OCR
Oxford Cambridge and RSA

.CG Maths.
Worked Solutions

Monday 7 November 2022 – Morning

GCSE (9–1) Mathematics

J560/03 Paper 3 (Foundation Tier)

Time allowed: 1 hour 30 minutes

You must have:
- the Formulae Sheet for Foundation Tier (inside this document)

You can use:
- a scientific or graphical calculator
- geometrical instruments
- tracing paper

F

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number						Candidate number				

First name(s) ______________________

Last name ______________________

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.
- Use the π button on your calculator or take π to be 3.142 unless the question says something different.

INFORMATION
- The total mark for this paper is **100**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **24** pages.

ADVICE
- Read each question carefully before you start your answer.

Please note that these worked solutions have neither been provided nor approved by OCR and may not necessarily constitute the only possible solutions. Please refer to the original mark schemes for full guidance.

Any writing in blue indicates what must be written in order to answer the questions and get the marks. The worked solutions have been designed to show the smallest amount of work which needs to be done to answer the question.

Anything written in green in a cloud doesn't have to be written in the exam.

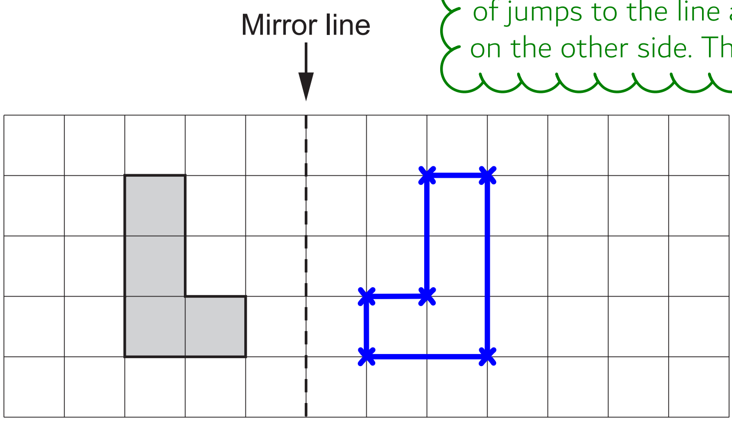
Anything written in orange in a rectangle doesn't have to be written in the exam and is there to show what should be put into a calculator or measured using a ruler or protractor.

If you find any mistakes or have any requests or suggestions, please send an email to curtis@cgmaths.co.uk

Answer **all** the questions.

1 Reflect this shape in the mirror line.

Reflecting each corner by counting the number of jumps to the line and doing the same number on the other side. Then joining up all the corners



[2]

2 **(a)** Write these numbers in order of size, starting with the smallest.

-20 10 0.351

-20 is smallest as it is negative. 0.351 is next as it is less positive than 10

(a) -20 , 0.351 , 10 **[1]**

smallest

(b) Find the difference between the largest and the smallest of these numbers.

34 304 3.04 300.4

304 − 3.04 ← Difference means largest subtract smallest. 304 is the largest of the numbers and 3.04 is the smallest of the numbers

(b) 300.96 **[2]**

3 **(a)** Insert brackets to make this calculation correct.

$$(5 - 5) \times 5 = 0$$

5 - 5 = 0 then 0 x 5 = 0

[1]

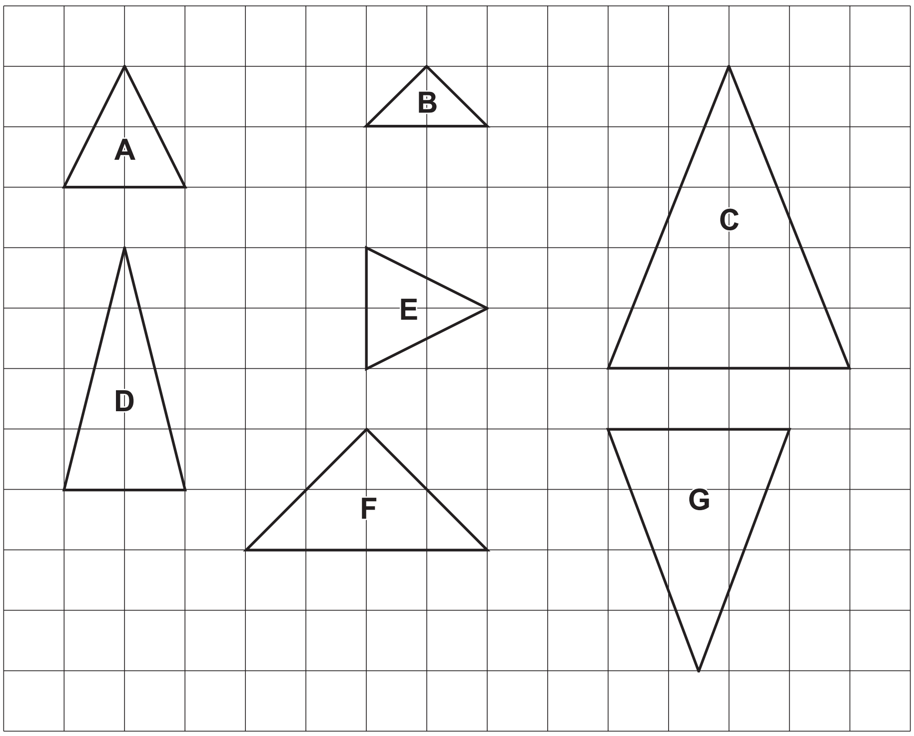
(b) Insert **two** of these symbols $+$, $-$, $\times$ or $\div$ to make this calculation correct.

$$20 \ldots - \ldots 5(1 \ldots + \ldots 3) = 0$$

[1]

1 + 3 = 4 then 5 x 4 = 20 then 20 - 20 = 0

4 On the grid are seven triangles, labelled **A** to **G**.



Complete each statement by writing the letter of the correct triangle.

E is congruent to A as they are the same shape and size. F is similar to B as it is the same shape but has been enlarged

Triangle **A** is congruent to triangle ....E..........

Triangle **B** is mathematically similar to triangle ....F.......... **[2]**

Turn over

5 Solve.

(a) $\frac{x}{4} = 8$

Multiplying both sides by 4 eliminates the denominator on the left and gets x on its own

(a) $x =$ ....32........................ **[1]**

(b) $8 - x = -2$

10 must be subtracted from 8 to get -2

(b) $x =$ ....10........................ **[1]**

6 **(a)** Write 28 : 70 as a ratio in its simplest form.

28/70 = 2/5

Fractions simplify in a similar way to ratios so putting 28/70 into the calculator and letting it simplify it works out what the simplified ratio must be

(a) ....2.......... : ....5.......... **[2]**

(b) A map has a scale of 8 centimetres represents 1 metre.
The scale can be written as a ratio in the form 1 : n.

Find the value of n.

8:100

1 metre is 100 centimetres so the scale can be written as 8 : 100

100÷8

Dividing both sides of the ratio by 8 gets 1 on the left

(b) $n =$ ....12.5........................ **[2]**

7 It takes a librarian $1\frac{1}{4}$ minutes to put a plastic cover on a book.

Work out how many books the librarian can cover in $\frac{1}{2}$ hour.

$\frac{1}{2} \times 60$ There are 60 minutes in an hour. Converting the 1/2 hour into minutes by multiplying it by 60

$30 \div 1\frac{1}{4}$ 1/2 hour is 30 minutes. Dividing this by the time taken in minutes to put a plastic cover on a book works out how many can be covered in 1/2 hour

.................................24................................. **[3]**

8 **(a)** Complete this statement by writing a positive whole number in each box to make two different but equivalent fractions.

$$\frac{2}{\boxed{16}} = \frac{\boxed{1}}{8}$$

Dividing both the numerator and denominator of 2/16 by 2 gives 1/8

[2]

(b) Complete this statement by writing a possible positive whole number in the box.

$$\underset{\frac{2}{10}}{\frac{1}{5}} < \frac{\boxed{3}}{10} < \underset{\frac{5}{10}}{\frac{1}{2}}$$

[2]

Multiplying both the numerator and denominator of 1/5 by 2 converts it to 2/10 and multiplying both the numerator and denominator of 1/2 by 5 converts it to 5/10. 3/10 is greater than 2/10 but less than 5/10

9 A meal deal consists of a burger, a side dish and a drink chosen from these lists.

Burgers	**Side dish**	**Drink**
Hamburger (H)	Baked beans (B)	Cola (C)
Veggie burger (V)	Fries (F)	Lemonade (L)
	Sweetcorn (S)	

(a) Some of the possible meal deals are shown in this table.

Complete the table to show all the possible meal deals.
You may not need all the rows.

Burger	Side dish	Drink
H	B	C
H	B	L
H	F	C
H	F	L
H	S	C
H	S	L
V	B	C
V	B	L
V	F	C
V	F	L
V	S	C
V	S	L

Using systematic listing

[2]

(b) Write down the fraction of the meal deals that include baked beans (B).

4 out of the 12 possible meal deals have baked beans as the side dish

(b) .... $\frac{4}{12}$ .... **[1]**

10 Two supermarkets, A and B, have special offers on the same packet of biscuits.

Supermarket A	Supermarket B
Normal price: £1.50 for each packet Special offer: Buy two packets at the normal price and get a third packet for half price	Normal price: £1.60 for each packet Special offer: 10% off the normal price

(a) Dan buys **one** packet of these biscuits.

Which supermarket is best value for Dan?
Show how you decide.

$1.60 \times \frac{100-10}{100} = 1.44$

Reducing the normal price at supermarket B by 10%. Subtracting 10 from 100 expresses the percentage it decreases to. Putting this over 100 expresses it as a fraction which when the £1.60 is multiplied by it is reduced by 10%

Supermarket ....B........ because £1.44 is less than £1.50 ....

.... **[3]**

(b) Darcy buys **three** packets of these biscuits.

Which supermarket is best value for Darcy?
Show how you decide.

$1.44 \times 3 = 4.32$

Working out that the price of three packets from supermarket B is £4.32. The price of each pack is £1.44 so multiplying this by 3

$1.50 \times 2\frac{1}{2} = 3.75$

Working out that the price of three packets from supermarket A is £3.75. $2^1/_2$ packets are paid for when the offer is used so multiplying the price of each pack by $2^1/_2$

Supermarket ....A........ because £3.75 is less than £4.32 ....

.... **[3]**

11 Here is a function machine.

$$\text{Input} \longrightarrow \boxed{\times 4} \longrightarrow \boxed{-3} \longrightarrow \text{Output}$$

(a) **(i)** Find the output when the input is 10.

10×4
$40 - 3$

Multiplying the input by 4 then subtracting 3 from the result

(a)(i) ....37........................ **[1]**

(ii) Find the input when the output is 17.

$17 + 3$
$20 \div 4$

Doing the opposite operations in the opposite order goes from the output to the input

(ii) ....5........................ **[2]**

(b) The input is *x* and the output is *y*.

Write an equation for *y* in terms of *x*.

The input x is multiplied by 4 then has 3 subtracted from it to get the output y. No brackets are necessary as writing it this way means that the multiplication is done first

(b) ....$x \times 4 - 3 = y$........................ **[2]**

12 Kai has a bag of marbles that are red or blue or green or yellow.

Kai takes a marble at random, records the colour and returns the marble to the bag.
Kai does this 800 times.

The table shows some of the results.

Colour	Red	Blue	Green	Yellow
Frequency	48	80	296	376
Relative frequency	0.06	0.10	0.37	0.47

(a) Complete the table to show the number of times a yellow marble is taken. **[2]**

0.47×800 Multiplying the relative frequency by the 800 times works out the frequency for yellow

(b) **(i)** There are 40 marbles in the bag.

Work out how many blue marbles are likely to be in the bag.

0.10×40 The relative frequency is an estimate of the probability, which is an estimate of the proportion of the marbles which are blue. So multiplying the relative frequency of blue by the 40 marbles works out an estimate of how many blue marbles there are

(b)(i) ....4.......... **[2]**

(ii) Is your answer to **part (b)(i)** likely to be the actual number of blue marbles in the bag? Give a reason for your answer.

.....Yes..... because there was a large sample size..........

.... **[1]**

The relative frequency was worked out by taking out a marble 800 times, which is a large number of times. Therefore it is likely that the relative frequency is an accurate estimate of the probability and this was used to work out how many of the 40 marbles are blue

13 **(a)** All of the loaves in a baker's shop cost the same price.
Rowan buys 3 loaves and pays £3.78.
Azmi buys 5 loaves.

Work out how much Azmi pays.

$3.78 \div 3$ ← Dividing the cost of 3 loaves by 3 works out that the cost of each loaf is £1.26

1.26×5 ← Multiplying the cost of each loaf by 5 works out the cost of 5 loaves

(a) £ ....6.30........ **[3]**

(b) Alex and Ling travel the same distance to school.

Alex walks to school in 20 minutes.
Ling runs to school at twice the speed that Alex walks.

Find how many minutes it takes Ling to run to school.

$20 \div 2$ ← Going at twice the speed must mean it will take half the time

(b) ....10........ min **[2]**

14 **(a)** An integer between 70 and 80 is written as the product of its prime factors as $2 \times 3 \times f$.

Find the value of f and the integer.

$\frac{80}{2\times3}$ ← This works out that f would be $13.\dot{3}$ if it was 2 x 3 x f to get 80, so f is probably 13 to get an integer between 70 and 80

$2\times3\times13$

(a) $f =$ 13

Integer = 78 **[3]**

(b) 98 and 147 are written as the product of their prime factors.

$98 = 2 \times 7^2$ $147 = 3 \times 7^2$

Work out the highest common factor (HCF) of 98 and 147.

7^2 ← The highest common factor is found by multiplying together the lowest power of each prime in both lists. There are no 2s in the second list and no 3s in the first list so these are ignored. Both lists have 7^2 so this is the lowest power of the 7s. There are no other primes

(b) 49 **[2]**

15 **(a)** 10^2 is written in words as 'one hundred'.

Write 10^4 in words.

$\boxed{10^4 = 10000}$

(a) Ten thousand **[2]**

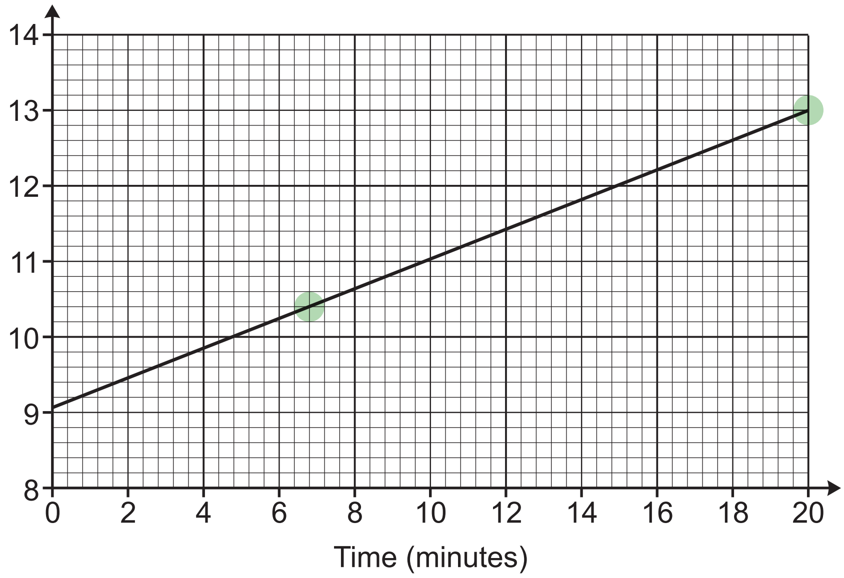
(b) Work out $(3.5 \times 10^{-1}) \times 100$, giving your answer in standard form.

35 ← Typing it into the calculator give 35

35 must be divided by 10 once to get 3.5, which is between 1 and 10. The 3.5 must be multiplied by 10^1 to keep it equal to 35

(b) 3.5×10^1 **[2]**

16 A ball of dough is left to rise before it is baked.
The graph shows the height of the ball of dough over the first 20 minutes.



(a) Work out the gradient of the line as a decimal, giving the units of your answer.
Show how you work out your answer.

$\frac{13-10.4}{20-6.8}$

Gradient = (change in y)/(change in x). Two point are picked which are on grid lines and are highlighted in green. y changes from 10.4 to 13 and x changes from 6.8 to 20

(a) ......$0.1\dot{9}\dot{6}$...... **[3]**

(b) A baker works out the height of the ball of dough at the end of 25 minutes as 14 cm.

(i) Use your gradient to show that the baker could be correct. **[2]**

$13+0.1\dot{9}\dot{6}\times5=13.9\dot{8}\dot{4}$

The gradient represents much the dough rises every minute. 25 minutes is 5 minutes after 20 minutes. Multiplying the gradient by this 5 minutes works out how much the bread could rise in these 5 minutes. Adding this to the height at 20 minutes works out what the height could be at 25 minutes

(ii) What assumption has the baker made?

It continues to rise at the same rate

.... **[1]**

17 Frankie draws a circle and works out its area, in cm^2, and circumference, in cm.
The answer for the area is two times the answer for the circumference.

Work out the diameter of the circle.
You must show your working.

$\pi r^2 = 2 \times 2\pi r$

Area of circle = πr^2 and circumference = $2\pi r$, where r is the radius. Multiplying the expression of the circumference by 2 makes it equal to the expression of the area

$r = 2 \times 2$

Dividing both sides by π and by r makes r the subject

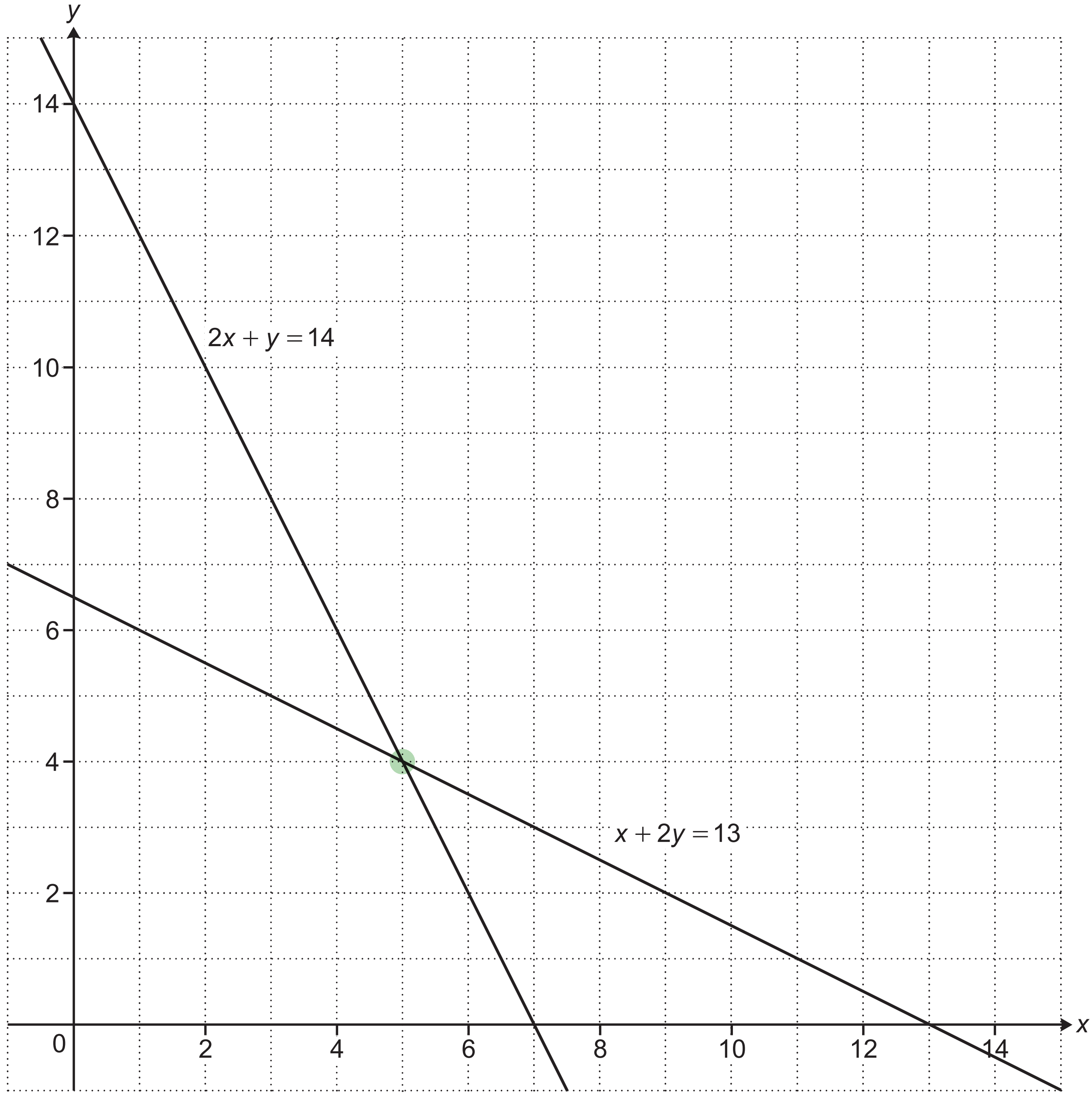
The radius is 4 cm and diameter is double radius so the diameter must be 8 cm

8 cm **[4]**

18 The graph shows the solution to this pair of simultaneous equations.

$2x + y = 14$
$x + 2y = 13$

Use the solution to work out the value of $3x + y$.
You must show how you work out your answer.

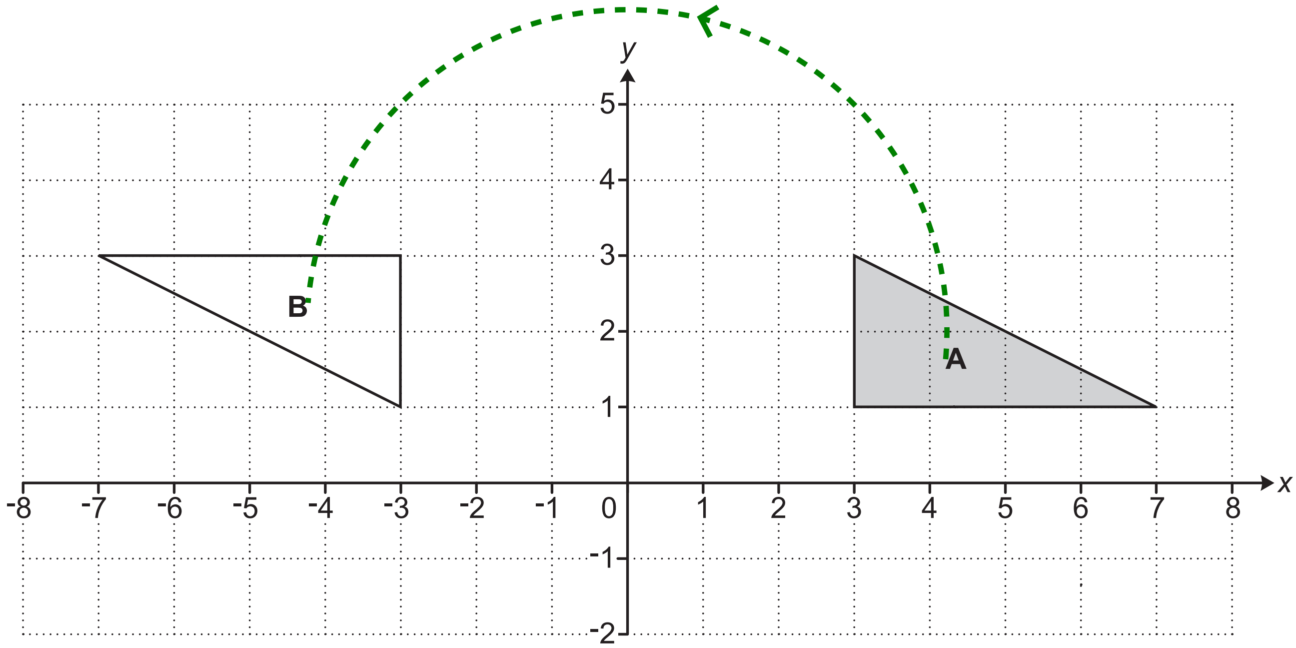


$3 \times 5 + 4$

The solutions to the simultaneous equations is where the graphs cross, highlighted in green. x = 5 and y = 4. Substituting these values into the expression 3x + y works out its value

$3x + y =$ ....19.......... **[3]**

19 Triangle **A** and triangle **B** are drawn on the coordinate grid.



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

Rotation by 180° centre (0 , 2)

The centre of rotation can be worked out by considering roughly where the centre of the circular motion is then using tracing paper to work out exactly where it is

[3]

20 $\overrightarrow{PQ} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\overrightarrow{QR} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$.

Work out $\overrightarrow{PR}$.

$\overrightarrow{PR} = \overrightarrow{PQ} + \overrightarrow{QR}$. Adding the x-components and y-components separately works out the vector. 3 + 4 = 7 and 2 + 1 = 3

$\begin{pmatrix} 7 \\ 3 \end{pmatrix}$

[2]

21 Solve.

$x^2 - 4x - 165 = 0$

You must show your working.

Using table mode, set f(x) = 165/x. Start: 1. End: 30. Step: 1

This lists out the factor pairs of 165

$(x+11)(x-15)=0$

11 and -15 multiply to give the -165 and add to give the -4. Putting these in brackets with x factorises the quadratic

Either x + 11 = 0 or x - 15 = 0. Subtracting 11 from both sides of the first equation finds that x = -11. Adding 15 to both sides of the second equation finds that x = 15

$x =$ ....-11........ or $x =$ ....15........ **[3]**

22 A recipe for a batch of jam needs 3 oranges, 5 lemons and 1.5 kg of sugar.
A cook uses the recipe to make lots of batches of jam.
They use 16 **more** lemons than oranges in total.

Find how much sugar the cook should use.

$3:5:1.5$ ← Writing the amount of oranges, lemons and sugar as a ratio

$2p = 16$ ← There are 2 more parts for lemons than oranges so this must represent the 16 more lemons than oranges

$p = 8$ ← Dividing both sides by 2 finds that 1 part of the ratio is worth 8

8×1.5 ← Multiplying the value of 1 part of the ratio by the 1.5 parts for sugar works out how much sugar should be used

..........12.......... kg **[3]**

23 Sam and Taylor are playing a game against a computer.
They can win, draw or lose the game.

Sam says

I think the probability of us winning the game is 0.3.

Taylor says

I think the probability of us losing the game is 0.75.

(a) Explain why Sam and Taylor cannot both be correct.

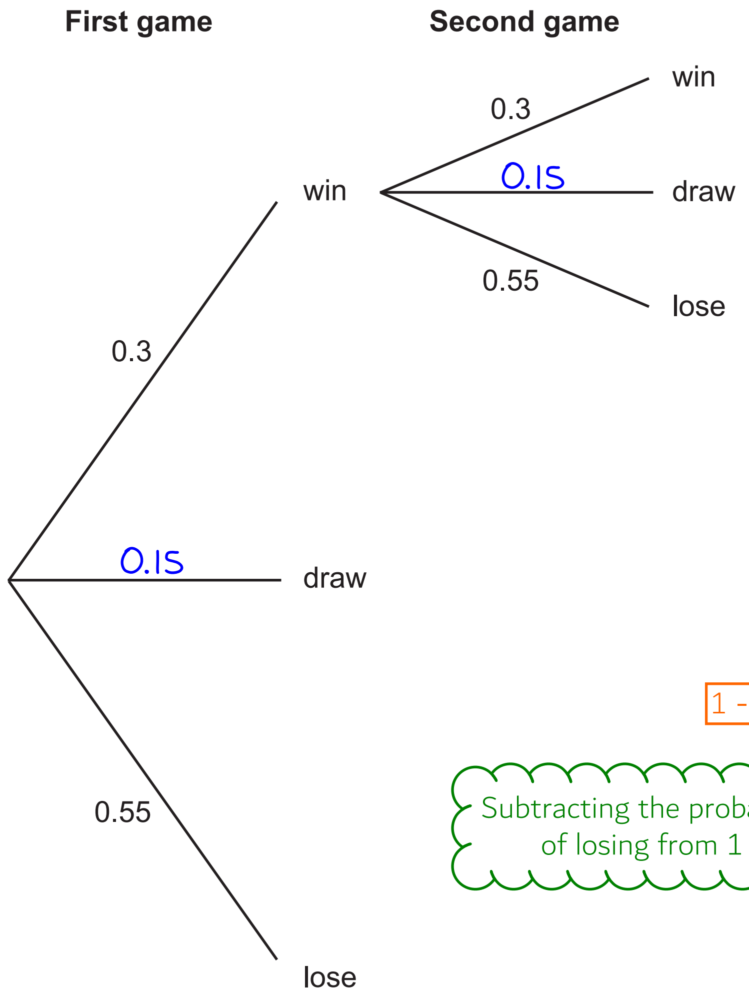
$0.3 + 0.75 > 1$

The probabilities cannot add up to more than 1 as this would mean that it would be more than certain for them to win or to lose

.... **[1]**

(b) Sam is correct. The probability of them winning the game is 0.3.
Taylor is not correct. The probability of them losing the game is actually 0.55.

Complete this **partly drawn** tree diagram to show **all** the possible outcomes of playing the game twice.



$1 - 0.3 - 0.55 = 0.15$

Subtracting the probability of winning and the probability of losing from 1 gives the probability of drawing

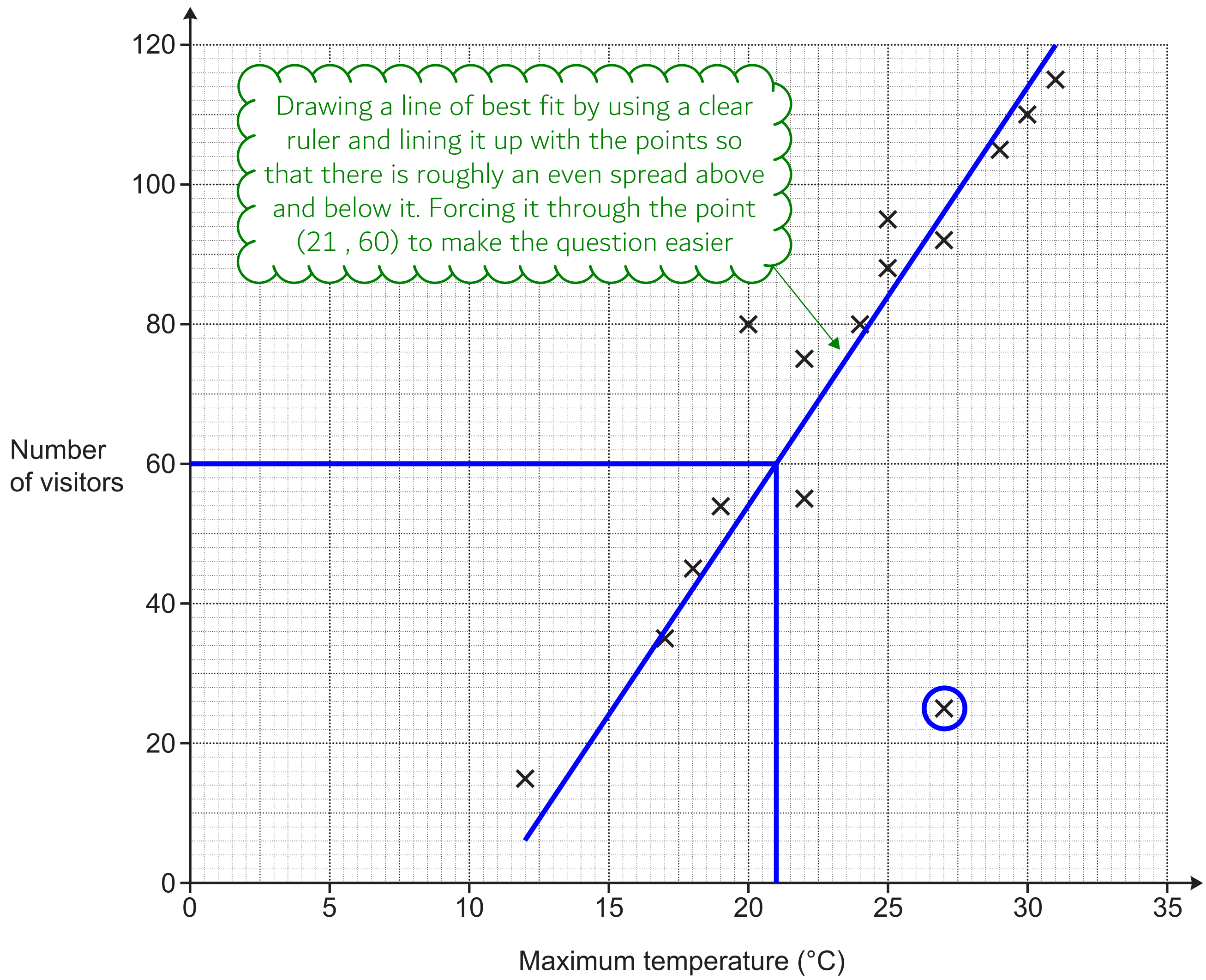
[3]

(c) Find the probability of them winning the first game and losing the second game.

0.3×0.55 Winning AND losing. AND means to multiply the probabilities

(c) ....0.165...................... **[2]**

24 The scatter diagram shows the number of visitors to a children's playground and the maximum temperature on fifteen Saturdays in summer.



(a) Describe the type of correlation shown in the scatter diagram.

As both variables increase together

(a) ....Positive........ **[1]**

(b) One Saturday was a hot but stormy day.

(i) Circle the most likely point on the scatter diagram for this Saturday. **[1]**

(ii) Explain why you chose this point.

It was a hot day with fewer visitors

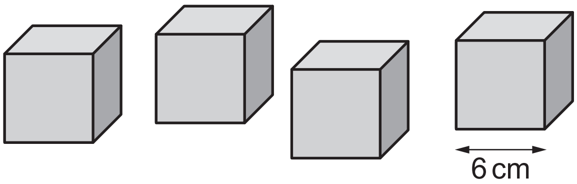
.... **[1]**

(c) Use a line of best fit to predict the number of visitors on a Saturday that has a maximum temperature of 21 °C.

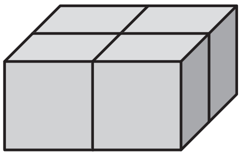
Reading up from 21 to the line and across to estimate the number of visitors when the maximum temperature was 21°C

(c) ....60........ visitors **[2]**

25 A child has four identical wooden cubes of side length 6 cm.



(a) They arrange the cubes in a 2 by 2 by 1 arrangement to form a cuboid.



Show that the surface area of the cuboid is 576 cm^2. **[2]**

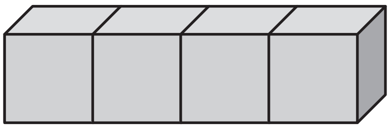
6×6

This works out that the area of each square face on each cube is 36 cm^2. Area of square = $length^2$

$36 \times 16 = 576$

There are 16 of the square faces on the surface of the cuboid. So multiplying the area of each one by 16 works out that the total surface area is 576 cm^2

(b) The child rearranges the cubes in a 4 by 1 by 1 arrangement to form a different cuboid.



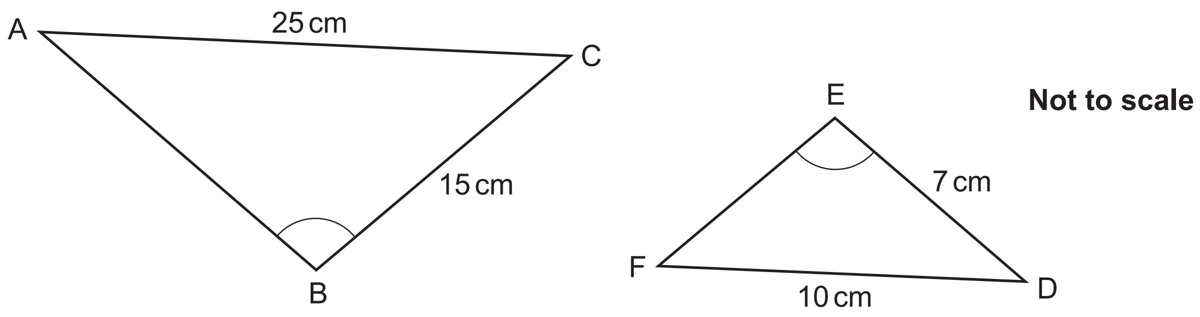
Calculate the percentage increase in surface area for this cuboid compared with the 2 by 2 by 1 cuboid.

$\frac{18-16}{16} \times 100$

There are 18 square faces on the surface of the different cuboid. 18 - 16 expresses the increase in the number of square faces on the surface. Putting this over the original 16 expresses it as a fraction increase. Multiplying this by 100 converts it into a percentage increase

(b) ....12.5.......... % **[4]**

26 Triangles ABC and DEF are mathematically similar.
Angle ABC = Angle DEF.



Calculate the perimeter of triangle ABC.

$25 \div 10$ FD is the smaller version of side AC. Dividing AC by FD works out that the scale factor is 2.5, which is the amount all of the sides on the smaller triangle have been multiplied by to get the sides on the larger triangle

7×2.5 Multiplying side ED by the scale factor works out side AB

$17.5 + 25 + 15$ Adding sides AB, AC and BC works out the perimeter of the triangle ABC

.........57.5......... cm **[4]**

END OF QUESTION PAPER