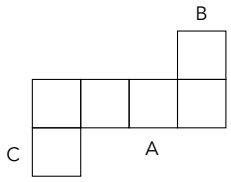
Exam paper 2 (page 51)

1 a A, B, C marked correctly (3 marks)
b First co-ordinate is one more than the second co-ordinate. (2 marks)
c i Marked correctly ii (6,5) (2 marks each)
d 11 e Any correct answer (2 marks each)
f Any number below 16 g Any correct explanation (2 marks each)

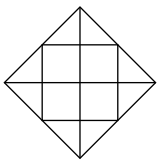
2 a cube
b, c, d (2 marks each)



3 a No. Any correct reason, eg angles or sides different sizes. (2 marks)
b Yes. Any correct reason, eg angles and sides the same. (2 marks)

4 Any correct diagrams (3 marks)

5 a (2 marks)



b Any correct explanation (2 marks)
c Any correct answer (2 marks)
d Any correct diagram (2 marks)

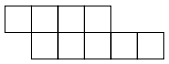
Total 40 marks

Exam paper 3 (page 55)

1 a Correct diagrams (6 marks)
b Second diagram. The diagonal line is the wrong way. (2 marks)

2 a gram b litre c metre (2 marks each)

3 a Any correct diagram eg (3 marks)



b  12 cm c 20 cm  (3 marks each)

d Only even numbers can be produced. (3 marks)

4 The total should be 20. (2 marks)
There are 5 students aged 16-18. (3 marks)

5 5 (3 marks)

6 a 120-130 shows $3\frac{1}{2}$. There are 22 children therefore it should be 4. (3 marks)
b 5 (2 marks)

7 a 11 years old b 140 cm c 165 cm (1 mark each)
d Correct line drawn (2 marks)

8 a Yes. A coin has two sides, so equal chances of each. (3 marks)
b No. A die has six sides, so less than even chance of it landing on 4. (3 marks)

Total 50 marks

Total for all three papers 140 marks

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