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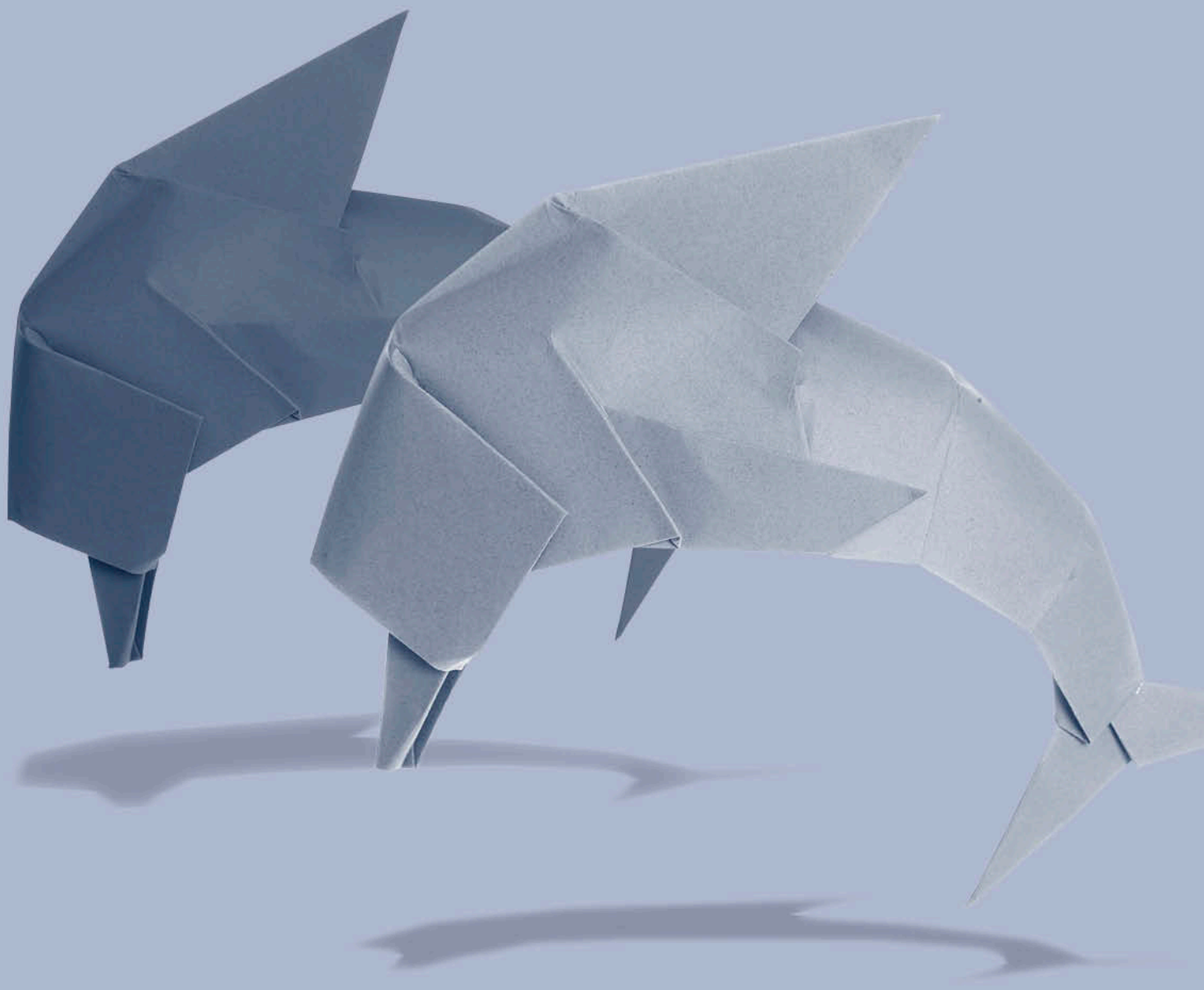
Pearson Edexcel Level 1/ Level 2 GCSE (9-1) in Mathematics (1MA1)



EXEMPLIFICATION OF THE NEW SAMPLE ASSESSMENT MATERIALS

First certification 2017 Issue 2

Contents

About this booklet

This booklet has been produced to support mathematics teachers delivering the new GCSE (9–1) Mathematics specification (first assessment summer 2017).

The booklet provides additional information on all the questions in the New Sample Assessment Materials, accredited by Ofqual in June 2015. It details the content references and Assessment Objectives being assessed in each question or question part, along with indicating if a question or question part is new to the Foundation tier, new to this specification, or a common question appearing in the respective paper for both tiers.

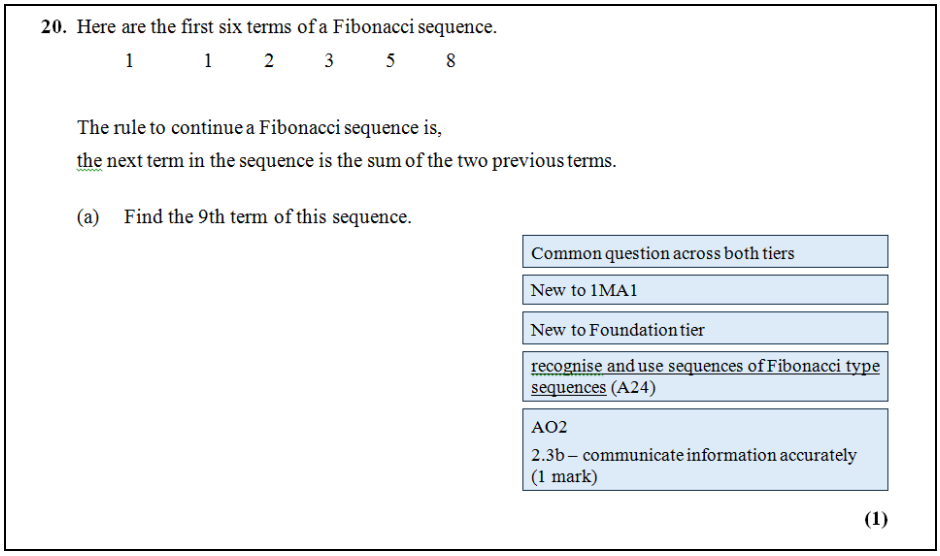
How to use this booklet

Callouts have been added to each question in the accredited New Sample Assessment Materials. In the callouts, the following information has been presented, as relevant to the question:

- **specification references** (in standard, underlined or bold type);
- **Assessment Objectives**, including elements and marks awarded for each element;
- **new to Foundation tier**, for any content previously assessed at Higher tier in 1MA0 or 2MB01;
- **new to 1MA1**, for any content not previously assessed in 1MA0 or 2MB01;
- **common question across both tiers**, for any question that appears in both tiers and is assessing performance at grades 4–5;
- **formula given with the question**: formulae will be provided for students with the relevant examination questions, rather than in a formulae sheet at the front of the examination paper (see Issue 2 of the specification).

Where content references or Assessment Objectives are being assessed across all the parts of a question, these are referred to by a single callout at the end of the question rather than by a callout for each question part.

The New Sample Assessment Materials, along with the two sets of specimen papers, are also available in the new GCSE (9–1) level on **Exam Wizard**, where you can search by topic or assessment objective and build your own practice papers.



20. Here are the first six terms of a Fibonacci sequence.

1 1 2 3 5 8

The rule to continue a Fibonacci sequence is,

the next term in the sequence is the sum of the two previous terms.

(a) Find the 9th term of this sequence.

Common question across both tiers

New to 1MA1

New to Foundation tier

recognise and use sequences of Fibonacci type sequences (A24)

AO2

2.3b – communicate information accurately (1 mark)

(1)

Issue 2 (August 2016)

A few small errors have been picked up and corrected for Issue 2.

p.44 – Paper 2F qu.24 is new to Foundation tier.

p.65 – Paper 3F qu.18 is new to Foundation tier.

p.70 – Paper 3F qu.24(a) – the last assessment objective is 2.3b, not 2.4a.

p.134 – Paper 3H qu.17(b) – 1 mark for 1.3a and 1 mark for 3.1c, not 2 marks for 1.3a.

Paper 1F

1. Write the following numbers in order of size.

Start with the smallest number.

0.61 0.1 0.16 0.106

order positive and negative integers, decimals and fractions (N1)
AO1 1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 1 is 1 mark)

2. Write 0.037 as a fraction.

work interchangeably with terminating decimals and their corresponding fractions (N10)
AO1 1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 2 is 1 mark)

3. Write down the 20th odd number.

use even and odd numbers (N4)
AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark)

(Total for Question 3 is 1 mark)

4. Write down all the factors of 20

use the concepts and vocabulary of factors (N4)
AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark) 1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 4 is 2 marks)

5. Tanya needs to buy chocolate bars for all the children in Year 7

Each of the 130 children get one chocolate bar.

There are 8 chocolate bars in each packet.

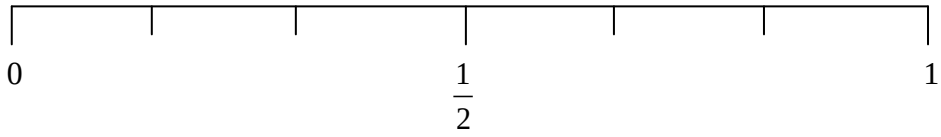
Work out the least number of chocolate bars that Tanya needs to buy.

apply the four operations to integers; understand and use place value (N2) round numbers and measures to an appropriate degree of accuracy (N15)
AO1 1.3a – accurately carry out routine procedures (1 mark) AO3 3.1c – translate problems in non-mathematical contexts into a mathematical process (1 mark) 3.3 – interpret results in the context of the given problem (1 mark)

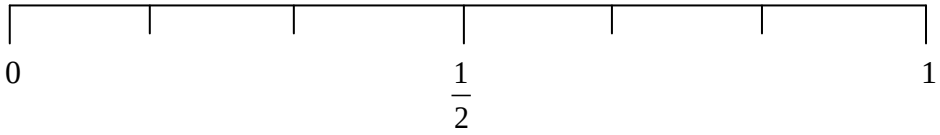
(Total for Question 5 is 3 marks)

6. Greg rolls a fair ordinary dice once.

(i) On the probability scale, mark with a cross (×) the probability that the dice will land on an odd number.



(ii) On the probability scale, mark with a cross (×) the probability that the dice will land on a number less than 5



relate relative expected frequencies to theoretical probability, using appropriate language and the 0-1 probability scale (P3)

AO1

1.3a – accurately carry out routine procedures (2 marks)

(Total for Question 6 is 2 marks)

7. One day Sally earned £60.

She worked for 8 hours.

Work out Sally's hourly rate of pay.

use compound units such as rates of pay (R11)

AO1

1.3a – accurately carry out routine procedures (2 marks)

(Total for Question 7 is 2 marks)

8. Work out 15% of 80

interpret fractions and percentages as operators (N12)
AO1 1.3a – accurately carry out routine procedures (2 marks)

(Total for Question 8 is 2 marks)

9. There are 3 red beads and 1 blue bead in a jar.

A bead is taken at random from the jar.

What is the probability that the bead is blue?

relate relative expected frequencies to theoretical probability, using appropriate language and the 0-1 probability scale (P3)
AO1 1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 9 is 1 mark)

10. There are only black pens and green pens in a box.

The ratio of the number of black pens in the box to the number of green pens in the box is 2 : 5

What fraction of the pens are black?

relate ratios to fractions (R8)
AO1 1.3a – accurately carry out routine procedures (1 mark)

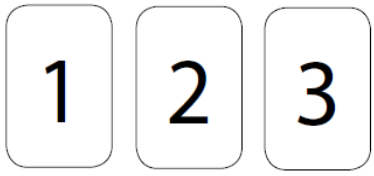
(Total for Question 10 is 1 mark)

11 Sally has three tiles.

Each tile has a different number on it.

Sally puts the three tiles down to make a number.

Each number is made with all three tiles.



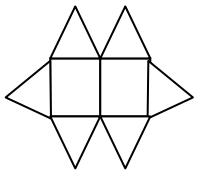
How many different numbers can Sally make?

apply systematic listing strategies (N5)
AO1 1.3a – accurately carry out routine procedures (2 marks)

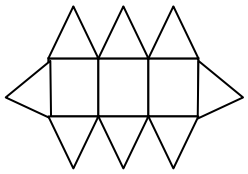
(Total for Question 11 is 2 marks)

12. Here are the first three patterns in a sequence.

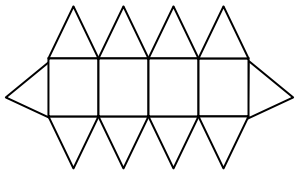
The patterns are made from triangles and rectangles.



pattern number 1



pattern number 2



pattern number 3

(a) How many triangles are there in pattern number 7?

recognise and use simple arithmetic progressions (A24)
AO1 1.3a – accurately carry out routine procedures (1 mark) AO2 2.3a – interpret information accurately (1 mark)

(2)

Charlie says

"There are 4 rectangles in pattern number 3 so there will be 8 rectangles in pattern number 6"

(b) Is Charlie right?
Give a reason for your answer.

generate terms of a sequence from either a term-to-term or a position-to-term rule (A23)
AO2 2.5a – assess the validity of an argument (1 mark)

(1)

(Total for Question 12 is 3 marks)

13. Paul organised an event for a charity.

Each ticket for the event cost £19.95

Paul sold 395 tickets.

Paul paid costs of £6000

He gave all money left to the charity.

(a) Work out an estimate for the amount of money Paul gave to the charity.

solve problems involving direct proportion (R10) estimate answers (N14) apply the four operations, including formal written methods, to integers and decimals; understand and use place value (N2)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

(3)

(b) Is your answer to (a) an underestimate or an overestimate?
Give a reason for your answer.

apply the four operations, including formal written methods, to integers and decimals; understand and use place value (N2)
AO3 3.4b – evaluate results obtained (1 mark)

(1)

(Total for Question 13 is 4 marks)

14. The table shows information about the numbers of fruit trees in an orchard.

Apple tree	Pear tree	Plum tree
45	20	25

(a) The pictogram shows this information.

Complete the key for the pictogram.

Apple tree	△△△△△△△△△
Pear tree	△△△△
Plum tree	△△△△△

Key: △ represents ..... trees

interpret and construct pictograms for categorical data (S2)

AO2

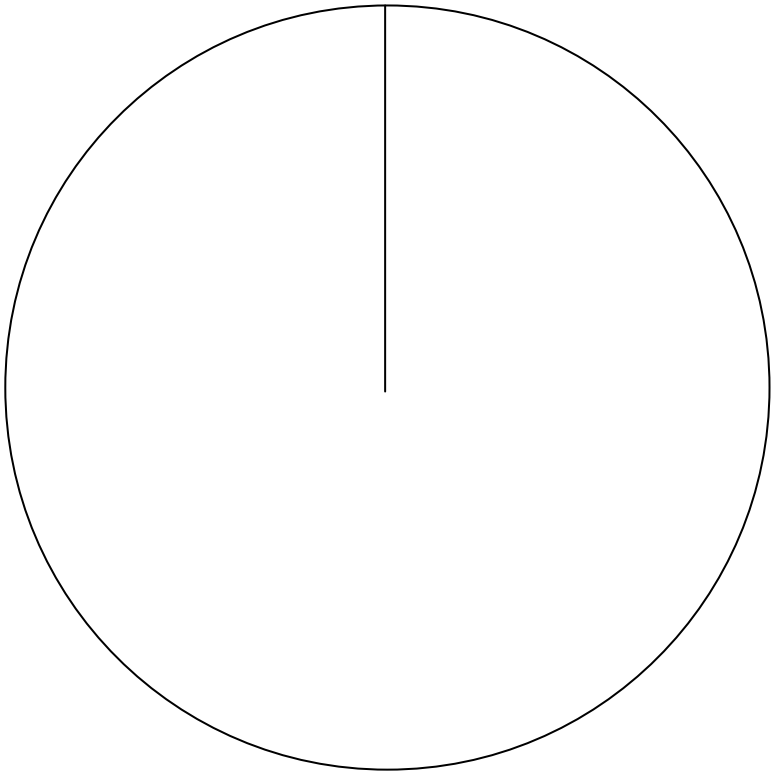
2.3a – interpret information accurately (1 mark)

(1)

(b) There are 90 fruit in the orchard.

Apple tree	Pear tree	Plum tree
45	20	25

Draw an accurate pie chart for this information.



interpret and construct pictograms for categorical data (S2)
AO2 2.3a – interpret information accurately (1 mark) 2.3b – communicate information accurately (2 marks)

(3)

(Total for Question 14 is 4 marks)

15. Carpet tiles are going to be used to cover a floor.

The floor is a 1200 mm by 1000 mm rectangle.

Each carpet tile is a 40 cm by 30 cm rectangle.

Exactly 10 carpets tiles can be used to cover the floor completely.

Show in a labelled sketch how this can be done.

use standard units of measure and related concepts (G14) apply the four operations, including formal written methods, to integers; understand and use place value (N2) change freely between related standard units in numerical contexts (R1)

AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark) AO2 2.3a – interpret information accurately (1 mark) 2.3b – communicate information accurately (1 mark)

(Total for Question 15 is 3 marks)

16. Sam buys 20 boxes of oranges.

There are 25 oranges in each box.

Each box of oranges costs £7

Sam sells $\frac{2}{5}$ of the oranges he bought.

He sells each of these oranges for 40p.

He then sells all of the remaining oranges at 3 oranges for 50p.

Did Sam make a profit or did Sam make a loss?

You must show working to justify your answer.

apply the four operations, including formal written methods, to integers, decimals and simple fractions (N2) interpret fractions as operators (N12) solve problems involving direct and inverse proportion (R10)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (3 marks) 3.3 – Interpret results in the context of the given problem (1 mark)

(Total for Question 16 is 5 marks)

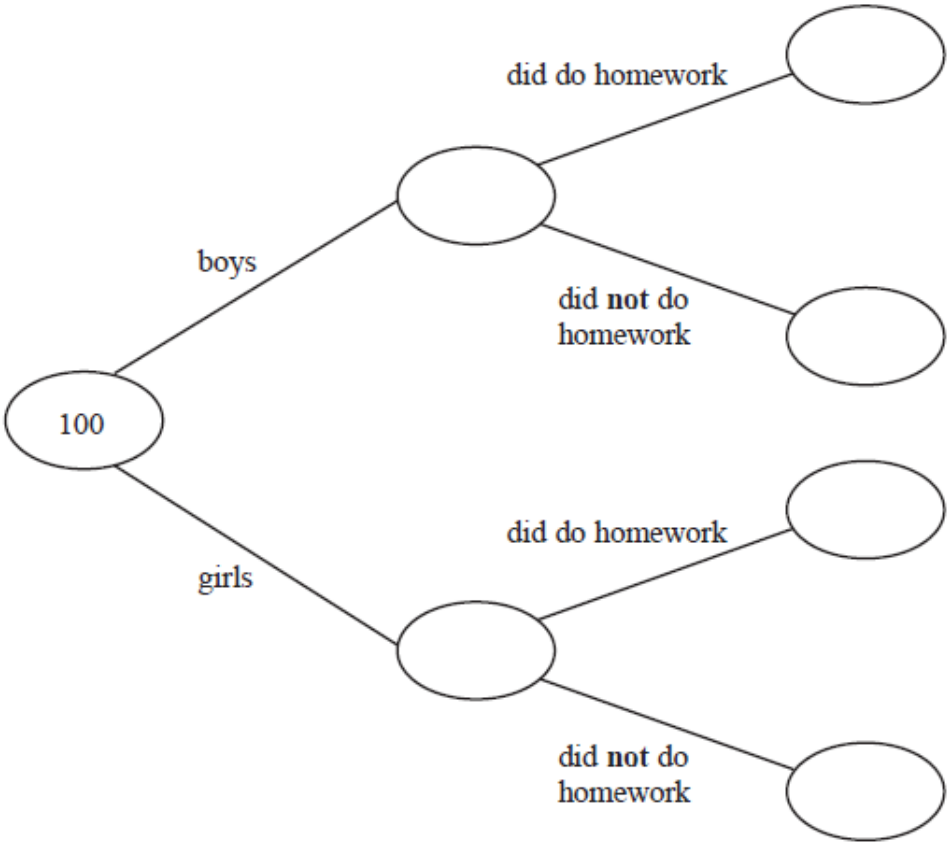
17. 100 students had some homework.

42 of these students are boys.

8 of the 100 students did **not** do their homework.

53 of the girls did do their homework.

(a) Use this information to complete the frequency tree.



New to 1MA1
record, describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees (P1)
AO2 2.3a – interpret information accurately (1 mark) 2.3b – communicate information accurately (2 marks)

(3)

One of the girls is chosen at random.

(b) Work out the probability that this girl did **not** do her homework.

relate relative expected frequencies to theoretical probability, using appropriate language and the 0-1 probability scale (P3)

AO1 1.3a – accurately carry out routine procedures (1 mark) AO2 2.3a – interpret information accurately (1 mark)

(2)

(Total for Question 17 is 5 marks)

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18. (a) Work out $\frac{2}{7}+\frac{1}{5}$

(2)

(b) Work out $1\frac{2}{3}\div\frac{3}{4}$

calculate exactly with fractions (N8)

AO1 1.3a – accurately carry out routine procedures (4 marks)

(2)

(Total for Question 18 is 4 marks)

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19 Solve $4x + 5 = x + 26$

solve linear equations in one unknown algebraically, including those with the unknown on both sides of the equation (A17)
1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

(Total for Question 19 is 2 marks)

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20 In a sale, normal prices are reduced by 20%.

The normal price of a coat is reduced by £15

Work out the normal price of the coat.

New to Foundation tier
solve problems involving percentage change (R9)
AO1 1.3a – accurately carry out routine procedures (2 marks)

(Total for Question 20 is 2 marks)

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21. Work out 6.34×5.2

Common question across both tiers
apply the four operations, including formal written methods, to decimals; understand and use place value (N2)
AO1 1.3a – accurately carry out routine procedures (3 marks)

(Total for Question 21 is 3 marks)

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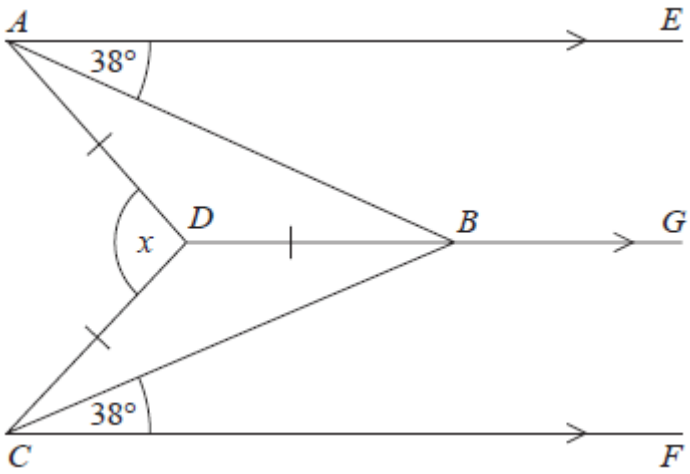
22. Expand and simplify $(m + 7)(m + 3)$

Common question across both tiers
New to Foundation tier
simplify and manipulate algebraic expressions by: • collecting like terms • expanding products of two binomials (A4)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

(Total for Question 22 is 2 marks)

23.



AE, *DBG* and *CF* are parallel.

DA = *DB* = *DC*.

Angle *EAB* = angle *BCF* = 38°

Work out the size of the angle marked *x*.

You must show your working.

Common question across both tiers
apply the properties of angles at a point; understand and use alternate and corresponding angles on parallel lines; derive and use the sum of angles in a triangle (G3) apply angle facts, including the fact that the base angles of an isosceles triangle are equal (G6)
AO2 2.1a – make deductions to draw conclusions from mathematical information (3 marks)

(Total for Question 23 is 3 marks)

24. Gary drove from London to Sheffield.

It took him 3 hours at an average speed of 80 km/h.

Lyn drove from London to Sheffield.

She took 5 hours.

Assuming that Lyn

drove along the same roads as Gary

and did not take a break,

(a) work out Lyn's average speed from London to Sheffield.

Common question across both tiers
use compound units such as speed (R11)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

(3)

(b) If Lyn did **not** drive along the same roads as Gary, explain how this could affect your answer to part (a).

Common question across both tiers
compare lengths, areas and volumes using ratio notation; make links to similarity and scale factors (R12)
AO3 3.5 – Evaluate solutions to identify how they may have been affected by assumptions made (1 mark)

(1)

(Total for Question 24 is 4 marks)

25. In a company, the ratio of the number of men to the number of women is 3 : 2

40% of the men are under the age of 25

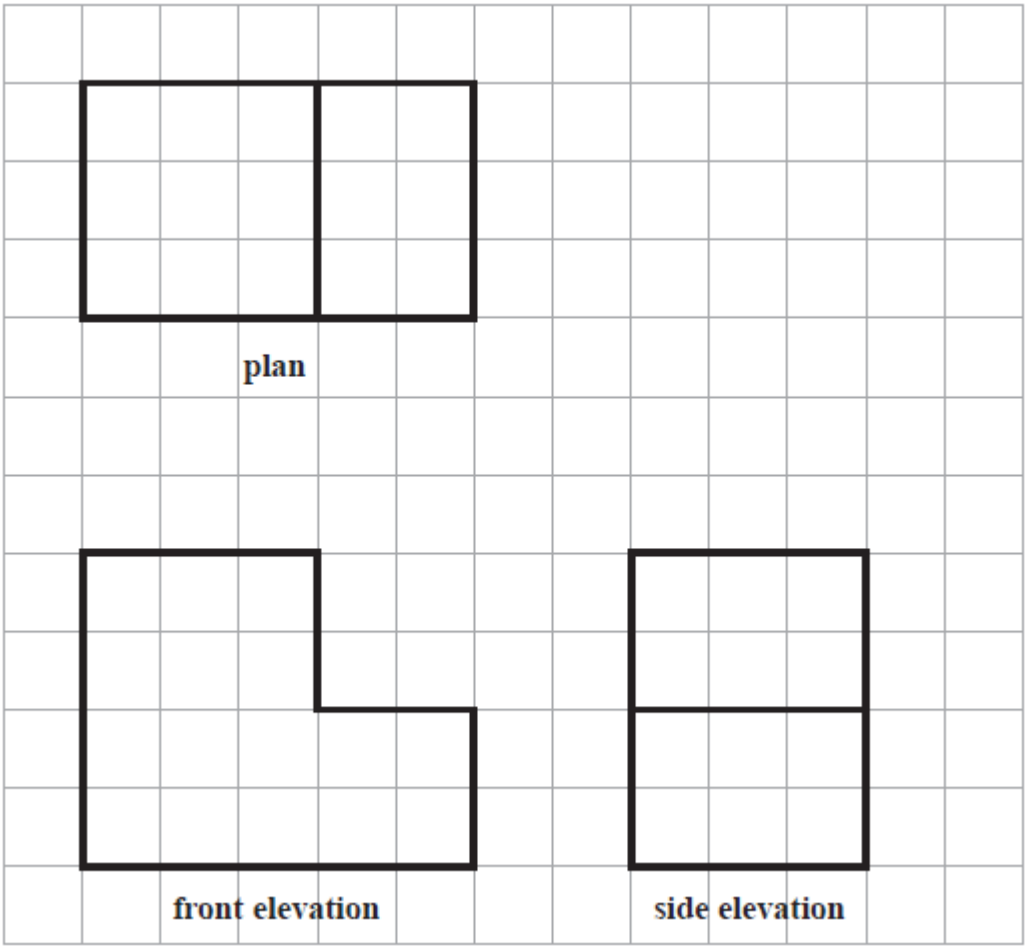
10% of the women are under the age of 25

What percentage of all the people in the company are under the age of 25?

Common question across both tiers
relate ratios to fractions and to linear functions (R8) define percentage as 'number of parts per hundred'; interpret percentages as a fraction or a decimal, and interpret these multiplicatively; express one quantity as a percentage of another (R9)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (3 marks)

(Total for Question 25 is 4 marks)

26. The plan, front elevation and side elevation of a solid prism are drawn on a centimetre grid.



In the space below, draw a sketch of the solid prism.

Write the dimensions of the prism on your sketch.

Common question across both tiers
construct and interpret plans and elevations of 3D shapes (G13)
AO2 2.3a – interpret information accurately (1 mark) 2.3b – communicate information accurately (1 mark)

(Total for Question 26 is 2 marks)

27. There are 1200 students at a school.

Kate is helping to organise a party.

She is going to order a pizza.

Kate takes a sample of 60 of the students at the school.

She asks each student to tell her one type of pizza they want.

The table shows information about her results.

Pizza	Number of students
ham	20
salami	15
vegetarian	8
margherita	17

Work out how much ham pizza Kate should order.

Write down any assumption you make **and** explain how this could affect your answer.

Common question across both tiers

New to Foundation tier

infer properties of populations or distributions from a sample, while knowing the limitations of sampling (S1)

AO1

1.3a – accurately carry out routine procedures (1 mark)

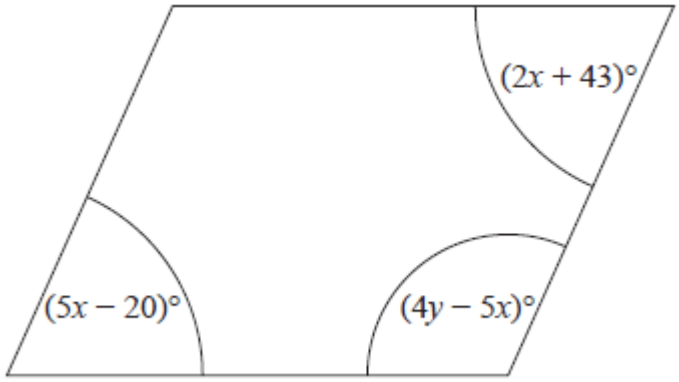
AO3

3.1c – translate problems in non-mathematical contexts into a mathematical process (1 mark)

3.5 – Evaluate solutions to identify how they may have been affected by assumptions made (1 mark)

(Total for Question 27 is 3 marks)

28. Here is a parallelogram.

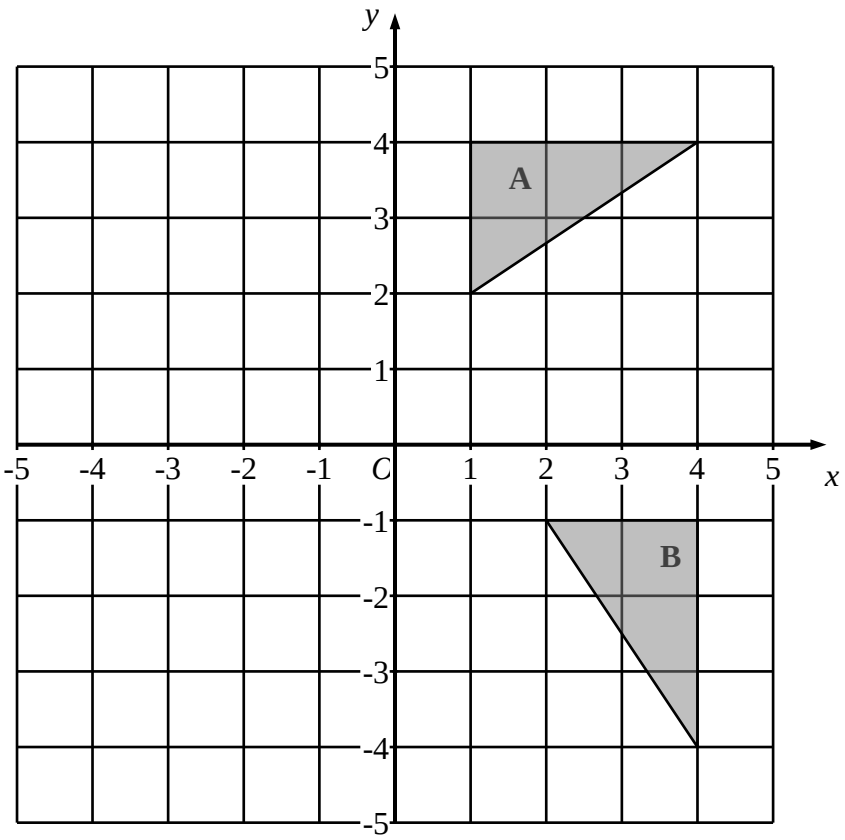


Work out the value of x and the value of y.

Common question across both tiers
derive and apply the properties and definitions of: special types of quadrilaterals, including parallelogram (G4) translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution (A21)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks) AO3 3.1c – translate problems in non-mathematical contexts into a mathematical process (3 marks)

(Total for Question 28 is 5 marks)

29.



Describe fully the single transformation that maps triangle **A** onto triangle **B**.

identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement (G7)

AO2

2.3b – communicate information accurately (2 marks)

(Total for Question 29 is 2 marks)

30. $\mathbf{a} = \begin{pmatrix} 3 \\ -7 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$

Work out $\mathbf{b} - 2\mathbf{a}$ as a column vector.

New to Foundation tier
apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors (G25)
AO1 1.2 – Use and interpret notation correctly (1 mark) 1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 30 is 2 marks)

TOTAL FOR PAPER IS 80 MARKS

Paper 2F

1. Write down the value of the 3 in the number 4376

understand and use place value (N2)
AO2 1.2 – Use and interpret notation correctly (1 mark)

(Total for Question 1 is 1 mark)

2. Write $\frac{7}{16}$ as a decimal.

work interchangeably with terminating decimals and their corresponding fractions (N10)
AO1 1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 2 is 1 mark)

3. Here is a list of numbers

4 7 9 25 27 31 64

From the numbers in the list, write down a cube number.

use positive integer powers and associated real roots, recognise powers of 2, 3, 4, 5 (N6)
AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark)

(Total for Question 3 is 1 mark)

4. Find the value of $(2.8-0.45)^2+\sqrt[3]{5.832}$

calculate with roots, and with integer indices (N7)
AO1 1.3a – accurately carry out routine procedures (2 marks)

(Total for Question 4 is 2 marks)

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5. There are some boys and girls in a classroom.

The probability of picking at random a boy is $\frac{1}{3}$

What is the probability of picking a girl?

apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one (P4)
AO1 1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 5 is 1 mark)

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6. Jan writes down

one multiple of 9

and two different factors of 40

Jan adds together her three numbers.

Her answer is greater than 20 but less than 30

Find three numbers that Jan could have written down.

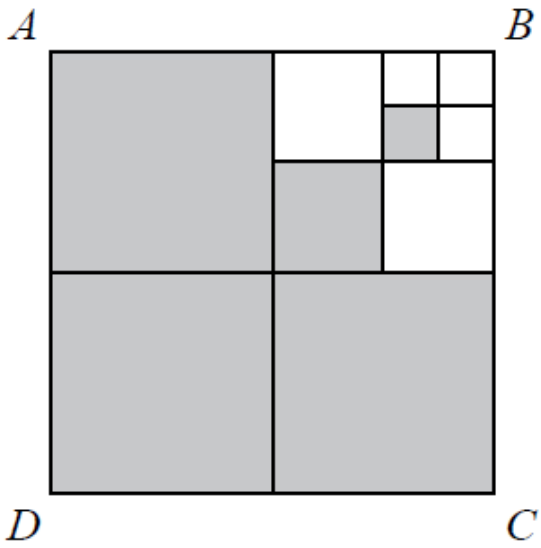
use the concepts and vocabulary of factors and multiples (N4)

AO1 1.2 – Use and interpret notation correctly (1 mark) AO3 3.1a – translate problems in mathematical contexts into a process (1 mark) 3.4b – evaluate results obtained (1 mark)

(Total for Question 6 is 3 marks)

7. *ABCD* is a square.

This diagram is drawn accurately



What fraction of the square *ABCD* is shaded?

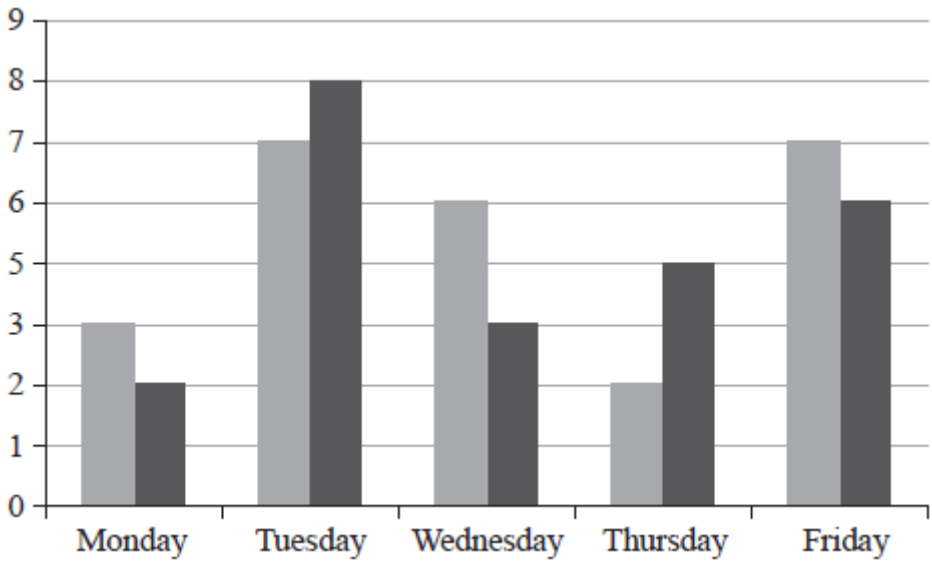
calculate exactly with fractions (N8)

AO1 1.3a – accurately carry out routine procedures (1 mark) AO2 2.3a – interpret information accurately (1 mark)

(Total for Question 7 is 2 marks)

8. Sam and Max work in a shop from Monday to Friday.

Sam draws a graph to show the number of TVs they each sell.



Write down **three** things that are wrong with this graph.

interpret and construct bar charts and know their appropriate use (S2)
AO2 2.5b – critically evaluate a given way of presenting information (3 marks)

(Total for Question 8 is 3 marks)

9. Here is a list of numbers

12 19 12 15 11 15 12 13 17

Find the median.

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (S4)
AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark) 1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 9 is 2 marks)

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10 (a) Rob buys p packets of plain crisps and c packets of cheese crisps.

Write down an expression for the total number of packets of crisps Rob buys.

translate simple situations or procedures into algebraic expressions or formulae; derive an equation, solve the equation(s) and interpret the solution (A21)
AO1 1.3a – accurately carry out routine procedures (1 mark)

(1)

(b) Solve $3x - 5 = 9$

solve linear equations in one unknown algebraically (A17)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

(2)

(Total for Question 10 is 3 marks)

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11. Adam says,

"When you multiply an even number by an odd number
the answer is always an odd number."

(a) Write down an example to show Adam is wrong.

apply the four operations, including formal written methods, to integers (N2)

AO2
2.1a – make deductions to draw conclusions from mathematical information (1 mark)

(1)

Betty says,

"When you multiply two prime numbers together
the answer is always an odd number."

(b) Betty is wrong.
Explain why.

use the concepts and vocabulary of prime numbers (N4)

AO2
2.4a – present arguments (2 marks)

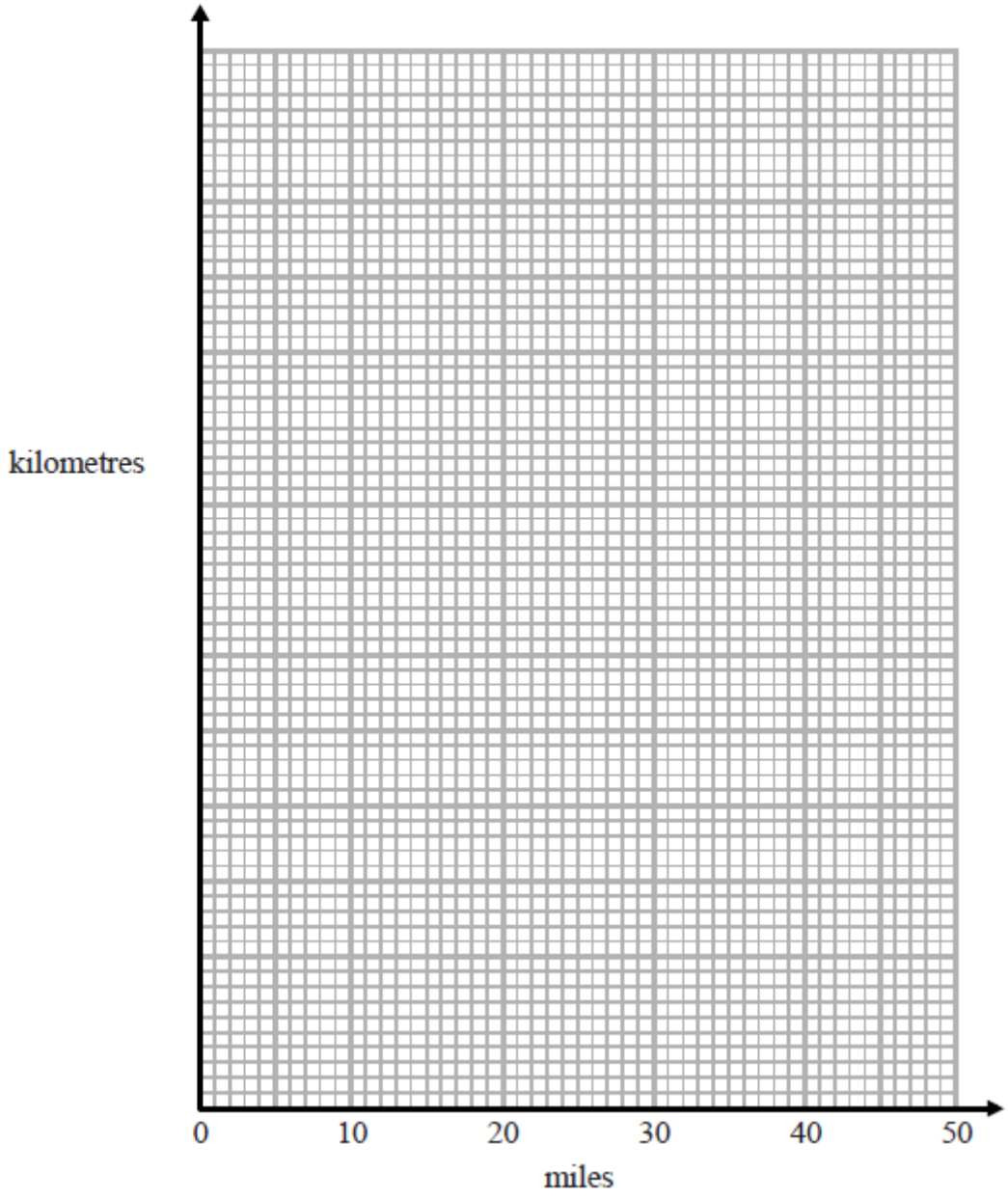
(2)

(Total for Question 11 is 3 marks

12. You can use the information in the table to convert between kilometres and miles.

miles	0	5	20	40
kilometres	0	8	32	64

(a) Use this information to draw a conversion graph.



plot and interpret graphs and graphs of non-standard functions in real contexts to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration (A14)

AO2

2.3b – communicate information accurately (3 marks)

(3)

(b) Which is further, 20 kilometres or 15 miles?
You must show how you got your answer.

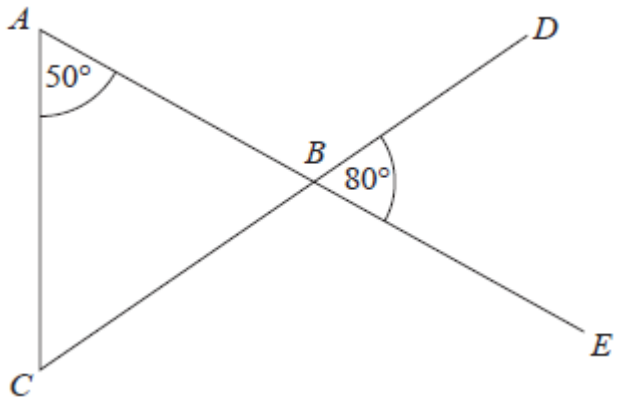
plot and interpret graphs and graphs of non-standard functions in real contexts to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration (A14) change freely between related standard units in numerical contexts (R1)

AO2 2.1a – make deductions to draw conclusions from mathematical information (1 mark) 2.3a – interpret information accurately (1 mark)

(2)

(Total for Question 12 is 5 marks)

13.



ABE and *CBD* are straight lines.

Show that triangle *ABC* is an isosceles triangle.

Give a reason for each stage of your working.

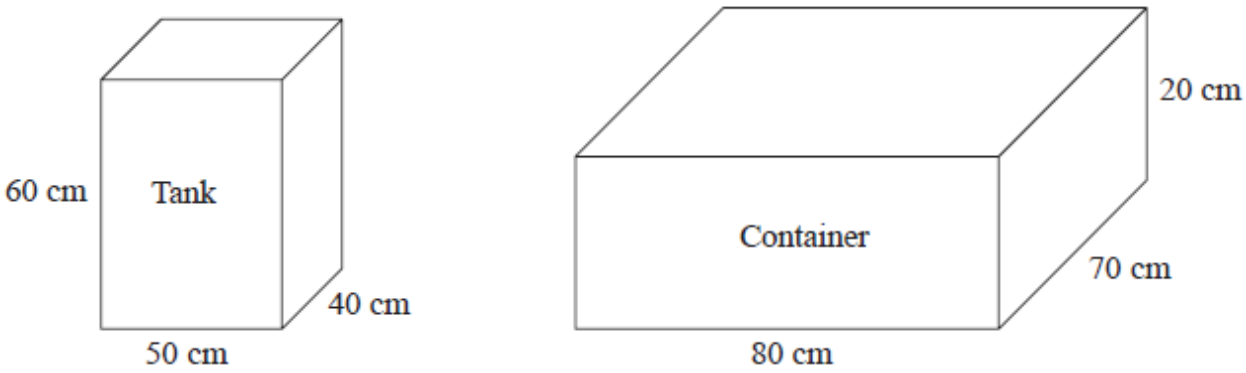
use conventional terms and notation (G1) apply the properties vertically opposite angles; understand and use alternate and corresponding angles on parallel lines; derive and use the sum of angles in a triangle (G3) derive and apply the properties and definitions of triangles using appropriate language (G4)

AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO2 2.2 – construct chains of reasoning to achieve a given result (2 marks) 2.4a – present arguments (1 mark)

(Total for Question 13 is 4 marks)

14. The diagram shows a tank in the shape of a cuboid.

It also shows a container in the shape of a cuboid.



The tank is full of oil.

The container is empty

35% of the oil from the tank is spilled.

The rest of the oil from the tank is put into the container.

Work out the height of the oil in the container.

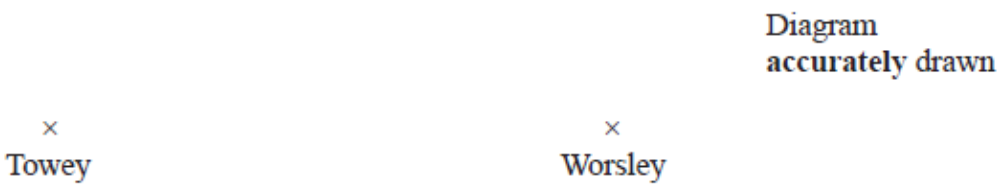
Give your answer to an appropriate degree of accuracy.

know and apply formulae to calculate volume of cuboids (G16) interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively; solve problems involving percentage change (R9)

AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (1 mark) 3.2 – Make and use connections between different parts of mathematics (1 mark) 3.4b – evaluate results obtained (1 mark)

(Total for Question 14 is 5 marks)

15. The diagram below represents two towns on a map.



Scale: 1 cm represents 3 kilometres.

Work out the distance, in kilometres, between Towey and Worsley.

use scale factors, scale diagrams and maps (R2)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO2 2.3a – interpret information accurately (1 mark)

(Total for Question 15 is 2 marks)

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16 Find the Highest Common Factor (HCF) of 24 and 60

use the concepts and vocabulary of highest common factor (N4)
AO1 1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 16 is 2 marks)

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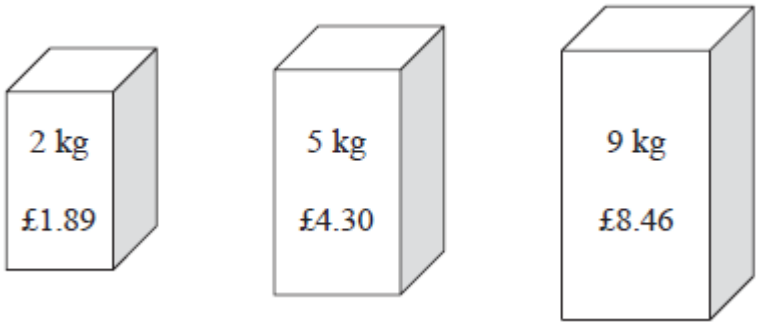
17. Soap powder is sold in three sizes of box.



A 2 kg box of soap powder costs £1.89

A 5 kg box of soap powder costs £4.30

A 9 kg box of soap powder costs £8.46

Which size of box of soap powder is the best value for money?

You must show how you get your answer.

apply the four operations, including formal written methods, to decimals; understand and use place value (N2) apply ratio to real contexts and problems (such as those involving comparison) (R5)
AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks) 3.3 – Interpret results in the context of the given problem (1 mark)

(Total for Question 17 is 3 marks)

18. $f = 5x + 2y$

$x = 3$ and $y = -2$

Find the value of f.

substitute numerical values into formulae and expressions (A2)
AO1 1.3a – accurately carry out routine procedures (2 marks)

(Total for Question 18 is 2 marks)

19. Jane made some almond biscuits which she sold at a fete.

She had:

5 kg of flour

3 kg of butter

2.5 kg of icing sugar

320 g of almonds

Here is the list of ingredients for making 24 almond biscuits.

Ingredients for 24 almond biscuits
150 g flour 100 g butter 75 g icing sugar 10 g almonds

Jane made as many almonds biscuits as she could, using the ingredients she had.

Work out how many almond biscuits she made.

solve problems involving direct and inverse proportion (R10)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1c – translate problems in non-mathematical contexts into a mathematical process (1 mark) 3.3 – Interpret results in the context of the given problem (1 mark)

(Total for Question 19 is 3 marks)

20. (a) Factorise $3f + 9$

simplify and manipulate algebraic expressions by taking out common factors (A4)

AO1

1.3a – accurately carry out routine procedures (1 mark)

(1)

(b) Factorise $x^2 - 2x - 15$

New to Foundation tier

simplify and manipulate algebraic expressions by factorising quadratic expressions of the form $x^2 + bx + c$ (A4)

AO1

1.3a – accurately carry out routine procedures (2 marks)

(2)

(Total for Question 20 is 3 marks)

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21. $q = \frac{p}{r} + s$

Make p the subject of this formula.

understand and use standard mathematical formulae; rearrange formulae to change the subject (A5)

AO1

1.3a – accurately carry out routine procedures (2 marks)

(Total for Question 21 is 2 marks)

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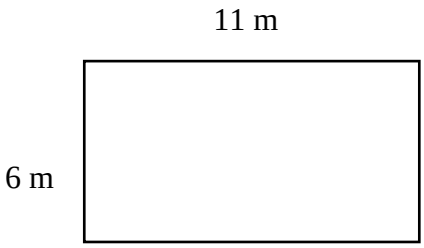
22. A tin of varnish costs £15

A rectangular floor has dimensions 6 m by 11 m.

The floor is going to be covered in varnish.



Helen assumes that each tin of this varnish covers an area of 12 m^2.

(a) Using Helen's assumption, work out the cost of buying the varnish for this floor.

apply the four operations, including formal written methods, to integers; understand and use place value (N2) round numbers and measures to an appropriate degree of accuracy (N15) solve problems involving direct and inverse proportion (R10) know and apply formulae to calculate area of parallelograms (G16)
AO1 1.3a – accurately carry out routine procedures (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (3 marks)

(4)

Helen finds that each tin of varnish covers less than 12 m^2.

(b) Explain how this might affect the number of tins she needs to buy.

solve problems involving direct and inverse proportion (R10)
AO3 3.5 – Evaluate solutions to identify how they may have been affected by assumptions made (1 mark)

(1)

(Total for Question 22 is 5 marks)

23. Frank, Mary and Seth shared some sweets in the ratio 4 : 5 : 7

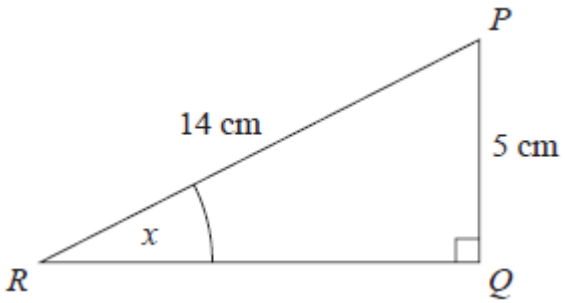
Seth got 18 more sweets than Frank.

Work out the total number of sweets they shared.

Common question across both tiers
use ratio notation (R4) apply ratio to real contexts and problems (R5)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

(Total for Question 23 is 3 marks)

24. *PQR* is a right-angled triangle.



Work out the size of the angle marked *x*.

Give your answer correct to 1 decimal place.

New to Foundation tier Common question across both tiers
know the formulae for the trigonometric ratios; apply them to find angles and lengths in right-angled triangles (G20)
AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark) 1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 24 is 2 marks)

25. Here are the first four terms of an arithmetic sequence.

6 10 14 18

(a) Write an expression, in terms of n, for the nth term of this sequence.

Common question across both tiers

deduce expressions to calculate the nth term of linear sequences (A25)

AO1

1.3a – accurately carry out routine procedures (1 mark)

AO2

2.1a – make deductions to draw conclusions from mathematical information (1 mark)

(2)

The nth term of a different arithmetic sequence is $3n + 5$

(b) Is 108 a term of this sequence?

Show how you get your answer.

Common question across both tiers

deduce expressions to calculate the nth term of linear sequences (A25)

AO2

2.4a – present arguments (2 marks)

(2)

(Total for Question 25 is 4 marks)

26. Axel and Lethna are driving along a motorway.

They see a road sign.

The road sign shows the distance to Junction 8

It also shows the average time drivers take to get to Junction 8

To Junction 8 30 miles 26 minutes

The speed limit on the motorway is 70 mph.

Lethna says

"We will have to drive faster than the speed limit to drive 30 miles in 26 minutes."

Is Lethna right?

You must show how you get your answer.

Common question across both tiers
change freely between related standard units and compound units in numerical contexts (R1) use compound units such as speed (R11)
AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (1 mark) 3.3 – Interpret results in the context of the given problem (1 mark)

(Total for Question 26 is 3 marks)

27. The table shows some information about the foot lengths of 40 adults.

Foot length (f cm)	Number of adults
$16 \leqslant f < 18$	3
$18 \leqslant f < 20$	6
$20 \leqslant f < 22$	10
$22 \leqslant f < 24$	12
$24 \leqslant f < 26$	9

(a) Write down the modal class interval.

Common question across both tiers

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (median, mean, mode and modal class) (S4)

AO2

2.3a – interpret information accurately (1 mark)

(1)

(b) Calculate an estimate for the mean foot length.

Common question across both tiers

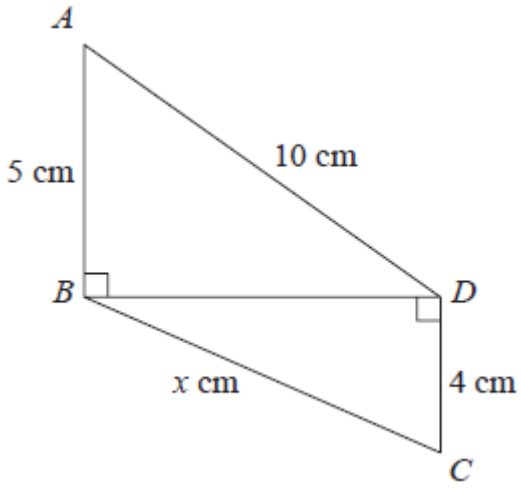
AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

(3)

(Total for Question 27 is 4 marks)

28. Triangles *ABD* and *BCD* are right-angled triangles.



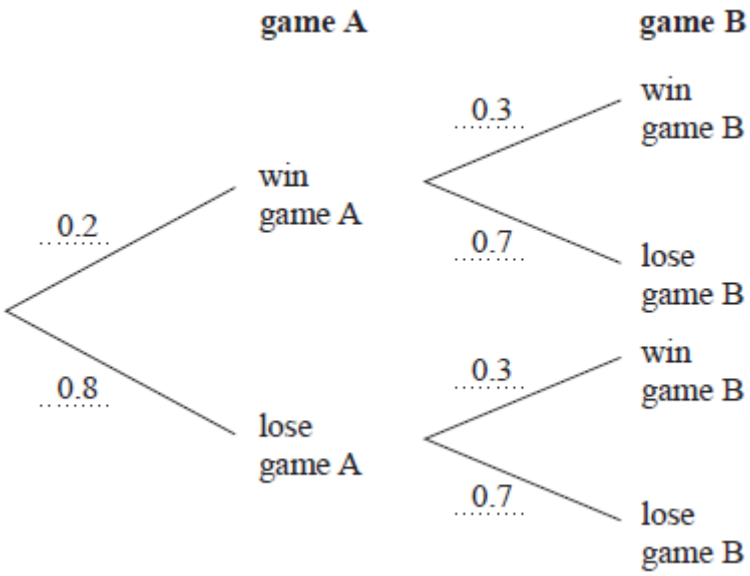
Work out the value of *x*.

Give your answer correct to 2 decimal places.

Common question across both tiers
know the formulae for: Pythagoras' theorem; apply to find angles and lengths in right-angled triangles (G20)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1b – translate problems in mathematical contexts into a series of processes (3 marks)

(Total for Question 28 is 4 marks)

29. Here is a probability tree diagram.



Work out the probability of winning both games.

New to Foundation tier
calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions (P8)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO2 2.3a – interpret information accurately (1 mark)

(Total for Question 29 is 2 marks)

TOTAL FOR PAPER IS 80 MARKS

Paper 3F

1. Write 2148 correct to the nearest 100

round numbers and measures to an appropriate degree of accuracy (N15)

AO1

1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 1 is 1 mark)

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2 (a) Simplify $8x - 3x + 2x$

simplify and manipulate algebraic expressions by collecting like terms (A4)

AO1

1.3a – accurately carry out routine procedures (1 mark)

(1)

(b) Simplify $4y \times 2y$

simplify and manipulate algebraic expressions by simplifying expressions involving products (A4)

AO1

1.3a – accurately carry out routine procedures (1 mark)

(1)

(Total for Question 2 is 2 marks)

---

3. There are 6760 people at a rugby match.
3879 of the people are men.
1241 of the people are women.

$\frac{1}{4}$ of the children are girls.

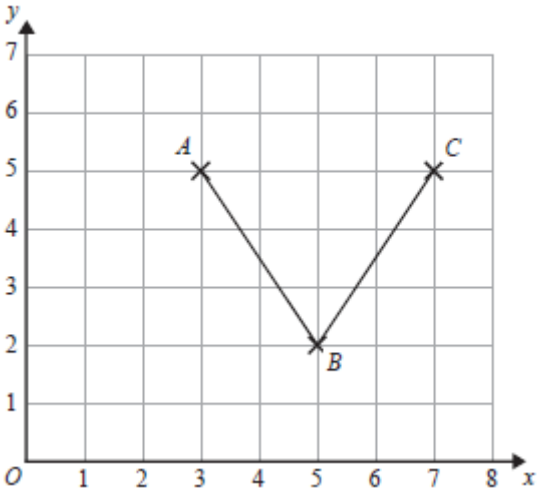
Work out how many boys are at the rugby match.

apply the four operations, including formal written methods, to integers, decimals and simple fractions (N2)

AO1 1.3a – accurately carry out routine procedures (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

(Total for Question 3 is 3 marks)

4. Here is a grid showing the points *A*, *B* and *C*.



(a) Write down the coordinates of the point *A*.

(1)

(b) On the grid, mark with a cross (×) the point (1, 2).
Label this point *D*.

work with coordinates in all four quadrants (A8)
AO1 1.2 – Use and interpret notation correctly (2 marks)

(1)

(c) On the grid, mark with a cross (×) a point *E*, so that the quadrilateral *ABCE* is a kite.

derive and apply the properties and definitions of special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus (G4)
AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark)

(1)

(Total for Question 4 is 3 marks)

5. Faiza buys

one magazine costing £2.30

one paper costing 92p

two identical bars of chocolate

Faiza pays with a £5 note.

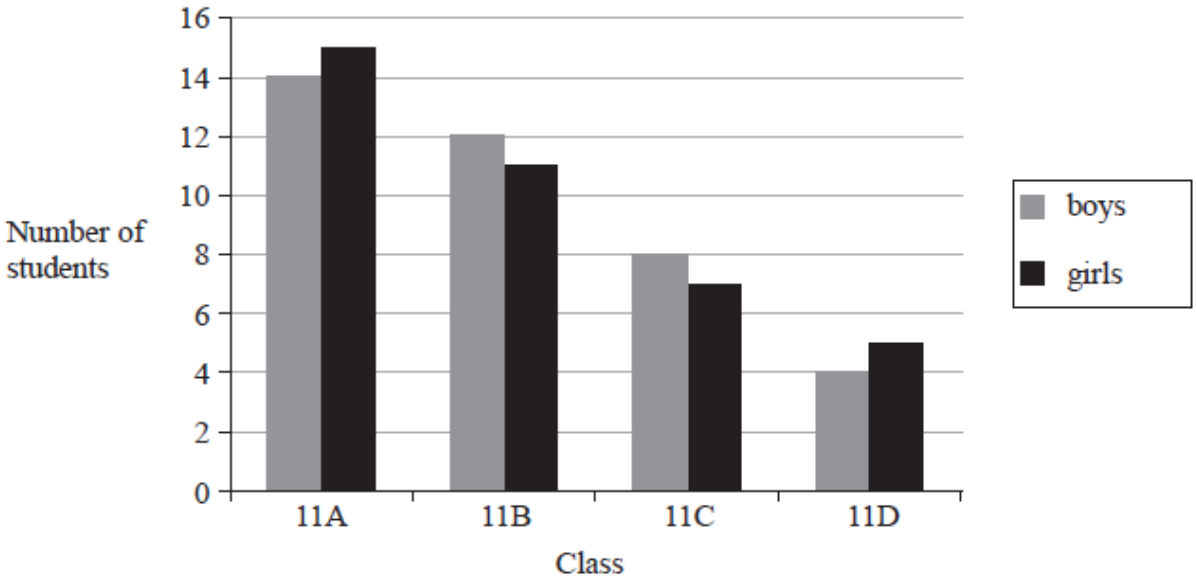
She gets 40p change.

Work out the cost of **one** bar of chocolate.

apply the four operations, including formal written methods, to integers and decimals; understand and use place value (N2) use standard units of money using decimal quantities where appropriate (N13)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

(Total for Question 5 is 3 marks)

6. The bar chart gives information about the numbers of students in the four Year 11 classes at Trowton School.



(a) What fraction of the students in class 11A are girls?

interpret and construct bar charts for categorical data and know their appropriate use (S2)
AO2 2.3a – interpret information accurately (2 marks)

(2)

Shola says,

"There are more boys than girls in Year 11 in Trowton School."

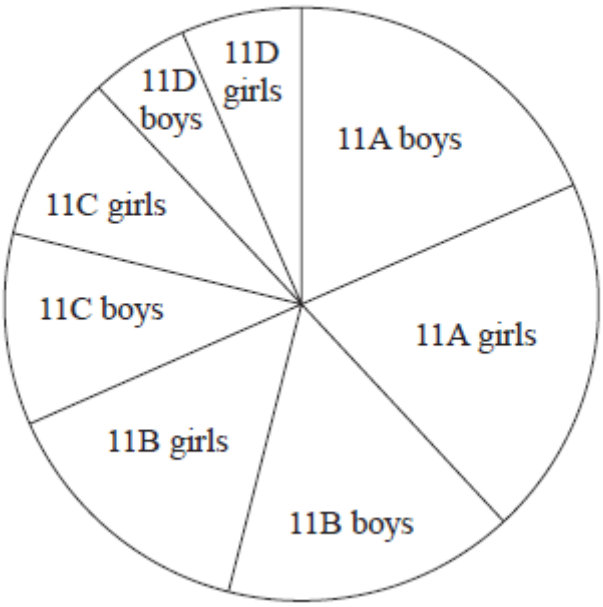
(b) Is Shola correct?
You must give a reason for your answer.

interpret and construct bar charts for categorical data and know their appropriate use (S2)
AO2 2.3b – communicate information accurately (1 mark) 2.4a – present arguments (1 mark)

(2)

The pie chart gives information about the 76 students in the same four Year 11 classes at Trowton School.

Number of students in Year 11 of Trowton School



Tolu says,

"It is more difficult to find out the numbers of students in each class from the pie chart than from the bar chart."

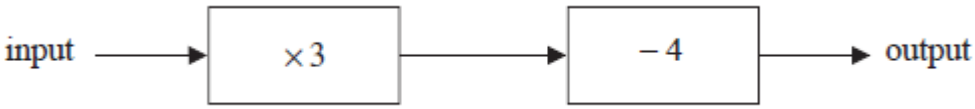
(c) Is Tolu correct?
You must give a reason for your answer.

interpret and construct pie charts for categorical data and know their appropriate use (S2)
AO2 2.5b – critically evaluate a given way of presenting information (1 mark)

(1)

(Total for Question 6 is 5 marks)

7. Here is a number machine.



(a) Work out the **output** when the input is 4

(1)

(b) Work out the **input** when the output is 11

where appropriate, interpret simple expressions as functions with inputs and outputs (A7)

AO1

1.3a – accurately carry out routine procedures (3 marks)

(2)

(c) Show that there is a value of the input for which the input and the output have the same value.

substitute numerical values into formulae and expressions, including scientific formulae (A2)

solve linear equations in one unknown algebraically (A17)

AO2

2.4a – present arguments (2 marks)

(2)

(Total for Question 7 is 5 marks)

8. 1 yard is 36 inches.

10 cm is an approximation for 4 inches.

Work out an approximation for the number of cm in 2 yards.

solve problems involving direct and inverse proportion, including graphical and algebraic representations (R10)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

(Total for Question 8 is 3 marks)

9. Work out 234% of 150

interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively; work with percentages greater than 100% (R9)
AO1 1.3a – accurately carry out routine procedures (2 marks)

(Total for Question 9 is 2 marks)

10. Here are four numbers.

$$0.43 \qquad \frac{3}{7} \qquad 43.8\% \qquad \frac{7}{16}$$

Write these numbers in order of size.
Start with the smallest number.

order positive and negative integers, decimals and fractions (N1) work interchangeably with terminating decimals and their corresponding fractions (N10)
AO1 1.3a – accurately carry out routine procedures (2 marks)

(Total for Question 10 is 2 marks)

11. Here is a list of five numbers.

14 15 16 17 18

From the list,

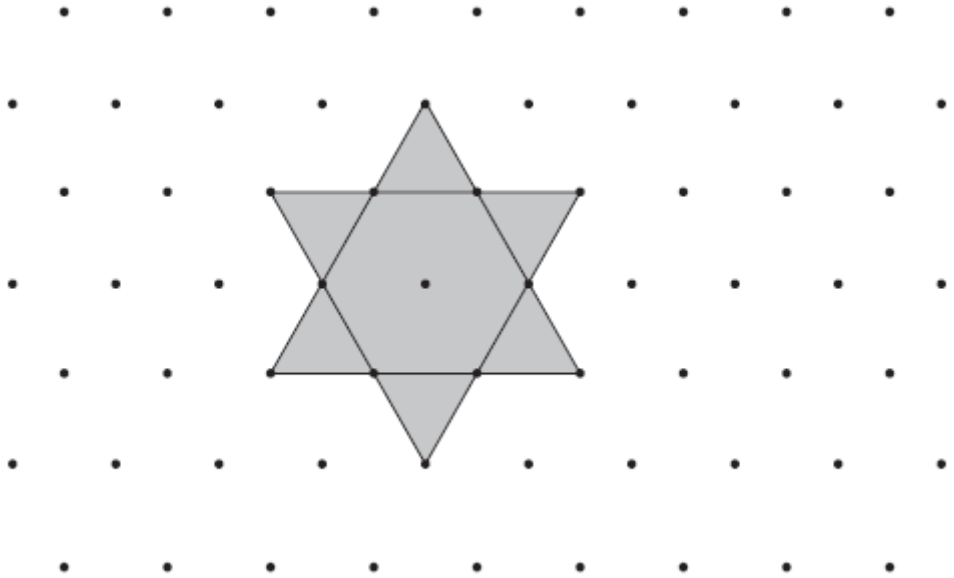
(i) write down the prime number,

(ii) write down the square number.

use the concepts and vocabulary of prime numbers (N4)
AO1 1.1 – Accurately recall facts, terminology and definitions (2 marks)

(Total for Question 11 is 2 marks)

12. Here is a star shape.



The star shape is made from a regular hexagon and six congruent equilateral triangles.

The area of the star shape is 96 cm^2.

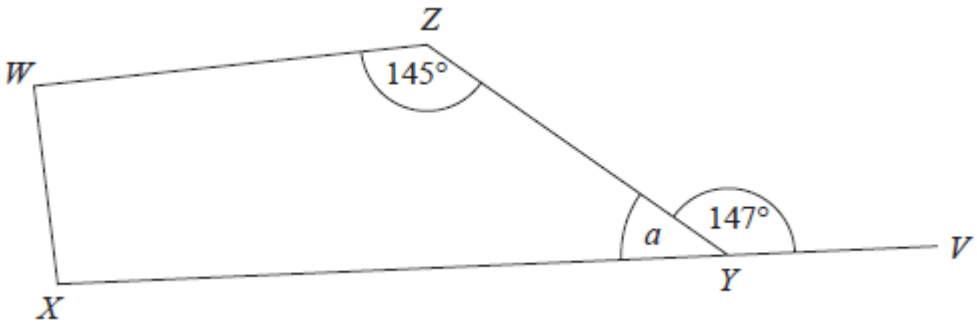
Work out the area of the regular hexagon.

derive and apply the properties and definitions of triangles and other plane figures using appropriate language (G4) identify, describe and construct congruent and similar shapes (G7)

AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1b – translate problems in mathematical contexts into a series of processes (1 mark)

(Total for Question 12 is 2 marks)

13.



WXYZ is a quadrilateral.

XYV is a straight line.

(a) (i) Find the size of the angle marked *a*.

(ii) Give a reason for your answer.

use conventional terms and notation: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons (G1)
AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark) 1.3a – accurately carry out routine procedures (1 mark)

(2)

Angle *ZWX* = angle *WXY*

(b) Work out the size of angle *ZWX*.

apply the properties of angles at a point on a straight line; deduce and use the angle sum in any polygon (G3)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1b – translate problems in mathematical contexts into a series of processes (1 mark)

(2)

(Total for Question 13 is 4 marks)

14. The total weight of 3 tins of beans and 4 jars of jam is 2080 g.
The total weight of 5 tins of beans is 2000 g.

Work out the weight of 1 tin of beans and the weight of 1 jar of jam.

solve problems involving direct and inverse proportion, including graphical and algebraic representations (R10)
1.3a – accurately carry out routine procedures (1 mark) 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

(Total for Question 14 is 4 marks)

15. There are 25 boys and 32 girls in a club.

$\frac{2}{5}$ of the boys and $\frac{1}{2}$ of the girls walk to the club.

The club leader picks at random a child from the children who walk to the club.

Work out the probability that this child is a boy.

calculate exactly with fractions (N8) relate relative expected frequencies to theoretical probability, using appropriate language and the 0-1 probability scale (P3)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

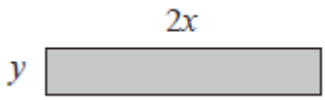
(Total for Question 15 is 3 marks)

16. Change 72 km/h into m/s.

change freely between related standard units and compound units in numerical contexts (R1)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

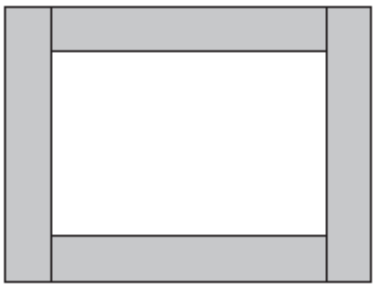
(Total for Question 16 is 3 marks)

17. Here is a rectangle made of card.



The measurements in the diagram are in centimetres.

Lily fits four of these rectangles together to make a frame.



The perimeter of the inside of the frame is P cm.

(a) Show that $P = 8x - 4y$

simplify and manipulate algebraic expressions by:

- collecting like terms
- multiplying a single term over a bracket (A4)

calculate: perimeters of 2D shapes (G17)

AO2

2.2 – construct chains of reasoning to achieve a given result (1 mark)

2.3b – communicate information accurately (1 mark)

(2)

Magda says,

"When x and y are whole numbers, P is always a multiple of 4."

(b) Is Magda correct?
You must give a reason for your answer.

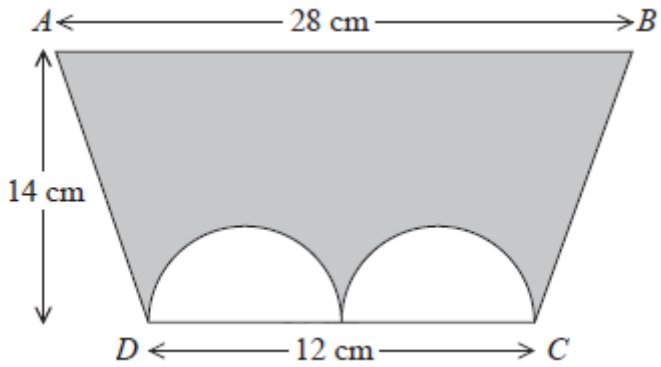
use the concepts and vocabulary multiples (N4) manipulate algebraic expressions by taking out common factors (A4)

AO2 2.3a – interpret information accurately (1 mark) 2.4a – present arguments (1 mark)

(2)

(Total for Question 17 is 4 marks)

18. The diagram shows a trapezium *ABCD* and two identical semicircles.



The centre of each semicircle is on *DC*.

Work out the area of the shaded region.

Give your answer correct to 3 significant figures.

New to Foundation tier Common question across both tiers
know and apply formulae to calculate area of trapezia (G16) know the formulae: area of a circle; areas of circles and composite shapes (G17)
AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark) 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1b – translate problems in mathematical contexts into a series of processes (2 marks)

(Total for Question 18 is 4 marks)

19. Asif is going on holiday to Turkey.

The exchange rate is £1 = 3.5601 lira.

Asif changes £550 to lira.

(a) Work out how many lira he should get.
Give your answer to the nearest lira.

Common question across both tiers
apply ratio to real contexts and problems such as those involving conversion (R5) solve problems involving direct and inverse proportion (R10)
AO1 1.3a – accurately carry out routine procedures (2 marks)

(2)

Asif sees a pair of shoes in Turkey.

The shoes cost 210 lira.

Asif does not have a calculator.

He uses £2 = 7 lira to work out the approximate cost of the shoes in pounds.

(b) Use £2 = 7 lira to show that the approximate cost of the shoes is £60

Common question across both tiers
solve problems involving direct and inverse proportion (R10)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO2 2.3b – communicate information accurately (1 mark)

(2)

(c) Is using £2 = 7 lira instead of using £1 = 3.5601 lira a sensible start to Asif's method to work out the cost of the shoes in pounds?
You must give a reason for your answer.

Common question across both tiers
AO3 3.4a – evaluate methods used (1 mark)

(1)

(Total for Question 19 is 5 marks)

20. Here are the first six terms of a Fibonacci sequence.

1 1 2 3 5 8

The rule to continue a Fibonacci sequence is,

the next term in the sequence is the sum of the two previous terms.

(a) Find the 9th term of this sequence.

Common question across both tiers

New to 1MA1

New to Foundation tier

recognise and use sequences of Fibonacci type sequences (A24)

AO2

2.3b – communicate information accurately (1 mark)

(1)

The first three terms of a different Fibonacci sequence are

a b $a + b$

(b) Show that the 6th term of this sequence is $3a + 5b$

Common question across both tiers

New to 1MA1

New to Foundation tier

AO2

2.2 – construct chains of reasoning to achieve a given result (1 mark)

2.3b – communicate information accurately (1 mark)

(2)

Given that the 3rd term is 7 and the 6th term is 29,

(c) find the value of a and the value of b.

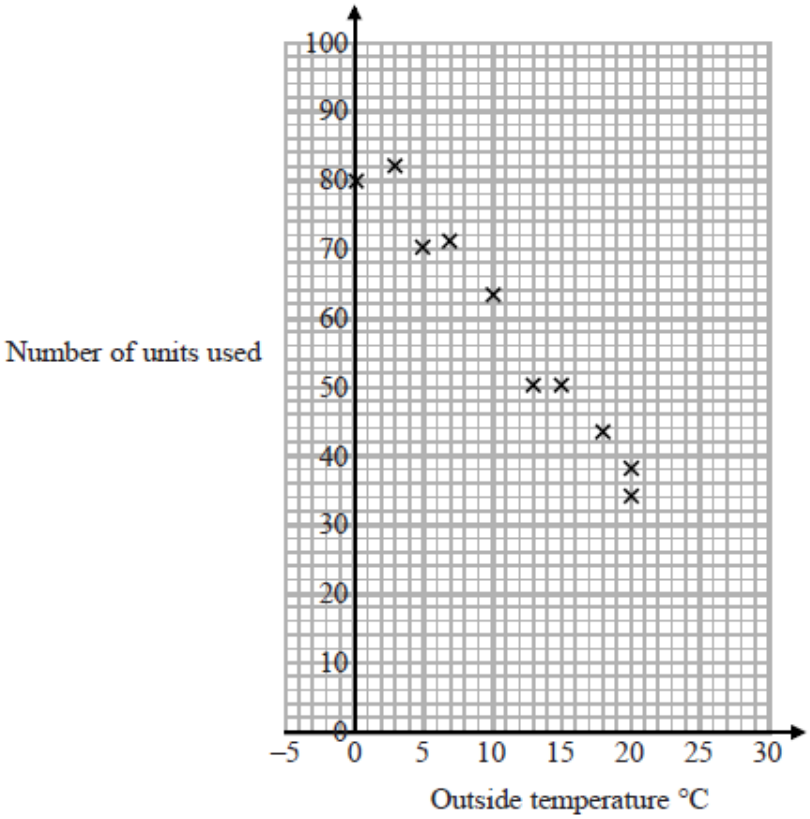
Common question across both tiers
solve two simultaneous equations in two variables (A19) derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution (A21)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1b – translate problems in mathematical contexts into a series of processes (2 marks)

(3)

(Total for Question 20 is 6 marks)

21. In a survey, the outside temperature and the number of units of electricity used for heating were recorded for ten homes.

The scatter diagram shows this information.



Molly says,

"On average the number of units of electricity used for heating decreases by 4 units for each °C increase in outside temperature."

(a) Is Molly right?

Show how you get your answer.

Common question across both tiers
use and interpret scatter graphs of bivariate data; draw estimated lines of best fit (S6) identify and interpret gradients and intercepts of linear functions graphically (A10)
AO2 2.1b – make inferences to draw conclusions from mathematical information (1 mark) 2.3a – interpret information accurately (1 mark) 2.3b – communicate information accurately (1 mark)

(3)

(b) You should **not** use a line of best fit to predict the number of units of electricity used for heating when the outside temperature is 30°C.

Give one reason why.

Common question across both tiers
interpolate and extrapolate apparent trends while knowing the dangers of so doing (S6)
AO2 2.4a – present arguments (1 mark)

(1)

(Total for Question 21 is 4 marks)

22. Henry is thinking of having a water meter.

These are the two ways he can pay for the water he uses.

Water Meter

A charge of £28.20 per year

plus

91.22p for every cubic metre of water used

1 cubic metre = 1000 litres

No Water Meter

A charge of £107 per year

Henry uses an average of 180 litres of water each day.

Use this information to determine whether or not Henry should have a water meter

Common question across both tiers
apply the four operations, including formal written methods, to integers and decimals; understand and use place value (N2) change freely between related standard units and compound units in numerical contexts (R1) solve problems involving direct and inverse proportion (R10) use compound units such as rates of pay (R11)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (3 marks) 3.3 – Interpret results in the context of the given problem (1 mark)

(Total for Question 22 is 5 marks)

23. A and B are two companies.

The table shows some information about the sales of each company and the number of workers for each company in 2004 and in 2014

	Company A		Company B	
	Sales (£ millions)	Number of workers	Sales (£ millions)	Number of workers
2004	320	2960	48	605
2014	388	3200	57	640

(a) Work out the percentage increase in sales from 2004 to 2014 for Company A.

solve problems involving percentage change, including percentage increase/decrease and original value problems (R9)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

(2)

(b) Which company had the most sales per worker in 2014, Company A or Company B?
You must show how you get your answer.

apply the four operations, including formal written methods, to integers and decimals; understand and use place value (N2)

use compound units such as rates of pay (R11)

AO1

1.3a – accurately carry out routine procedures (2 marks)

AO2

2.1a – make deductions to draw conclusions from mathematical information (1 mark)

(3)

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

Paper 1H

1. Work out 6.34 × 5.2

Common question across both tiers
apply the four operations, including formal written methods, to decimals; understand and use place value (N2)
AO1 1.3a – accurately carry out routine procedures (3 marks)

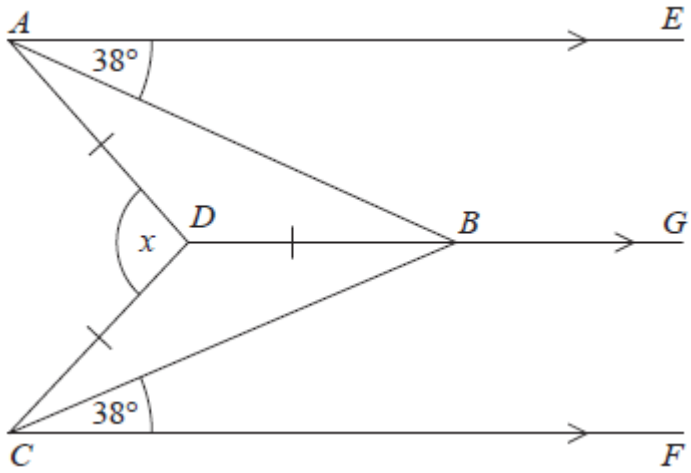
(Total for Question 1 is 3 marks)

2. Expand and simplify $(m + 7)(m + 3)$

Common question across both tiers
simplify and manipulate algebraic expressions by: • collecting like terms • expanding products of two binomials (A4)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

(Total for Question 2 is 2 marks)

3.



AE, *DBG* and *CF* are parallel.

DA = *DB* = *DC*.

Angle *EAB* = angle *BCF* = 38°

Work out the size of angle marked *x*.

You must show your working.

Common question across both tiers
apply the properties of angles at a point; understand and use alternate and corresponding angles on parallel lines; derive and use the sum of angles in a triangle (G3) apply angle facts, including the fact that the base angles of an isosceles triangle are equal (G6)
AO2 2.1a – make deductions to draw conclusions from mathematical information (3 marks)

(Total for Question 3 is 3 marks)

4. Gary drove from London to Sheffield.

It took him 3 hours at an average speed of 80 km/h.

Lyn drove from London to Sheffield.

She took 5 hours.

Assuming that Lyn

drove along the same roads as Gary

and did not take a break,

(a) work out Lyn's average speed from London to Sheffield.

Common question across both tiers
use compound units such as speed (R11)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

(3)

(b) If Lyn did **not** drive along the same roads as Gary, explain how this could affect your answer to part (a).

Common question across both tiers
compare lengths, areas and volumes using ratio notation; make links to similarity and scale factors (R12)
AO3 3.5 – Evaluate solutions to identify how they may have been affected by assumptions made (1 mark)

(1)

(Total for Question 4 is 4 marks)

5. In a company, the ratio of the number of men to the number of women is 3 : 2

40% of the men are under the age of 25

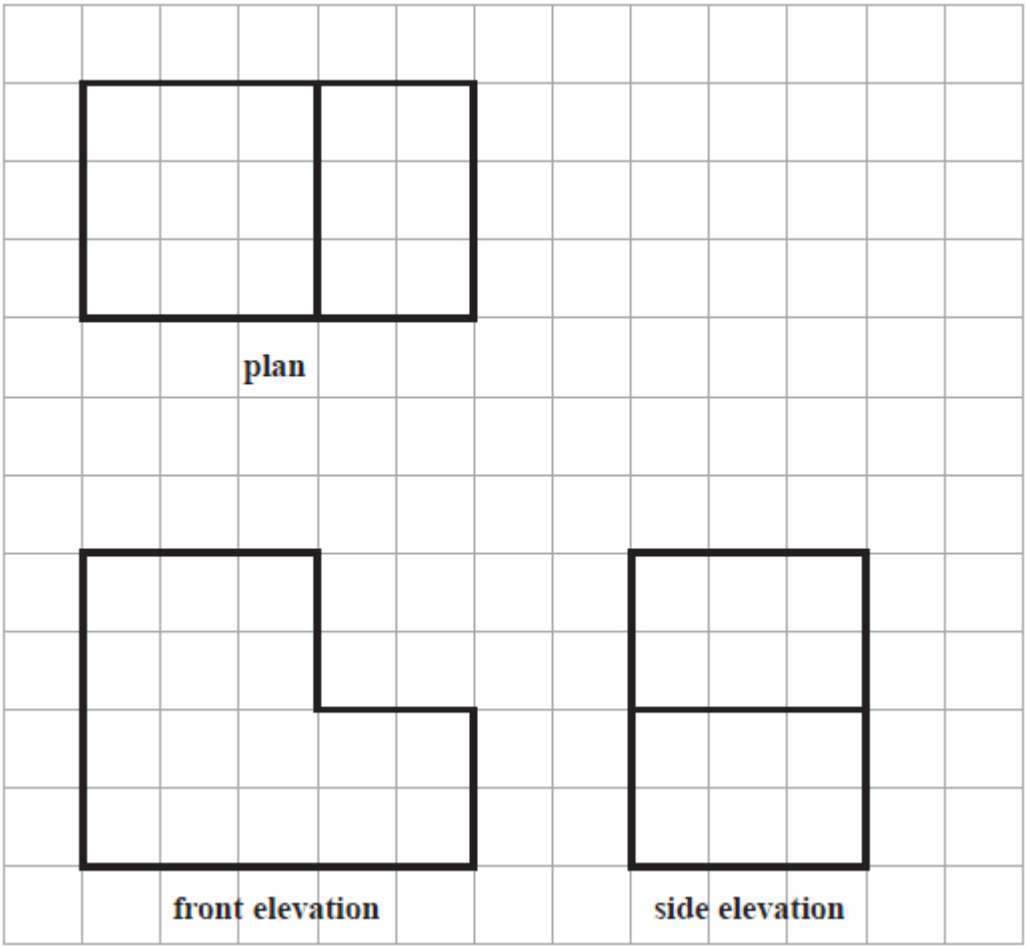
10% of the women are under the age of 25

What percentage of all the people in the company are under the age of 25?

Common question across both tiers
relate ratios to fractions and to linear functions (R8) define percentage as 'number of parts per hundred'; interpret percentages as a fraction or a decimal, and interpret these multiplicatively; express one quantity as a percentage of another (R9)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (3 marks)

(Total for Question 5 is 4 marks)

6. The plan, front elevation and side elevation of a solid prism are drawn on a centimetre grid.



In the space below, draw a sketch of the solid prism.

Write the dimensions of the prism on your sketch.

Common question across both tiers
construct and interpret plans and elevations of 3D shapes (G13)
AO2 2.3a – interpret information accurately (1 mark) 2.3b – communicate information accurately (1 mark)

(Total for Question 6 is 2 marks)

7. There are 1200 students at a school.

Kate is helping to organise a party.

She is going to order pizza.

Kate takes a sample of 60 of the students at the school.

She asks each student to tell her **one** type of pizza they want.

The table shows information about her results.

Pizza	Number of students
ham	20
salami	15
vegetarian	8
margherita	17

Work out how much ham pizza Kate should order.

Write down any assumption you make **and** explain how this could affect your answer.

Common question across both tiers

infer properties of populations or distributions from a sample, while knowing the limitations of sampling (S1)

AO1

1.3a – accurately carry out routine procedures (1 mark)

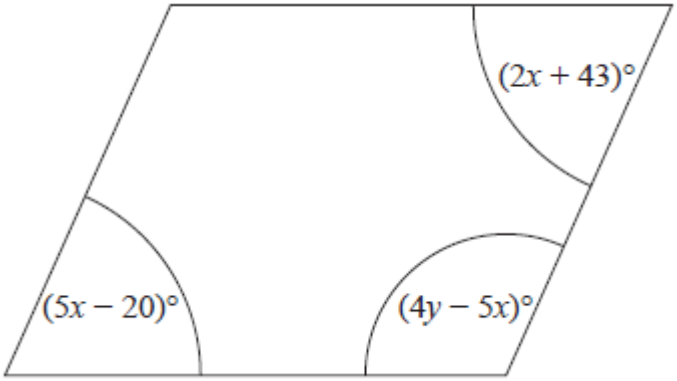
AO3

3.1c – translate problems in non-mathematical contexts into a mathematical process (1 mark)

3.5 – Evaluate solutions to identify how they may have been affected by assumptions made (1 mark)

(Total for Question 7 is 3 marks)

8. Here is a parallelogram.



Work out the value of x and the value of y.

Common question across both tiers
derive and apply the properties and definitions of: special types of quadrilaterals, including parallelogram (G4) translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution (A21)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks) AO3 3.1c – translate problems in non-mathematical contexts into a mathematical process (3 marks)

(Total for Question 8 is 5 marks)

9. Work out the value of $(9 \times 10^{-4}) \times (3 \times 10^{7})$

Give your answer in standard form.

calculate with and interpret standard form (N9)
AO1 1.2 – Use and interpret notation correctly (1 mark) 1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 9 is 2 marks)

10 (a) Write down the value of $64^{\frac{1}{2}}$

calculate with roots, and with integer **and fractional** indices (N7)
AO1 1.2 – Use and interpret notation correctly (1 mark)

(1)

(b) Find the value of $\left(\frac{8}{125}\right)^{-\frac{2}{3}}$

calculate exactly with fractions (N8)
AO1 1.2 – Use and interpret notation correctly (1 mark) 1.3a – accurately carry out routine procedures (1 mark)

(2)

(Total for Question 10 is 3 marks)

11. One uranium atom has a mass of 3.95×10^{-22} grams.

(a) Work out an estimate for the number of uranium atoms in 1 kg of uranium.

calculate with and interpret standard form (N9) estimate answers (N14) change freely between related standard units and compound units in numerical contexts (R1) solve problems involving direct and inverse proportion (R10)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

(3)

(b) Is your answer to (a) an underestimate or an overestimate?
Give a reason for your answer.

estimate answers; check calculations using approximation and estimation (N14)
AO3 3.4b – evaluate results obtained (1 mark)

(1)

(Total for Question 11 is 4 marks)

12. $\text{Pressure} = \dfrac{\text{force}}{\text{area}}$

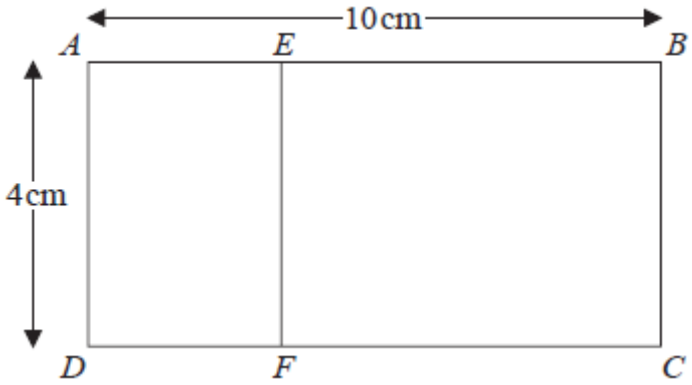
Find the pressure exerted by a force of 900 newtons on an area of 60 cm^2.

Give your answer in newtons/m^2.

New to 1MA1
change freely between related standard units and compound units in numerical contexts (R1) use compound units such as speed, rates of pay, unit pricing, density and pressure (R11)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

(Total for Question 12 is 2 marks)

13. Rectangle *ABCD* is mathematically similar to rectangle *DAEF*.



AB = 10 cm.

AD = 4 cm.

Work out the area of rectangle *DAEF*.

apply similarity and properties of quadrilaterals to conjecture and derive results about angles and sides (G6) know and apply formulae to calculate: area of parallelograms (G16)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1b – translate problems in mathematical contexts into a series of processes (2 marks)

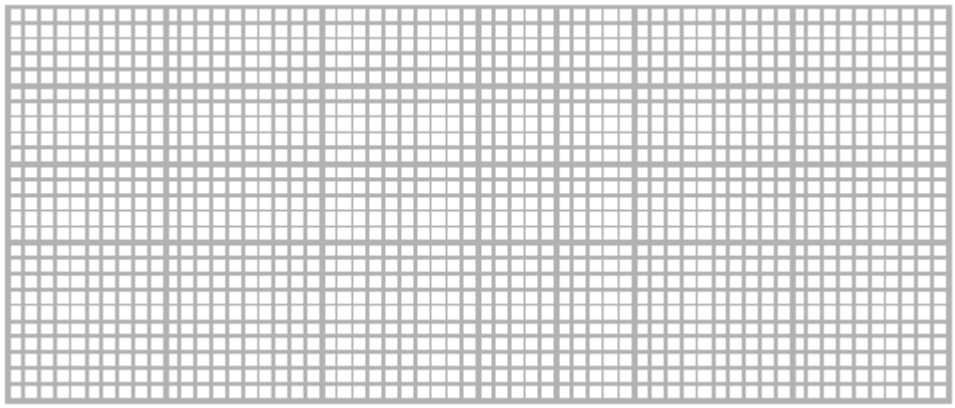
(Total for Question 13 is 3 marks)

14. Ben played 15 games of basketball.

Here are the points he scored in each game.

17 18 18 18 19 20 20 22 23 23 23 26 27 28 28

(a) Draw a box plot for this information.



interpret, analyse and compare the distributions of data sets from univariate empirical distributions through:

- appropriate graphical representation involving discrete, continuous and grouped data, **including box plots**
- appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers, **quartiles and inter-quartile range**) (S4)

AO2

2.3a – interpret information accurately (1 mark)

2.3b – communicate information accurately (2 marks)

(3)

Sam plays in the same 15 games of basketball.

The median number of points Sam scored is 23
The interquartile range of these points is 12
The range of these points is 20

(b) Who is more consistent at scoring points, Sam or Ben?
You must give a reason for your answer.

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of spread (range, including consideration of outliers, **quartiles and inter-quartile range**) (S4)
AO2 2.1b – make inferences to draw conclusions from mathematical information (1 mark) 2.3a – interpret information accurately (1 mark)

(2)

(Total for Question 14 is 5 marks)

15. In a shop, all normal prices are reduced by 20% to give the sale price.

The sale price of a TV set is then reduced by 30%.

Mary says,

" 30 + 20 = 50, so this means that the normal price of the TV set has been reduced by 50%."

Is Mary right?

You must give a reason for your answer.

solve problems involving percentage change, including percentage increase/decrease and original (R9)
AO2 2.5a – assess the validity of an argument (2 marks)

(Total for Question 15 is 2 marks)

16. Factorise fully $20x^2 - 5$

simplify and manipulate algebraic expressions by factorising quadratic expressions of the form $ax^2 + bx + c$ (A4)
AO1 1.3a – accurately carry out routine procedures (2 marks)

(Total for Question 16 is 2 marks)

17. Make a the subject of $a + 3 = \frac{2a + 7}{r}$

rearrange formulae to change the subject (A5)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

(Total for Question 17 is 3 marks)

18. Solid **A** and solid **B** are mathematically similar.

The ratio of the surface area of solid **A** to the surface area of solid **B** is 4 : 9

The volume of solid **B** is 405 cm^3.

Show that the volume of solid **A** is 120 cm^3.

compare lengths, areas and volumes using ratio notation; make links to similarity and scale factors (R12) apply the concepts of congruence and similarity, including the relationships between lengths, **areas and volumes** in similar figures (G19)
AO2 2.2 – construct chains of reasoning to achieve a given result (3 marks)

(Total for Question 18 is 3 marks)

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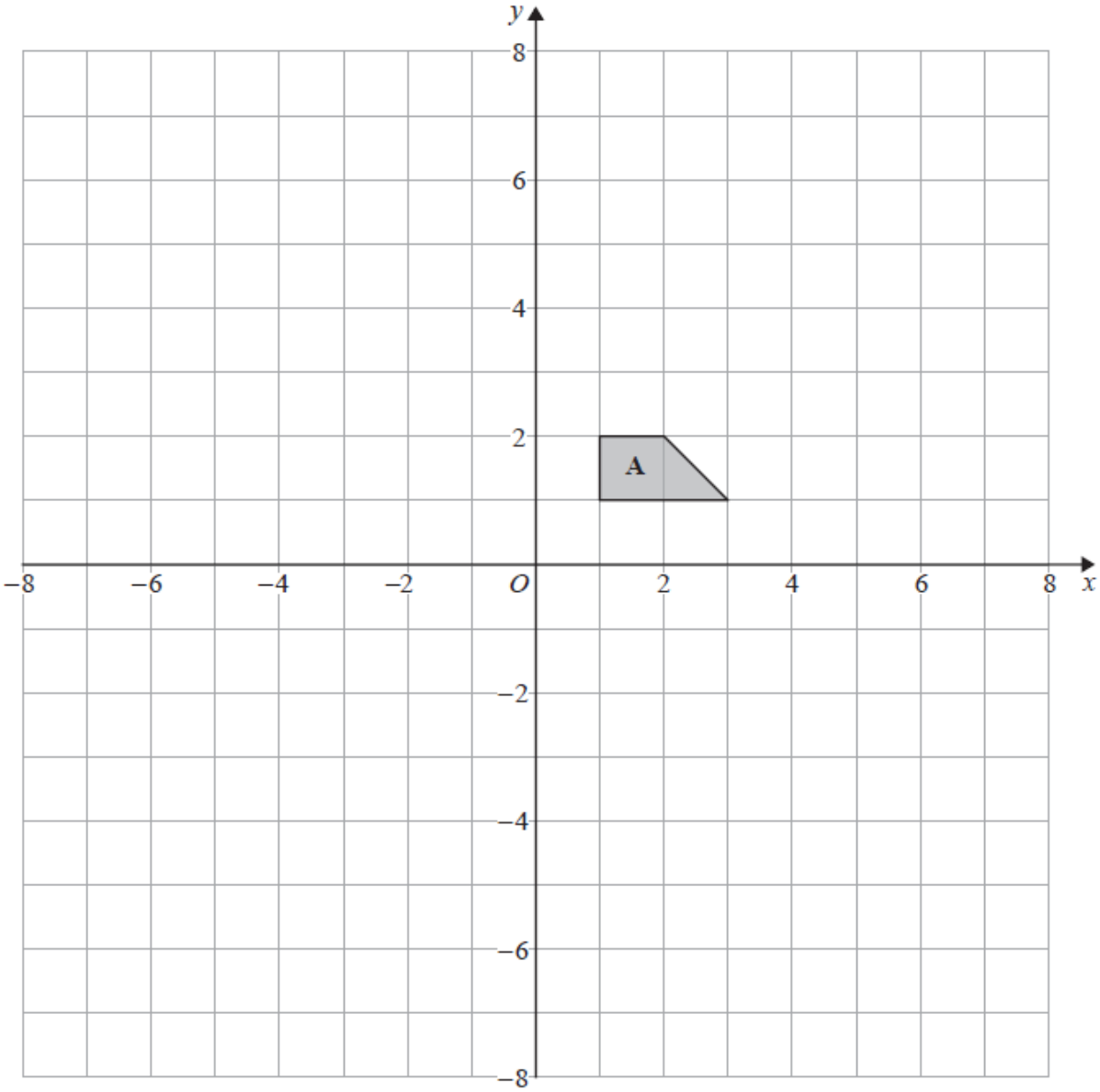
19. Solve $x^2 > 3x + 4$

New to 1MA1
solve quadratic inequalities in one variable (A22)
AO1 1.2 – Use and interpret notation correctly (1 mark) 1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

(Total for Question 19 is 3 marks)

20.



(a) Enlarge shape A by scale factor −2, centre (0, 0)
Label your image B.

identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement (**including negative scale factors**) (G7)
AO1 1.3a – accurately carry out routine procedures (2 marks)

(2)

(b) Describe fully the single transformation that will map shape B onto shape A.

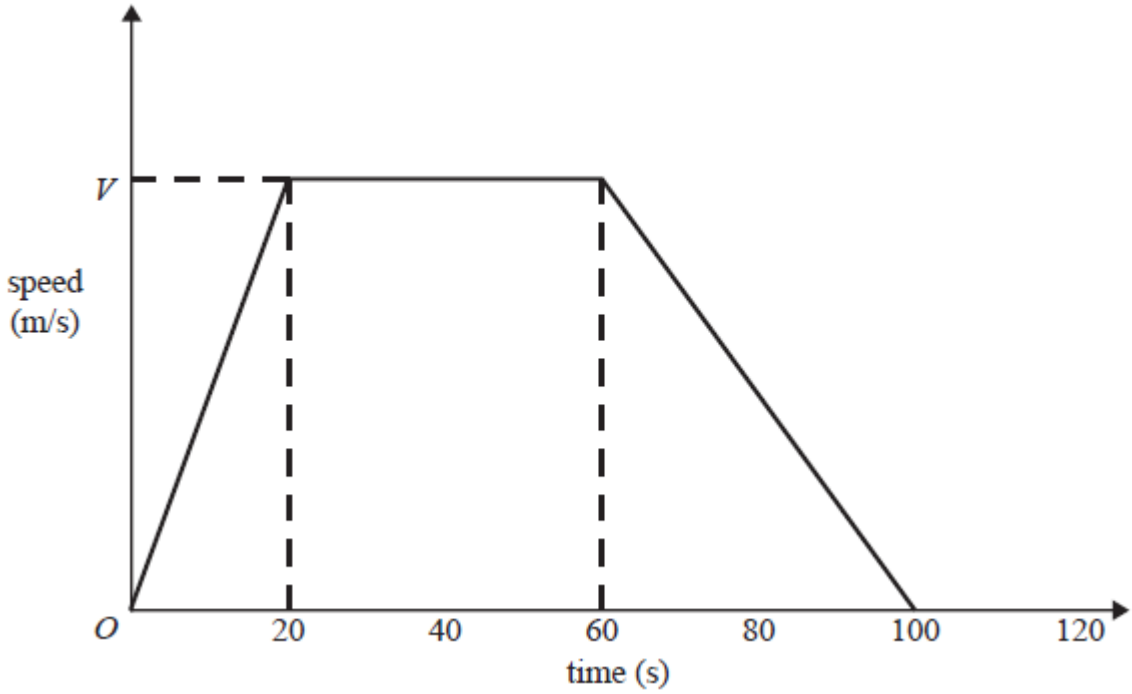
describe the changes and invariance achieved by combinations of rotations, reflections and translations (G8)
AO2 2.3b – communicate information accurately (1 mark)

(1)

(Total for Question 20 is 3 marks)

21. Here is a speed-time graph for a car journey.

The journey took 100 seconds.



The car travelled 1.75 km in the 100 seconds.

(a) Work out the value of V.

New to 1MA1
calculate or estimate gradients of graphs and areas under graphs and interpret results in cases such as velocity-time graphs (A15)
AO1 1.3a – accurately carry out routine procedures (1 mark) AO2 2.3a – interpret information accurately (1 mark) AO3 3.1c – translate problems in non-mathematical contexts into a mathematical process (1 mark)

(3)

(b) Describe the acceleration of the car for each part of this journey.

AO2

2.3a – interpret information accurately
(1 mark)

2.3b – communicate information accurately
(1 mark)

(2)

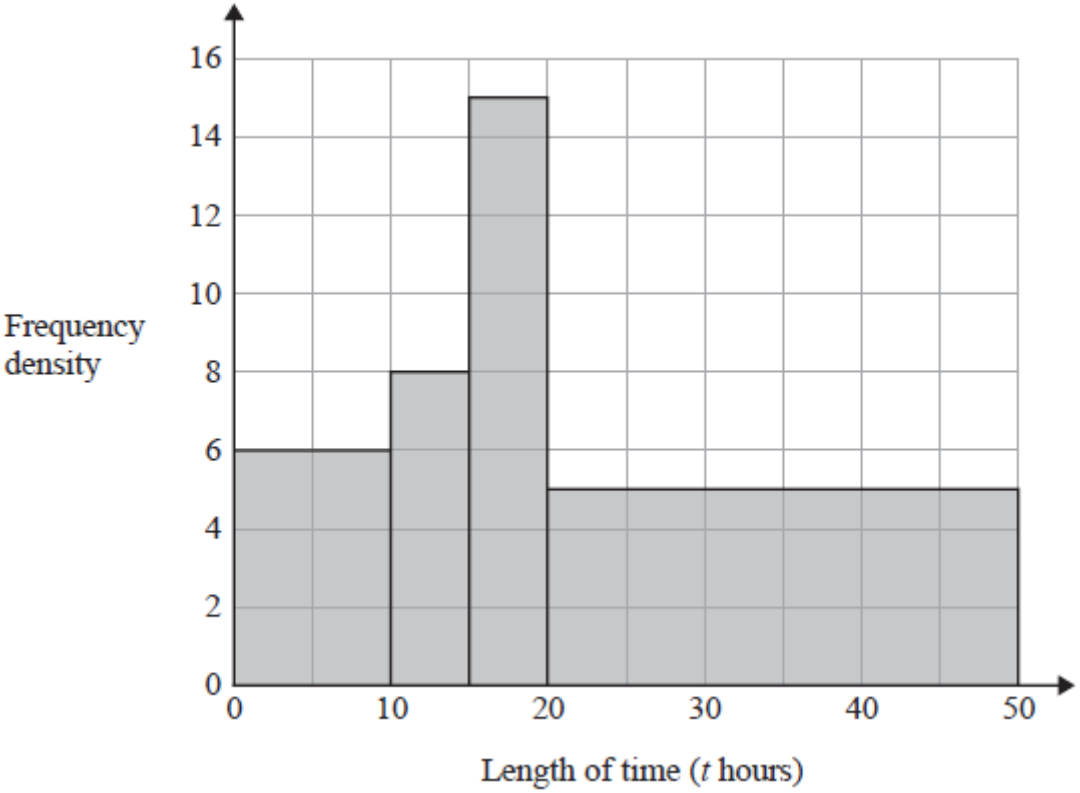
(Total for Question 21 is 5 marks)

22. Bhavna recorded the lengths of time, in hours, that some adults watched TV last week.

The table shows information about her results.

Length of time (t hours)	Frequency
$0 \leqslant t < 10$	6
$10 \leqslant t < 15$	8
$15 \leqslant t < 20$	15
$20 \leqslant t < 40$	5

Bhavna made some mistakes when she drew a histogram for this information.



Write down **two** mistakes Bhavna made.

construct and interpret histograms with equal and unequal class intervals and know their appropriate use (S3)

AO2

2.5b – critically evaluate a given way of presenting information (2 marks)

(Total for Question 22 is 2 marks)

23. Show that $\dfrac{1}{1+\dfrac{1}{\sqrt{2}}}$ can be written as $2 - \sqrt{2}$

calculate exactly with fractions and surds; simplify surd expressions involving squares and rationalise denominators (N8)
AO2 2.2 – construct chains of reasoning to achieve a given result (3 marks)

(Total for Question 23 is 3 marks)

24. John has an empty box.

He puts some red counters and some blue counters into the box.

The ratio of the number of red counters to the number of blue counters is 1 : 4

Linda takes at random 2 counters from the box.

The probability that she takes 2 red counters is $\dfrac{6}{155}$

How many red counters did John put into the box?

calculate and interpret conditional probabilities (P9) translate simple situations or procedures into algebraic expressions or formulae; derive an equation, solve the equation(s) and interpret the solution (A21) relate ratios to fractions and to linear functions (R8)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks) 3.2 – Make and use connections between different parts of mathematics (1 mark)

(Total for Question 24 is 4 marks)

25. $A(-2, 1)$, $B(6, 5)$, and $C(4, k)$ are the vertices of a right-angled triangle *ABC*.

Angle *ABC* is the right angle.

Find an equation of the line that passes through *A* and *C*.

Give your answer in the form $ay + bx = c$ where *a*, *b* and *c* are integers.

plot graphs of equations that correspond to straight-line graphs in the coordinate plane; use the form $y = mx + c$ to identify parallel **and perpendicular lines**; find the equation of the line through two given points or through one point with a given gradient (A9)

AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1b – translate problems in mathematical contexts into a series of processes (4 marks)

(Total for Question 25 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

Paper 2H

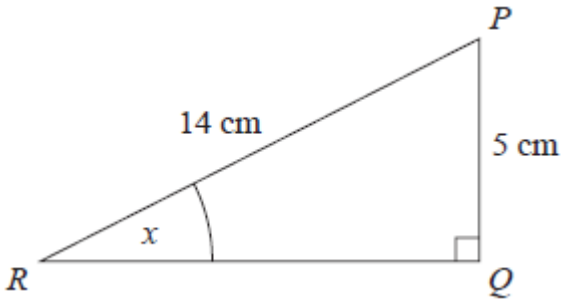
1. Frank, Mary and Seth shared some sweets in the ratio 4 : 5 : 7
Seth got 18 more sweets than Frank.

Work out the total number of sweets they shared.

Common question across both tiers
use ratio notation, including reduction to simplest form (R4) apply ratio to real contexts and problems (R5)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

(Total for Question 1 is 3 marks)

2. *PQR* is a right-angled triangle



Work out the size of the angle marked *x*.

Give your answer correct to 1 decimal place.

Common question across both tiers
know the formulae for the trigonometric ratios; apply them to find angles and lengths in right-angled triangles (G20)
AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark) 1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 2 is 2 marks)

3. Here are the first four terms of an arithmetic sequence.

6 10 14 18

(a) Write an expression, in terms of n, for the nth term of this sequence.

Common question across both tiers
deduce expressions to calculate the nth term of linear sequences (A25)
AO1 1.3a – accurately carry out routine procedures (1 mark) AO2 2.1a – make deductions to draw conclusions from mathematical information (1 mark)

(2)

The nth term of a different arithmetic sequence is $3n + 5$

(b) Is 108 a term of this sequence?
Show how you get your answer.

Common question across both tiers
deduce expressions to calculate the nth term of linear sequences (A25)
AO2 2.4a – present arguments (2 marks)

(2)

(Total for Question 3 is 4 marks)

4. Axel and Lethna are driving along a motorway.

They see a road sign.

The road sign shows the distance to Junction 8

It also shows the average time drivers take to get to Junction 8

To Junction 8 30 miles 26 minutes

The speed limit on the motorway is 70 mph.

Lethna says

"We will have to drive faster than the speed limit to drive 30 miles in 26 minutes."

Is Lethna right?

You must show how you get your answer.

Common question across both tiers
change freely between related standard units and compound units in numerical contexts (R1) use compound units such as speed (R11)
AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (1 mark) 3.3 – Interpret results in the context of the given problem (1 mark)

(Total for Question 4 is 3 marks)

5. The table shows some information about the foot lengths of 40 adults.

Foot length (f cm)	Number of adults
$16 \leqslant f < 18$	3
$18 \leqslant f < 20$	6
$20 \leqslant f < 22$	10
$22 \leqslant f < 24$	12
$24 \leqslant f < 26$	9

(a) Write down the modal class interval.

Common question across both tiers

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (median, mean, mode and modal class) (S4)

AO2

2.3a – interpret information accurately (1 mark)

(1)

(b) Calculate an estimate for the mean foot length.

Common question across both tiers

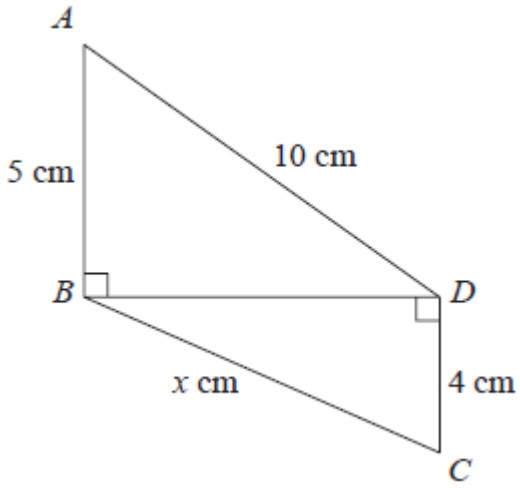
AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

(3)

(Total for Question 5 is 4 marks)

6. Triangles ABD and BCD are right-angled triangles.



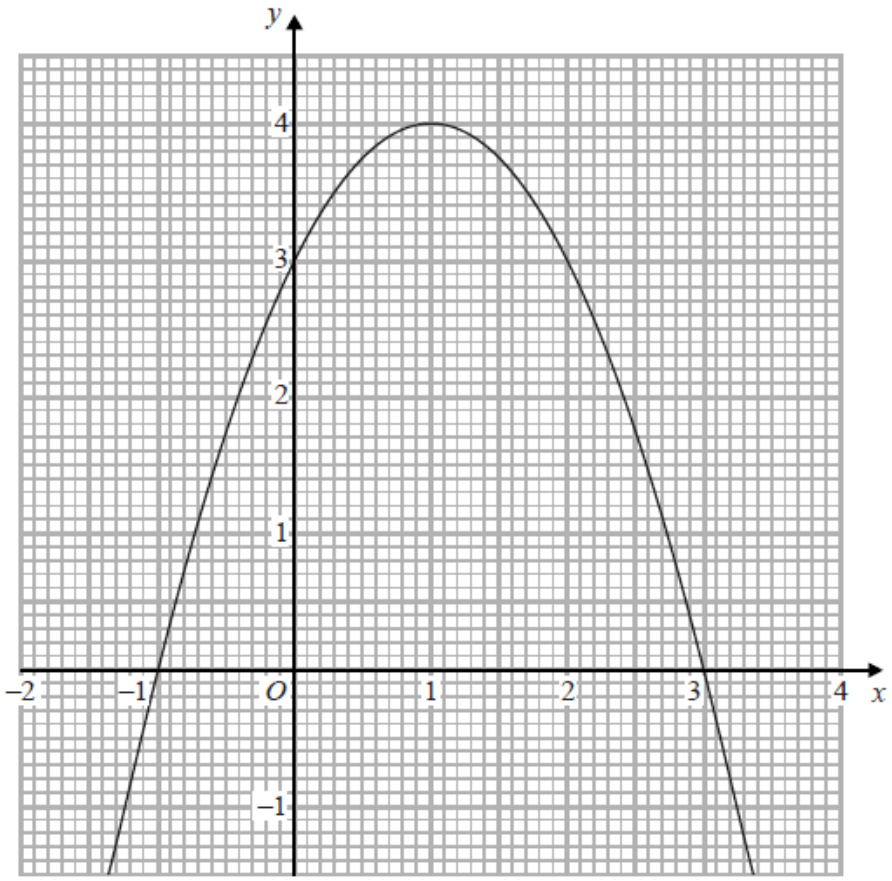
Work out the value of x.

Give your answer correct to 2 decimal places.

Common question across both tiers
know the formulae for: Pythagoras' theorem; apply to find angles and lengths in right-angled triangles (G20)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1b – translate problems in mathematical contexts into a series of processes (3 marks)

(Total for Question 6 is 4 marks)

7. The graph of $y = f(x)$ is drawn on the grid.



(a) Write down the coordinates of the turning point of the graph.

(1)

(b) Write down the roots of $f(x) = 2$

New to 1MA1
identify and interpret roots, intercepts, turning points of quadratic functions graphically (A11)

(1)

(c) Write down the value of f(0.5)

New to 1MA1
where appropriate, interpret simple expressions as functions with inputs and outputs (A7)
AO2 2.3a – interpret information accurately (3 marks)

(1)

(Total for Question 7 is 3 marks)

8. In a box of pens, there are

three times as many red pens as green pens
and two times as many green pens as blue pens.

For the pens in the box, write down
the ratio of the number of red pens to the number of green pens to the number of blue pens.

express a multiplicative relationship between two quantities as a ratio or a fraction (R6)

AO2

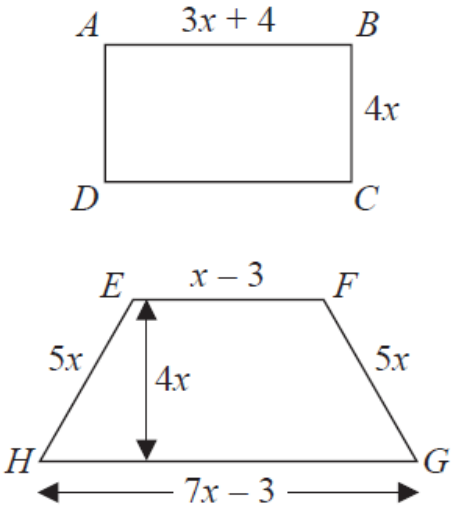
2.3a – interpret information accurately
(1 mark)

2.3b – communicate information accurately
(1 mark)

(Total for Question 8 is 2 marks)

9. *ABCD* is a rectangle.

EFGH is a trapezium.



All measurements are in centimetres.

The perimeters of these two shapes are the same.

Work out the area of the rectangle.

substitute numerical values into formulae and expressions (A2) simplify and manipulate algebraic expressions by: ● collecting like terms ● multiplying a single term over a bracket ● simplifying expressions involving sums, products and powers (A4) solve linear equations in one unknown algebraically (A17) translate simple situations or procedures into algebraic expressions or formulae; derive an equation, solve the equation(s) and interpret the solution (A21)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks) AO3 3.1b – translate problems in mathematical contexts into a series of processes (3 marks)

(Total for Question 9 is 5 marks)

10. Katy invests £2000 in a savings account for 3 years.

The account pays compound interest at an annual rate of

2.5% for the first year

x % for the second year

x % for the third year

There is a total amount of £2124.46 in the savings account at the end of 3 years.

(a) Work out the rate of interest in the second year.

interpret fractions and percentages as operators (N12)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (3 marks)

(4)

Katy goes to work by train.

The cost of her weekly train ticket increases by 12.5% to £225

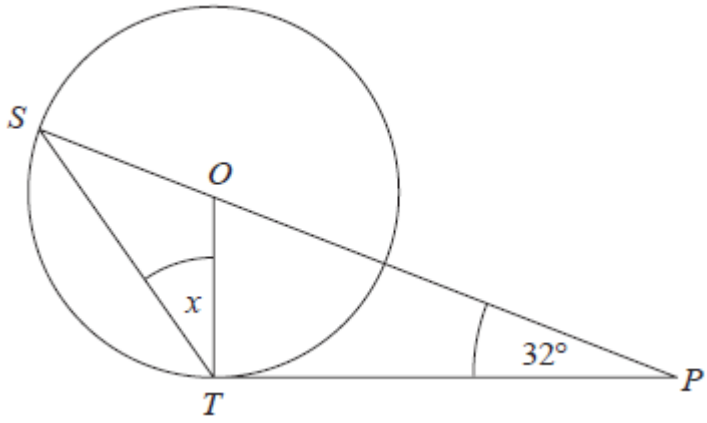
(b) Work out the cost of her weekly train ticket before this increase.

interpret fractions and percentages as operators (N12) interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively; solve problems involving percentage change, including percentage increase/decrease and original value problems, and simple interest including in financial mathematics (R9)
AO1 1.3a – accurately carry out routine procedures (2 marks)

(2)

(Total for Question 10 is 6 marks)

11.



S and *T* are points on the circumference of a circle, centre *O*.

PT is a tangent to the circle.

SOP is a straight line.

Angle *OPT* = 32°

Work out the size of the angle marked *x*.

You must give a reason for each stage of your working.

apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results (G10)

AO2 2.1a – make deductions to draw conclusions from mathematical information (2 marks) 2.4a – present arguments (2 marks)

(Total for Question 11 is 4 marks)

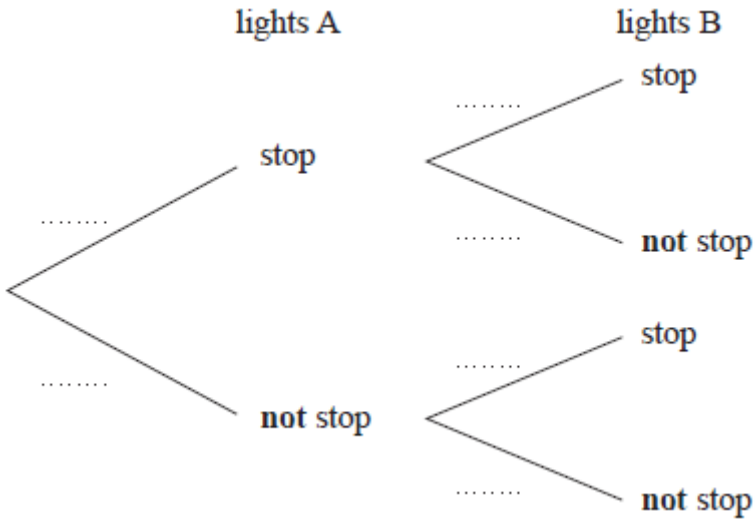
12. A and B are two sets of traffic lights on a road.

The probability that a car is stopped by lights A is 0.4

If a car is stopped by lights A, then the probability that the car is **not** stopped by lights B is 0.7

If a car is **not** stopped by lights A, then the probability that the car is **not** stopped by lights B is 0.2

(a) Complete the probability tree diagram for this information.



enumerate sets and combinations of sets systematically, using tree diagrams (P6)

AO2

2.3a – interpret information accurately (1 mark)

2.3b – communicate information accurately (1 mark)

(2)

Mark drove along this road.

He was stopped by just one of the sets of traffic lights.

(b) Is it more likely that he stopped by lights A or by lights B?
You must show your working.

relate relative expected frequencies to theoretical probability, using appropriate language and the 0-1 probability scale (P3)

calculate the probability of independent and dependent combined events, including using tree diagrams, and know the underlying assumptions (P8)

AO3

3.1c – translate problems in non-mathematical contexts into a mathematical process (2 marks)

3.3 – Interpret results in the context of the given problem (1 mark)

(3)

(Total for Question 12 is 5 marks)

13. d is inversely proportional to c

When $c = 280$, $d = 25$

Find the value of d when $c = 350$

solve problems involving direct and inverse proportion, including algebraic representations (R10) understand that X is inversely proportional to Y is equivalent to X is proportional to $1/Y$; **construct and** interpret equations that describe direct and inverse proportion (R13)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

(Total for Question 13 is 3 marks)

14. Prove algebraically that

$(2n + 1)^2 – (2n + 1)$ is an even number

for all positive integer values of n.

use and interpret algebraic manipulation (A1) simplify and manipulate algebraic expressions by: ● collecting like terms ● taking out common factors ● expanding products of two **or more** binomials ● simplifying expressions involving sums, products and powers (A4)
AO1 1.3a – accurately carry out routine procedures (1 mark) AO2 2.4b – present proofs (2 marks)

(Total for Question 14 is 3 marks)

15. Prove algebraically that the recurring decimal $0.2\dot{5}$ has the value $\frac{23}{90}$

change recurring decimals into their corresponding fractions and vice versa (N10)
AO1 1.3a – accurately carry out routine procedures (2 marks)

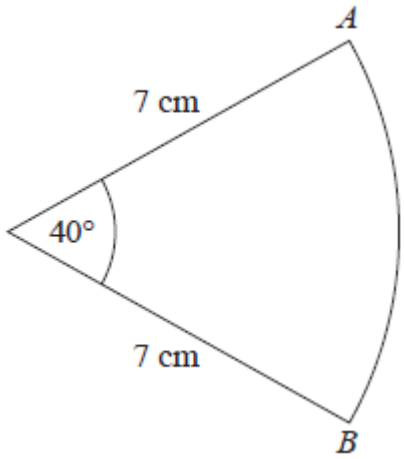
(Total for Question 15 is 2 marks)

16. Show that $\frac{1}{6x^2+7x-5} \div \frac{1}{4x^2-1}$ simplifies to $\frac{ax+b}{cx+d}$ where a, b, c and d are integers.

simplify and manipulate algebraic expressions (including those involving algebraic fractions) by: ● taking out common factors ● factorising quadratic expressions of the form $ax^2 + bx + c$ ● simplifying expressions involving sums, products and powers (A4)
AO2 2.2 – construct chains of reasoning to achieve a given result (3 marks)

(Total for Question 16 is 3 marks)

17. The diagram shows a sector of a circle of radius 7 cm.



Work out the length of arc *AB*.

Give your answer correct to 3 significant figures.

calculate arc lengths of circles (G18)
AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark) 1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 17 is 2 marks)

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18 $m = \dfrac{\sqrt{s}}{t}$ $s = 3.47$ correct to 3 significant figures

$t = 8.132$ correct to 4 significant figures

By considering bounds, work out the value of m to a suitable degree of accuracy.

Give a reason for your answer.

apply and interpret limits of accuracy (N16)
AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark) 1.3a – accurately carry out routine procedures (3 marks) AO2 2.4a – present arguments (1 mark)

(Total for Question 18 is 5 marks)

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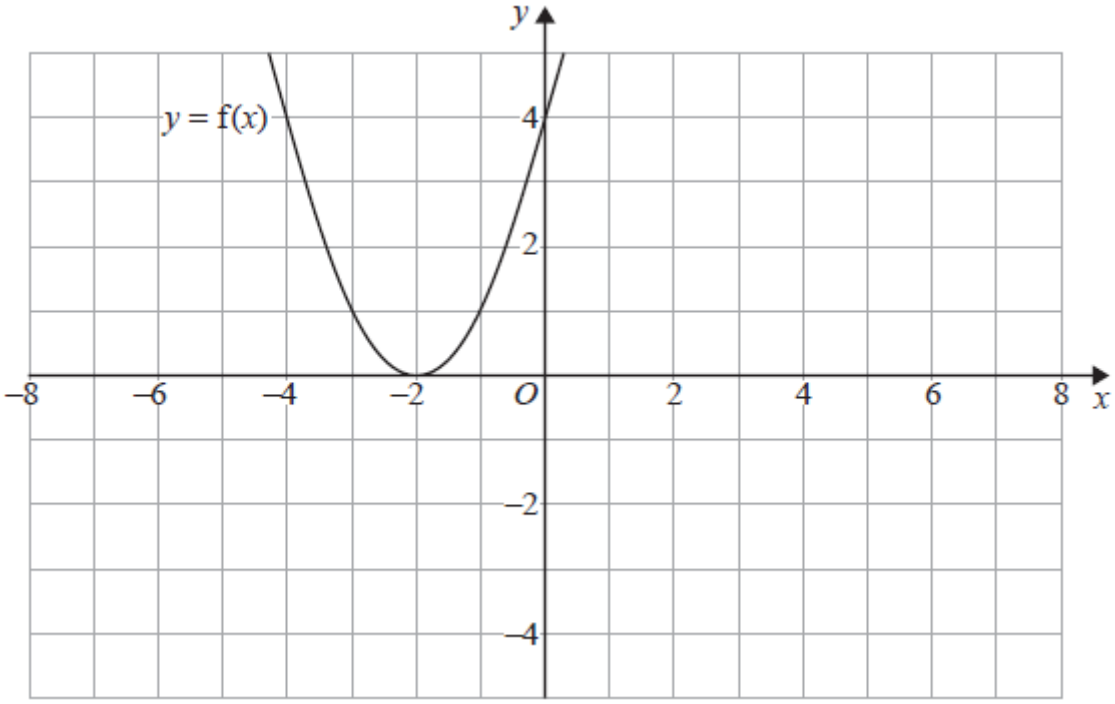
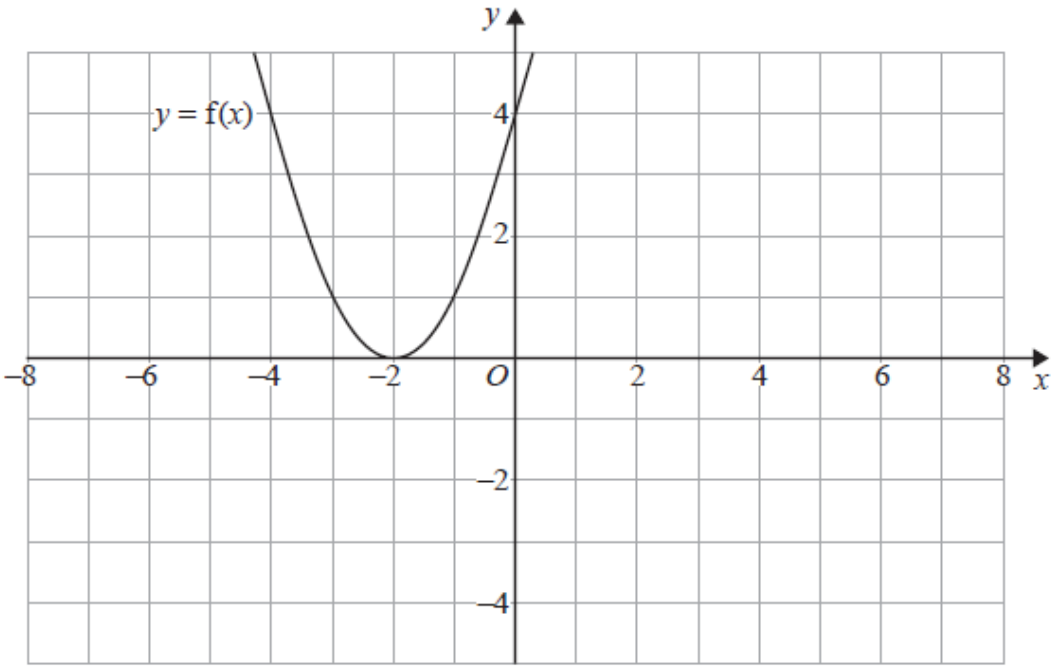
19. The graph of $y = f(x)$ is shown on both grids below.



(a) On the grid above, sketch the graph of $y = f(-x)$

(1)



(b) On this grid, sketch the graph of $y = -f(x) + 3$

recognise, sketch and interpret graphs of quadratic functions (A12)

sketch translations and reflections of a given function (A13)

AO2

2.3b – communicate information accurately (2 marks)

(1)

(Total for Question 19 is 2 marks)

---

20 Solve algebraically the simultaneous equations

$x^2 + y^2 = 25$

$y - 2x = 5$

solve two simultaneous equations in two variables (linear/linear or **linear/quadratic**) algebraically (A19)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (4 marks)

AO2

2.3b – communicate information accurately (1 mark)

(Total for Question 20 is 5 marks)

---

21. In triangle *RPQ*,

RP = 8.7 cm

PQ = 5.2 cm

Angle *PRQ* = 32°

(a) Assuming that angle *PQR* is an acute angle,
calculate the area of triangle *RPQ*.
Give your answer correct to 3 significant figures.

know and apply Area = ½ *ab* sin *C* to calculate the area, sides or angles of any triangle (G23)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1b – translate problems in mathematical contexts into a series of processes (3 marks)

(4)

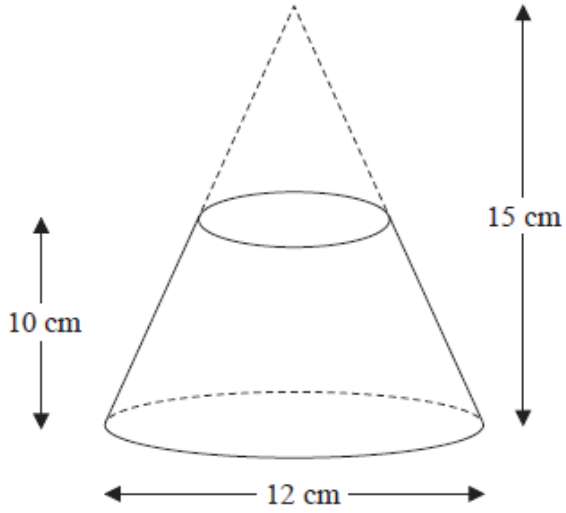
(b) If you did not know that angle *PQR* is an acute angle, what effect would this have on your calculation of the area of triangle *RPQ*?

New to 1MA1
recognise, sketch and interpret graphs of **the trigonometric functions *y* = sin *x*, *y* = cos *x* and *y* = tan *x* for angles of any size** (A12)
AO3 3.4a – evaluate methods used (1 mark)

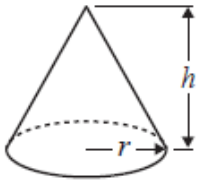
(1)

(Total for Question 21 is 5 marks)

22. A frustum is made by removing a small cone from a large cone as shown in the diagram.



Volume of cone $= \frac{1}{3}\pi r^2 h$



The frustum is made from glass.

The glass has a density of $2.5\,\text{g} / \text{cm}^3$

Work out the mass of the frustum.

Give your answer to an appropriate degree of accuracy.

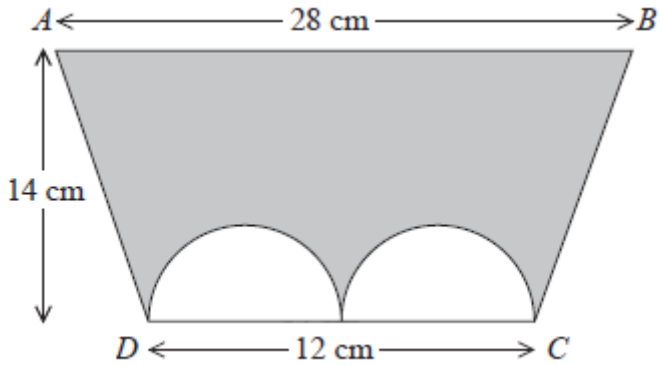
Formula given with the question
know the formulae: volume of spheres, pyramids, cones and composite solids (G17) apply the concepts of congruence and similarity, including the relationships between lengths, **areas and volumes** in similar figures (G19) round numbers and measures to an appropriate degree of accuracy (N15) use compound units such as speed, rates of pay, unit pricing, density and pressure (R11)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks) 3.2 – Make and use connections between different parts of mathematics (1 mark) 3.4b – evaluate results obtained (1 mark)

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

Paper 3H

1. The diagram shows a trapezium *ABCD* and two identical semicircles.



The centre of each semicircle is on *DC*.

Work out the area of the shaded region.

Give your answer correct to 3 significant figures.

Common question across both tiers
know and apply formulae to calculate area of trapezia (G16) know the formulae: area of a circle; areas of circles and composite shapes (G17)
AO1 1.1 – Accurately recall facts, terminology and definitions (1 mark) 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1b – translate problems in mathematical contexts into a series of processes (2 marks)

(Total for Question 1 is 4 marks)

2. Asif is going on holiday to Turkey.

The exchange rate is £1 = 3.5601 lira.

Asif changes £550 to lira.

(a) Work out how many lira he should get.

Give your answer to the nearest lira.

Common question across both tiers
apply ratio to real contexts and problems such as those involving conversion (R5) solve problems involving direct and inverse proportion (R10)
AO1 1.3a – accurately carry out routine procedures (2 marks)

(2)

Asif sees a pair of shoes in Turkey.
The shoes cost 210 lira.

Asif does not have a calculator.
He uses £2 = 7 lira to work out the approximate cost of the shoes in pounds.

(b) Use £2 = 7 lira to show that the approximate cost of the shoes is £60

Common question across both tiers
solve problems involving direct and inverse proportion (R10)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO2 2.3b – communicate information accurately (1 mark)

(2)

(c) Is using £2 = 7 lira instead of using £1 = 3.5601 lira a sensible start to Asif's method to work out the cost of the shoes in pounds?
You must give a reason for your answer.

Common question across both tiers

AO3
3.4a – evaluate methods used (1 mark)

(1)

(Total for Question 2 is 5 marks)

3. Here are the first six terms of a Fibonacci sequence.

1 1 2 3 5 8

The rule to continue a Fibonacci sequence is,

the next term in the sequence is the sum of the two previous terms.

(a) Find the 9th term of this sequence.

Common question across both tiers
New to 1MA1
recognise and use sequences of Fibonacci type sequences (A24)
AO2 2.3b – communicate information accurately (1 mark)

(1)

The first three terms of a different Fibonacci sequence are

a b $a + b$

(b) Show that the 6th term of this sequence is $3a + 5b$

Common question across both tiers
AO2 2.2 – construct chains of reasoning to achieve a given result (1 mark) 2.3b – communicate information accurately (1 mark)

(2)

Given that the 3rd term is 7 and the 6th term is 29,

(c) find the value of a and the value of b.

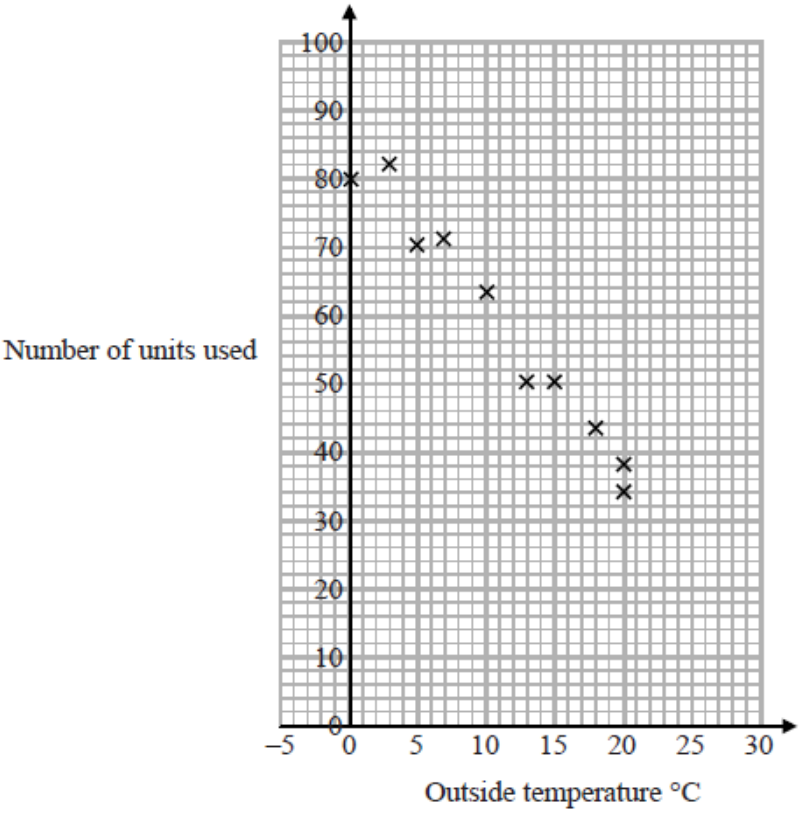
Common question across both tiers
solve two simultaneous equations in two variables (A19) derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution (A21)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1b – translate problems in mathematical contexts into a series of processes (2 marks)

(3)

(Total for Question 3 is 6 marks)

4. In a survey, the outside temperature and the number of units of electricity used for heating were recorded for ten homes.

The scatter diagram shows this information.



Molly says,

"On average the number of units of electricity used for heating decreases by 4 units for each °C increase in outside temperature."

(a) Is Molly right?
Show how you get your answer.

Common question across both tiers
use and interpret scatter graphs of bivariate data; draw estimated lines of best fit (S6) identify and interpret gradients and intercepts of linear functions graphically (A10)
AO2 2.1b – make inferences to draw conclusions from mathematical information (1 mark) 2.3a – interpret information accurately (1 mark) 2.4a – present arguments (1 mark)

(3)

(b) You should **not** use a line of best fit to predict the number of units of electricity used for heating when the outside temperature is 30°C.

Give one reason why.

Common question across both tiers
interpolate and extrapolate apparent trends while knowing the dangers of so doing (S6)
AO2 2.3b – communicate information accurately (1 mark)

(1)

(Total for Question 4 is 4 marks)

5. Henry is thinking of having a water meter.

These are the two ways he can pay for the water he uses.

Water Meter

A charge of £28.20 per year

plus

91.22p for every cubic metre of water used

1 cubic metre = 1000 litres

No Water Meter

A charge of £107 per year

Henry uses an average of 180 litres of water each day.

Use this information to determine whether or not Henry should have a water meter

Common question across both tiers
apply the four operations, including formal written methods, to integers and decimals; understand and use place value (N2) change freely between related standard units and compound units in numerical contexts (R1) solve problems involving direct and inverse proportion (R10) use compound units such as rates of pay (R11)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (3 marks) 3.3 – Interpret results in the context of the given problem (1 mark)

(Total for Question 5 is 5 marks)

6. Liz buys packets of coloured buttons.

There are 8 red buttons in each packet of red buttons.

There are 6 silver buttons in each packet of silver buttons.

There are 5 gold buttons in each packet of gold buttons.

Liz buys equal numbers of red buttons, silver buttons and gold buttons.

How many packets of each colour of buttons did Liz buy?

use the concepts and vocabulary of prime numbers, factors (divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation theorem (N4)

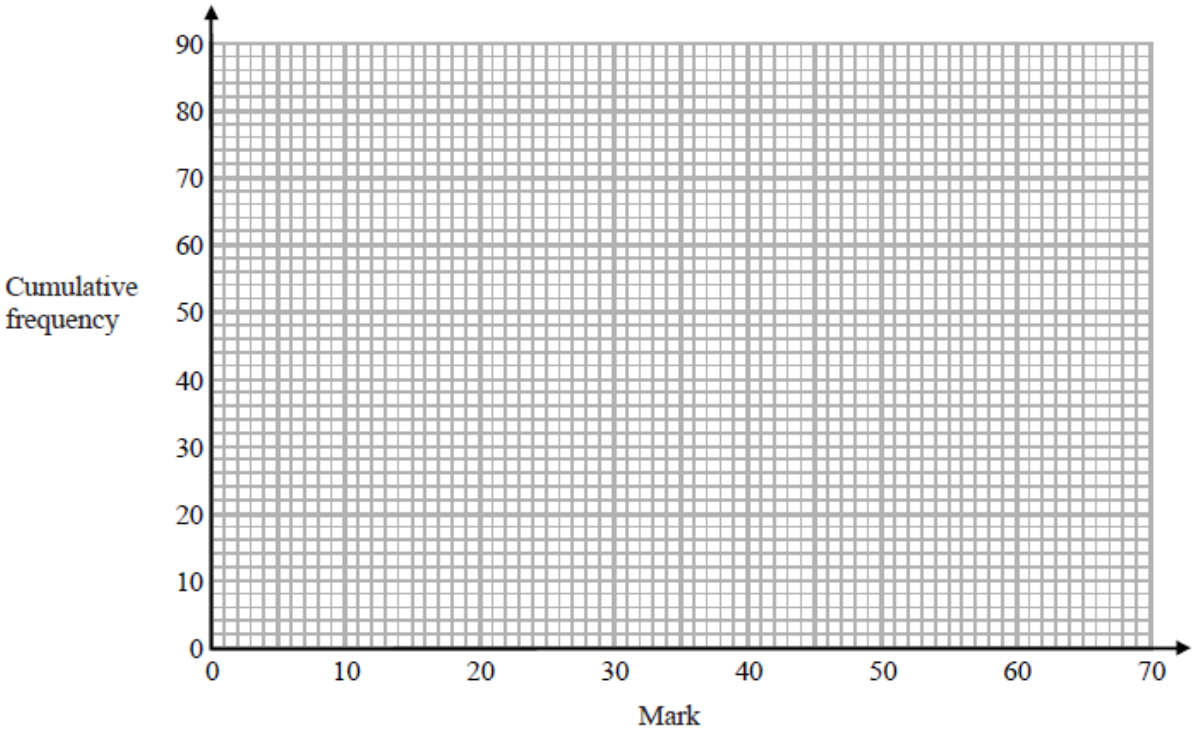
AO1 1.3a – accurately carry out routine procedures (1 mark) AO3 3.1c – translate problems in non-mathematical contexts into a mathematical process (2 marks)

(Total for Question 6 is 3 marks)

7. The cumulative frequency table shows the marks some students got in a test.

Mark (m)	Cumulative frequency
$0 < m \leqslant 10$	8
$0 < m \leqslant 20$	23
$0 < m \leqslant 30$	48
$0 < m \leqslant 40$	65
$0 < m \leqslant 50$	74
$0 < m \leqslant 60$	80

(a) On the grid, plot a cumulative frequency graph for this information.



construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use (S3)

AO2

2.3a – interpret information accurately (1 mark)

2.3b – communicate information accurately (1 mark)

(2)

(b) Find the median mark.

construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use (S3)

AO2

2.3a – interpret information accurately (1 mark)

(1)

Students either pass the test or fail the test.
The pass mark is set so that 3 times as many students fail the test as pass the test.

(c) Find an estimate for the lowest possible pass mark.

construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use (S3)

express a multiplicative relationship between two quantities as a ratio or a fraction (R6)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (1 mark)

3.2 – Make and use connections between different parts of mathematics (1 mark)

(3)

(Total for Question 7 is 6 marks)

8. Write 0.000068 in standard form.

calculate with integer **and fractional** indices (N7) calculate with and interpret standard form (N9)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 8 is 1 mark)

---

9 (a) Factorise $y^2 + 7y + 6$

simplify and manipulate algebraic expressions by factorising quadratic expressions of the form $x^2 + bx + c$ (A4)
AO1 1.3a – accurately carry out routine procedures (2 marks)

(2)

(b) Solve $6x + 4 > x + 17$

solve linear inequalities in one variable (A22)
AO1 1.3a – accurately carry out routine procedures (2 marks)

(2)

(c) n is an integer with $-5 < 2n \leq 6$
Write down all the values of n

solve linear inequalities in one variable (A22) order positive and negative integers; use the symbols $=, \neq, <, >, \leq, \geq$ (N1)
AO1 1.2 – Use and interpret notation correctly (1 mark) 1.3a – accurately carry out routine procedures (1 mark)

(2)

(Total for Question 9 is 6 marks)

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10. The function f is such that

$f(x) = 4x - 1$

(a) Find $f^{-1}(x)$

New to 1MA1

interpret the reverse process as the 'inverse function' (A7)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

(2)

The function g is such that

$g(x) = kx^2$ where k is a constant.

Given that $fg(2) = 12$

(b) work out the value of k

New to 1MA1

interpret the succession of two functions as a 'composite function' (A7)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (1 mark)

(2)

(Total for Question 10 is 4 marks)

---

11. Solve $x^2 - 5x + 3 = 0$

Give your solutions correct to 3 significant figures.

solve quadratic equations by using the quadratic formula (A18)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

(Total for Question 11 is 3 marks)

---

12. Sami asked 50 people which drinks they liked from tea, coffee and milk.

All 50 people like at least one of the drinks.
19 people like all three drinks.
16 people like tea and coffee but do **not** like milk.
21 people like coffee and milk.
24 people like tea and milk.
40 people like coffee.
1 person likes only milk.

Sami selects at random one of the 50 people.

(a) Work out the probability that this person likes tea.

New to 1MA1
calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions (P8)
AO1 1.3a – accurately carry out routine procedures (1 mark) AO2 2.3a – interpret information accurately (3 marks)

(4)

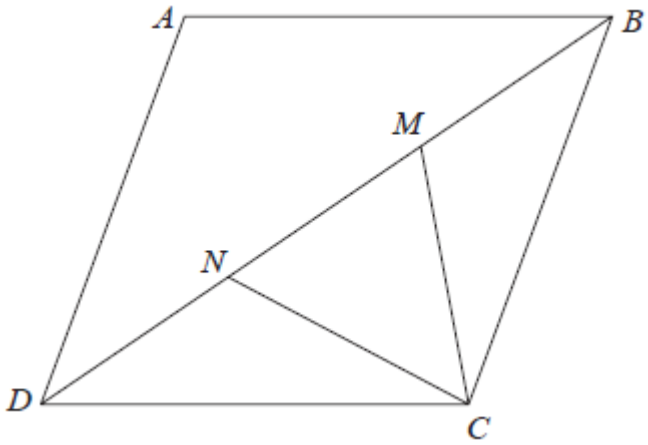
(b) Given that the person selected at random from the 50 people likes tea, find the probability that this person also likes exactly one other drink.

calculate and interpret conditional probabilities through representation using Venn diagrams (P9)
AO1 1.3a – accurately carry out routine procedures (1 mark) AO3 3.1a – translate problems in mathematical contexts into a process (1 mark)

(2)

(Total for Question 12 is 6 marks)

13. *ABCD* is a rhombus.



M and *N* are points on *BD* such that $DN = MB$.

Prove that triangle *DNC* is congruent to triangle *BMC*.

derive and apply the properties and definitions of: special types of quadrilaterals and triangles and other plane figures using appropriate language (G4) use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS) (G5)
AO2 2.4b – present proofs (3 marks)

(Total for Question 13 is 3 marks)

14. (a) Show that the equation $x^3 + 4x = 1$ has a solution between $x = 0$ and $x = 1$

(2)

(b) Show that the equation $x^3 + 4x = 1$ can be arranged to give $x = \frac{1}{4} - \frac{x^3}{4}$

simplify and manipulate algebraic expressions by simplifying expressions involving sums, products and powers (A4)

AO2

2.2 – construct chains of reasoning to achieve a given result (3 marks)

(1)

(c) Starting with $x_0 = 0$, use the iteration formula $x_{n+1} = \frac{1}{4} - \frac{x_n^{\ 3}}{4}$ twice,

to find an estimate for the solution of $x^3 + 4x = 1$

New to 1MA1

find approximate solutions to equations numerically using iteration (A20)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

(3)

(Total for Question 14 is 6 marks)

15. There are 17 men and 26 women in a choir.
The choir is going to sing at a concert.

One of the men and one of the women are going to be chosen to make a pair to sing the first song.

(a) Work out the number of different pairs that can be chosen.

New to 1MA1
apply systematic listing strategies, including use of the product rule for counting (N5)
AO1 1.3a – accurately carry out routine procedures (2 marks)

(2)

Two of the men are going to be chosen to make a pair to sing the second song.

Ben thinks the number of different pairs that can be chosen is 136
Mark thinks the number of different pairs that can be chosen is 272

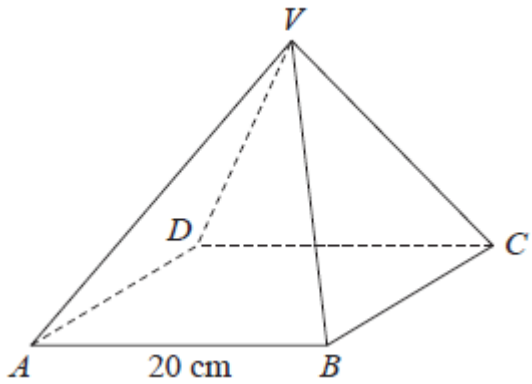
(b) Who is correct, Ben or Mark?
Give a reason for your answer.

New to 1MA1
AO2 2.4a – present arguments (1 mark)

(1)

(Total for Question 15 is 3 marks)

16. *VABCD* is a solid pyramid.



ABCD is a square of side 20 cm.

The angle between any sloping edge and the plane *ABCD* is 55^{o}

Calculate the surface area of the pyramid.

Give your answer correct to 2 significant figures.

calculate surface area of pyramids (G17) know the formulae for Pythagoras' theorem and the trigonometric ratios; apply them to find angles and lengths in right-angled triangles **and, where possible, general triangles** in two **and three dimensional figures** (G20)

AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1b – translate problems in mathematical contexts into a series of processes (4 marks)

(Total for Question 16 is 5 marks)

17. Louis and Robert are investigating the growth in the population of a type of bacteria.
They have two flasks A and B.

At the start of day 1, there are 1000 bacteria in flask A.
The population of bacteria grows exponentially at the rate of 50% per day.

(a) Show that the population of bacteria in flask A at the start of each day forms a geometric progression.

New to 1MA1
set up, solve and interpret the answers in growth and decay problems **and work with general iterative processes** (R16)
AO2 2.2 – construct chains of reasoning to achieve a given result (2 marks)

(2)

The population of bacteria in flask A at the start of the 10th day is k times the population of bacteria in flask A at the start of the 6th day.

(b) Find the value of k.

New to 1MA1
AO1 1.3a – accurately carry out routine procedures (1 mark) 3.1c – translate problems in non-mathematical contexts into a mathematical process (1 mark)

(2)

At the start of day 1 there are 1000 bacteria in flask B.
The population of bacteria in flask B grows exponentially at the rate of 30% per day.

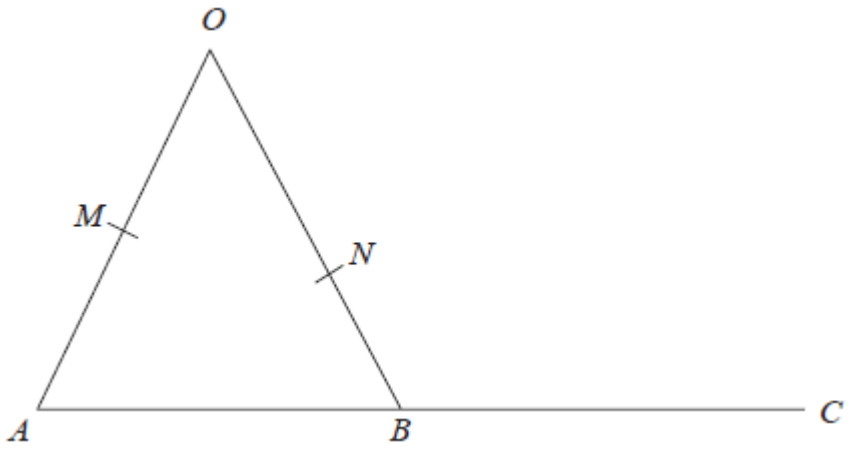
(c) Sketch a graph to compare the size of the population of bacteria in flask A and in flask B.

New to 1MA1
recognise, sketch and interpret graphs of **exponential functions $y = kx$ for positive values of k** (A12)
AO2 2.3b – communicate information accurately (1 mark)

(1)

(Total for Question 17 is 5 marks)

18.



OMA, *ONB* and *ABC* are straight lines.

M is the midpoint of *OA*.

B is the midpoint of *AC*.

$\overrightarrow{OA} = 6\mathbf{a}$ $\overrightarrow{OB} = 6\mathbf{b}$ $\overrightarrow{ON} = k\mathbf{b}$ where *k* is a scalar quantity.

Given that *MNC* is a straight line, find the value of *k*.

apply addition and subtraction of vectors, multiplication of vectors by a scalar**; use vectors to construct geometric arguments and proofs** (G25) simplify and manipulate algebraic expressions by: ● collecting like terms ● multiplying a single term over a bracket ● taking out common factors (A4)
AO1 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark) AO3 3.1b – translate problems in mathematical contexts into a series of processes (4 marks)

(Total for Question 18 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS