Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
MATHEMATICS

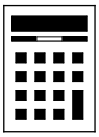
F

Foundation Tier Paper 3 Calculator

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a calculator
- mathematical instruments
- the Formulae Sheet (enclosed).



Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

Advice

In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24–25	
26–27	
28–29	
TOTAL	

Please note that these worked solutions have neither been provided nor approved by AQA 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

.CG Maths.

Answer **all** questions in the spaces provided.

Do not write outside the box

1 What is $\frac{1}{4}$ as a percentage?

Circle your answer.

[1 mark]

10% 25% 40% 75%

1/4 x 100 = 25

Percentage is out of 100. So multiplying any fraction by 100 converts it into a percentage

2 Circle the number that is a factor of 10

[1 mark]

7 6 5 4

5 goes into 10 exactly 2 times. Therefore it is a factor

3 Circle the value of the digit 9 in 0.094

[1 mark]

$\frac{9}{100}$ $\frac{9}{10}$ $\frac{1}{90}$ $\frac{1}{9}$

The 9 is in the hundredths column

Do not write outside the box

4 Simplify $4 \times 2c$

Circle your answer.

[1 mark]

$42c$ $16c$ $8c$ $6c$

4 x 2 x c = 8 x c = 8c

5 (a) Write a suitable unit for measuring each amount.

One has been done for you.

[2 marks]

	Unit
Distance from London to Manchester	kilometres
Length of a pencil	centimetres
Mass of a pound coin	grams

The length of a pencil is typically up to about 18 centimetres. This makes centimetres a suitable unit as it isn't a very small or very large number. Metres, for example, would not be so suitable as it is less than a metre.

The mass of a pound coin is about 9 grams. This makes grams a suitable unit as it isn't a very small or very large number. Kilograms, for example, would not be so suitable as it is less than a kilogram

Turn over for the next question

6

Do not write outside the box

5 (b) Times for the three parts of a journey are

- 20 minutes
- 40 minutes
- 1 hour 30 minutes.

Work out the **total** time for the journey.

Give your answer in hours.

[2 marks]

Time can be added using the calculator then converted into a decimal. Using sexagesimals: 0°20° + 0°40° + 1°30° = 2°30'0'', which can be converted into a decimal number of hours

Answer 2.5 hours

Do not write outside the box

6 Pens cost 20p each.

Rulers cost 60p each.

Saj buys some pens and some rulers.

He buys 8 rulers.

The total cost is £10

How many pens does he buy?

[3 marks]

8X0.60 ← There is 100p in £1 so 60p can be divided by 100 to convert it to £0.60. Multiplying this by 8 works out that the 8 rulers cost £4.80

10-4.80 ← Subtracting the cost of the 8 rulers from the total cost of £10 works out that the pens must cost £5.20

5.20÷0.20 ← Dividing the cost of the pens by the cost of each pen works out that there were 26 pens. 20p is divided by 100 to convert it to £0.20

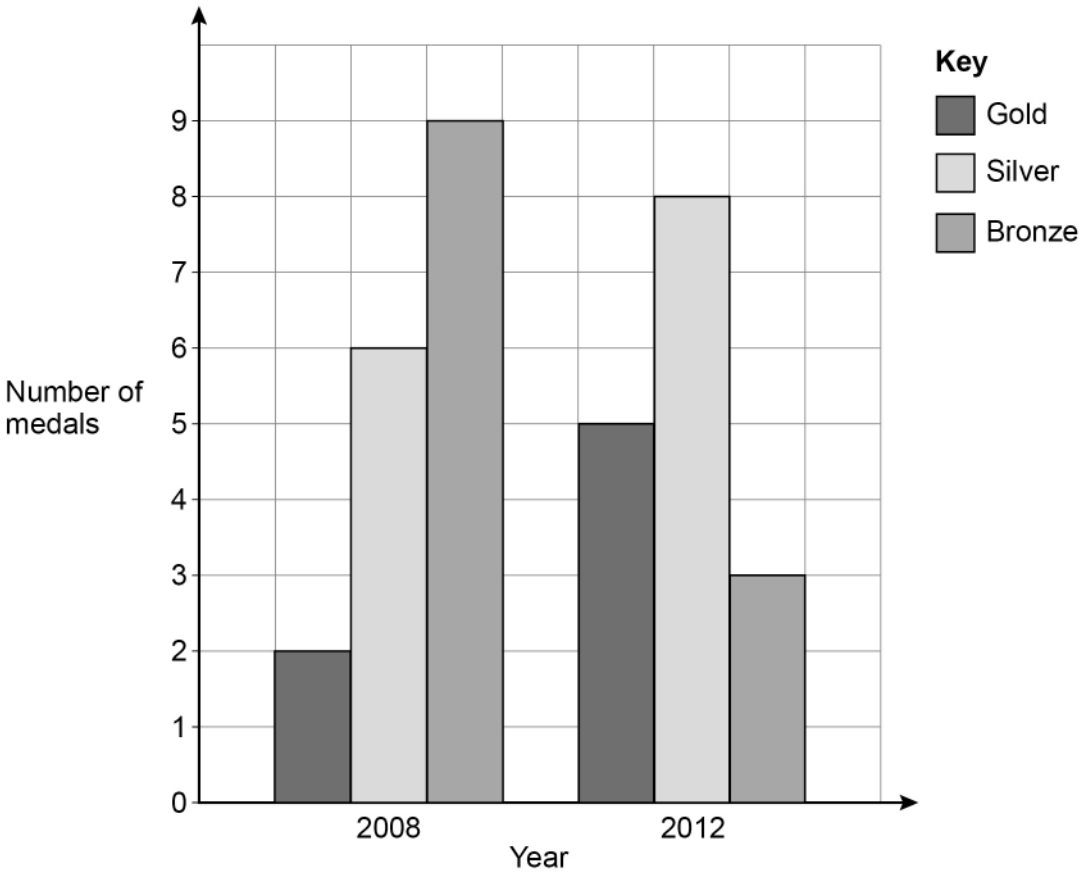
Answer 26

Turn over for the next question

5

Do not write outside the box

7 The bar chart shows the number of medals won by a country at events in 2008 and 2012



7 (a) Complete this statement about the medals won by the country in 2008

[1 mark]

number of Silver medals = 3 × number of Gold medals

The number of silver medals in 2008 was 6. The number of gold medals in 2008 was 2. 6 is 3 times 2

Do not write outside the box

7 (b) Show that the country won **more** medals in 2008 than in 2012

[2 marks]

2+6+9=17
5+8+3=16

Adding together the number of bronze, silver and gold medals works out the total number of medals each year. There were 17 medals in total in 2008 and 16 medals in total in 2012

17 is more than 16

7 (c) At the 2016 event the country won an **equal** number of each type of medal.

Here is a statement about the medals won by the country in 2016

The total number of medals **cannot** be 25

Give a reason why the statement is correct.

[1 mark]

$25 \div 3 = 8.\dot{3}$

There are 3 types of medal. If there were 25 medals in total, dividing this by the 3 types does not give a whole number and there needs to be a whole number of each type of medal

Turn over for the next question

4

Do not write outside the box

8 In this question use 1 litre = 1000 millilitres

A mixture is made using white paint and red paint.

amount of white paint = amount of red paint ÷ 7

5.6 litres of red paint will make **more** than 6 litres of the **mixture**.

How much more?

Give your answer in millilitres.

[4 marks]

5.6 × 1000 = 5600
6 × 1000 = 6000

Converting both the 5.6 litres and 6 litres into millilitres as the answer needs to be in millilitres. Every litre is 1000 millilitres so multiplying the number of litres by 1000 does this

5600 ÷ 7

Working out the amount of white paint by dividing the amount of red paint by 7

5600 + 800

Adding the amount of white paint to the red paint works out that there will be 6400ml of the mixture

6400 − 6000

Subtracting the 6 litres from the amount of mixture works out that there is 400ml more of the mixture than 6 litres

Answer 400 ml

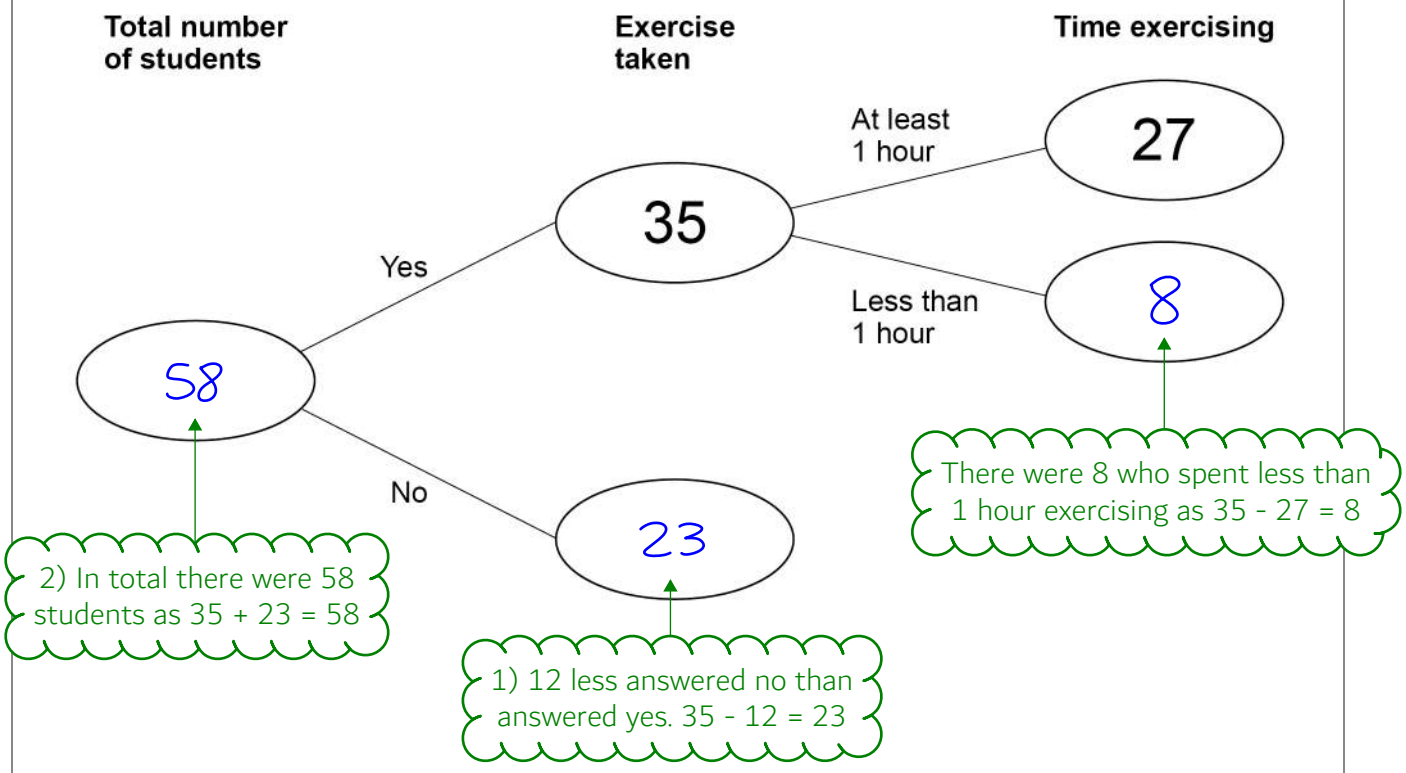
Do not write outside the box

9 Some students were asked about their daily exercise.

9 (a) 12 **more** students answered Yes than answered No.

Complete the frequency tree.

[3 marks]



9 (b) One of the 35 students who answered Yes is chosen at random.

What is the probability that they exercise for at least 1 hour?

[1 mark]

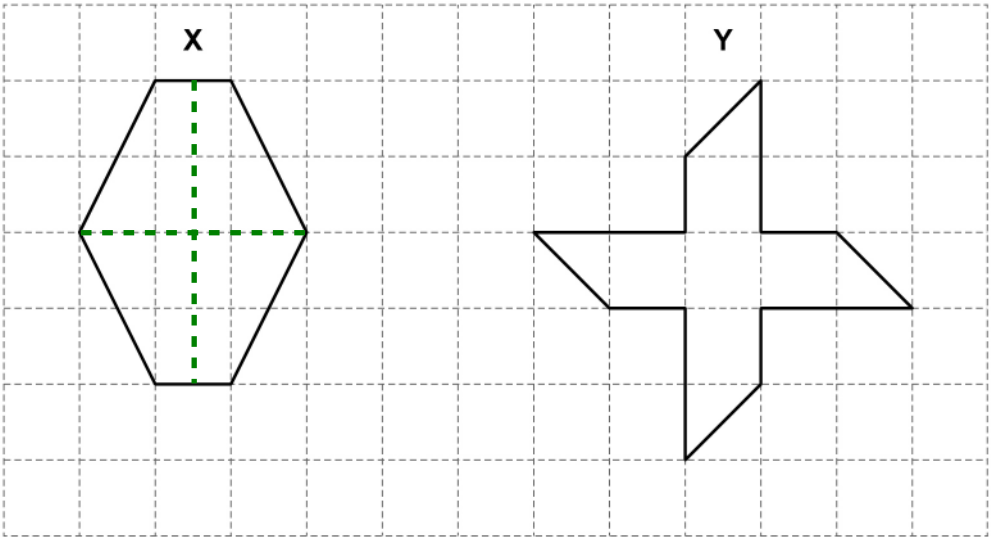
Answer $\frac{27}{35}$

27 out of the 35 students who answered Yes exercise for at least 1 hour

8

Do not write outside the box

10 Shapes X and Y are shown on a centimetre grid.



10 (a) Circle the name of shape **X**.

[1 mark]

pentagon hexagon octagon decagon

It has 6 straight sides

10 (b) Give a reason why shape **Y** is **not** a regular polygon.

[1 mark]

Its sides are not equal

Regular means that all the sides and angles are equal so it is not regular.
Polygon means a shape with at least 3 straight sides so it is a polygon

10 (c) Complete these statements.

[2 marks]

The number of lines of symmetry of shape **X** is 2

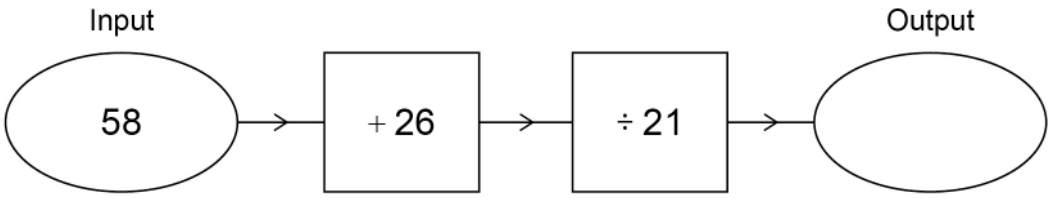
They are shown on the shape

The order of rotational symmetry of shape **Y** is 4

It can be rotated 4 times within a full turn with it looking the same

Do not write outside the box

11 (a) Here is a number machine.



Work out the output.

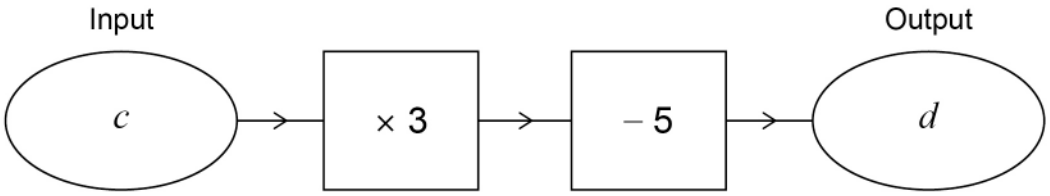
[1 mark]

58 + 26 = 84
84 ÷ 21 = 4

The operations need to be done in the right order so typing in 58 + 26 ÷ 21 does not work as only the 26 is being divided by 21 if this is done

Answer 4

11 (b) Here is a different number machine.



Work out a formula for d in terms of c.

[2 marks]

Answer $d=c\times3-5$

No brackets are required as the order of operations, BIDMAS, means that the multiplication is done first

7

Do not write outside the box

12 (a) Simplify fully $9x + y - 6x + y$

[2 marks]

Answer 3x+2y

Collecting the like terms: 9x - 6x = 3x and y + y = 2y

12 (b) Here are two expressions.

$8a$	$a^2 - b$

When $a = 25$ the expressions have the same value.

Work out the value of b.

[3 marks]

8X25=200 ← This works out the value of the first expression

25²=625 ← This works out the value of a^2

625−200 ← The second expression also has a value of 200. Subtracting the value of the expression from the value of a^2 works out the difference between them and therefore what must be subtracted. This is the value of b

$b =$ 425

Do not write outside the box

12 (c) Simplify $\frac{6w+10}{2}$

Circle your answer.

[1 mark]

$6w + 8$ $3w + 10$ $6w + 5$ $3w + 5$

Both the 6w and the 10 need to be divided by 2

13 In a bag,

number of green discs : number of blue discs = 20 : 11

Tick **one** box for each statement about the discs in the bag.

[2 marks]

	True	False	Cannot tell
There are more green discs than blue discs.	✓		
In total there are 31 discs.			✓

There must be more green discs than blue discs as there are more parts in the ratio for green. This means a higher proportion (fraction, decimal or percentage) are green.

It is impossible to tell if there are 31 discs in the bag as only a ratio is given and this indicates the proportion, not the actual number of discs. However the ratio is in its simplest form and there are 31 parts in total meaning that the total number of discs must be a multiple of 31 so it is possible for there to be 31 discs

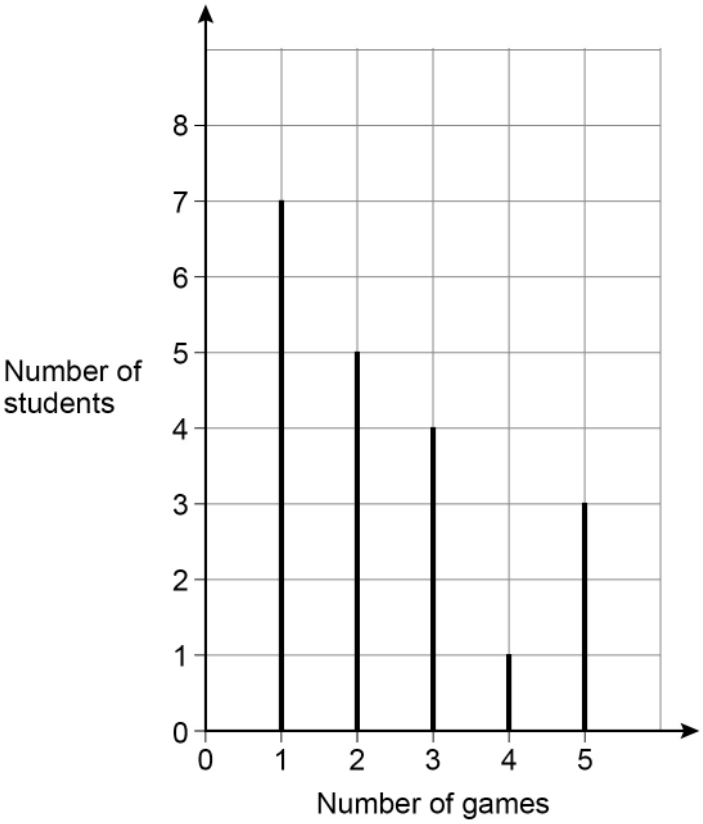
Turn over for the next question

8

Do not write outside the box

14 20 students are asked how many video games they played last month.

The chart shows information about the results.



14 (a) How many students played **more** than 2 games?

[1 mark]

4+1+3

Answer 8

More than 2 games would be 3, 4 or 5 video games played last month. 4 students played 3 games, 1 student played 4 games and 3 students played 5 games. Adding these numbers of students together works out that 8 students played more than 2 games

Do not write outside the box

14 (b) Work out the mean number of games played.

Give your answer as a decimal.

[3 marks]

$1 \times 7 = 7$
$2 \times 5 = 10$
$3 \times 4 = 12$
$4 \times 1 = 4$
$5 \times 3 = 15$

Multiplying the number of games by the number of students for each bar works out the total number of games played represented by each bar

$7 + 10 + 12 + 4 + 15$

Adding together all of the totals for each bar works out that there were 48 games played in total by all of the students

$48 \div 20$

Mean = total ÷ number, where total is the total number of games played by all of the students and number is the number of students

Answer 2.4

Turn over for the next question

4

Do not write outside the box

15 (a) Work out the multiple of 60 that is closest to 400

[2 marks]

Enter 60 and press =. Then enter ans + 60 and keep pressing =

This counts up in 60s. The multiple of 60 before 400 is 360, which is 40 away from 400. The multiple of 60 after 400 is 420, which is 20 away from 400

Answer 420

15 (b) Work out the highest common factor (HCF) of 12 and 18

[2 marks]

1, 12
2, 6

Listing out the factor pairs of 12 until the HCF is found. The highest factors are on the right of each pair and 6 is a factor of 18

Answer 6

Do not write outside the box

16 An empty container is a cylinder of radius 3.5 cm and height 40 cm

A tennis ball is a sphere of radius 3.5 cm

Will six of the tennis balls fit in the container?

Tick a box.

Yes ☐ No ☑

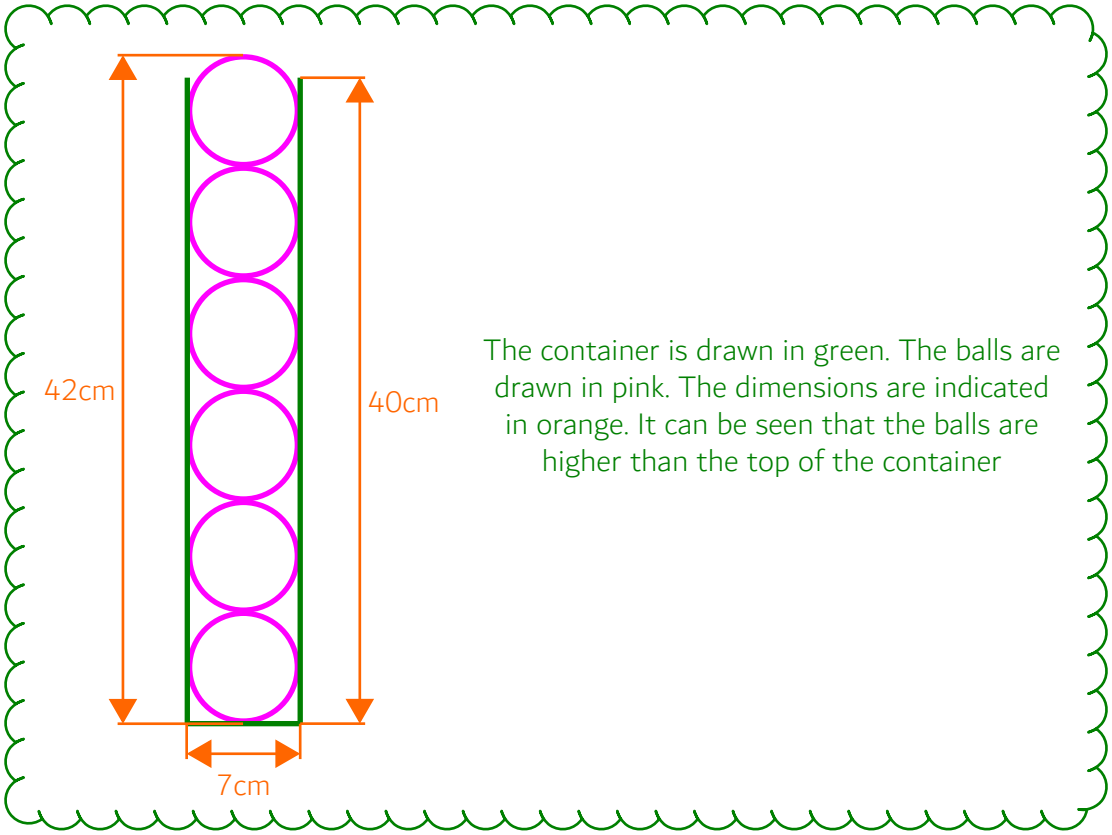
Show working to support your answer.

[2 marks]

The radius of the container is the same as the radius of each ball. Therefore the balls will have to be stacked on top of each other

3.5x2 ← Multiplying the radius of the ball by 2 works out the diameter of each ball. This is the distance across the ball

7x6=42 ← This works out that 6 of the balls stacked on top of each other will have a height of 42cm. This is more than the height of the container so they will not fit



The container is drawn in green. The balls are drawn in pink. The dimensions are indicated in orange. It can be seen that the balls are higher than the top of the container

Turn over for the next question

6

Do not write outside the box

17 (a) Calculate $2^7 \times 5^2$

Type into the calculator exactly as it is

[1 mark]

Answer 3200

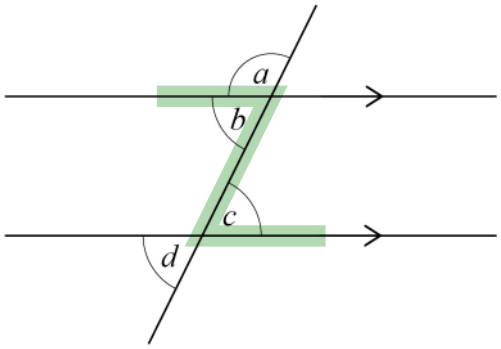
17 (b) Calculate $\sqrt[4]{20\,736}$

Type into the calculator exactly as it is

[1 mark]

Answer 12

18



Circle the pair of alternate angles.

[1 mark]

a and b | b and c | c and d | a and d

The angles on the insides of the Z-shape are alternate angles

Do not write outside the box

19 Juice and water are mixed together in the ratio 2 : 7

19 (a) Draw a straight line graph that shows the amounts of juice and water to mix together.

Your graph **must** show up to 10 litres of juice.

[2 marks]

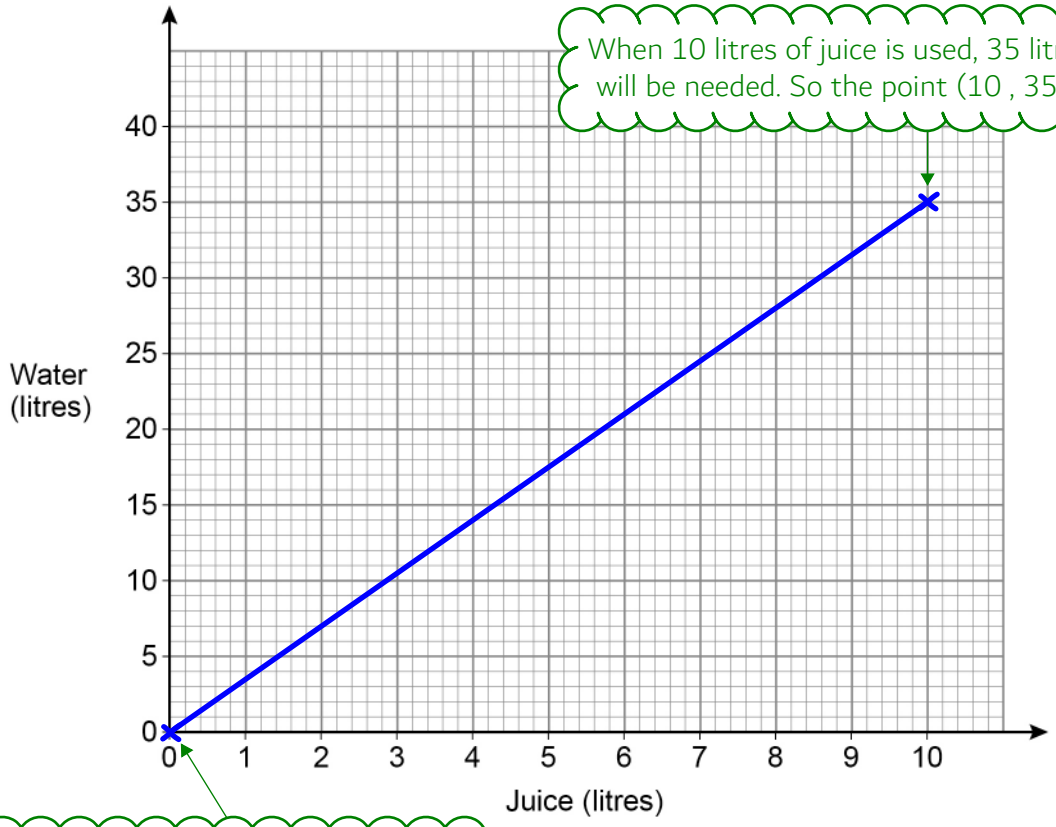
10 ÷ 2

2 parts of the ratio represent the juice. When there is 10 litres of juice, dividing the 10 by 2 works out that the value of 1 part of the ratio is 5

5 x 7 = 35

7 parts of the ratio represent the water. Multiplying the value of 1 part of the ratio by 7 works out that 35 litres of water will be needed when there is 10 litres of juice

When 10 litres of juice is used, 35 litres of water will be needed. So the point (10 , 35) is plotted



When 0 litres of juice is used, 0 litres of water will be needed. So the point (0 , 0) is plotted

It is a straight line graph so the two plotted points can be joined

19 (b) How much water needs to be mixed with 5 litres of juice?

[1 mark]

5 ÷ 2

2.5 x 7

Answer 17.5 litres

Dividing the 5 litres by the 2 parts representing the juice works out that 1 part of the ratio is worth 2.5. Multiplying the value of 1 part by 7 works out what the 7 parts representing water is worth

6

Turn over ►

Do not write outside the box

20 Adam and Bianca each throw the same biased coin.

Here is some information about their throws.

	Number of throws	Number of Heads
Adam	40	14
Bianca	60	20

Bianca says,

''My results give a better estimate of the probability of Heads than Adam's results.''

Is she correct?

Tick a box.

Yes ☑ No ☐

Give a reason for your answer.

[1 mark]

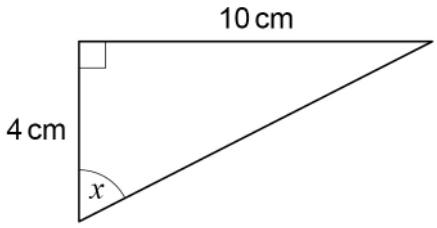
She has thrown it more times

The more times it is thrown, the more likely it is that the relative frequency is an accurate estimate of the probability

Do not write outside the box

21 Use trigonometry to work out the size of angle x.

Not drawn accurately



[3 marks]

S Ó H C Á H T Ó Á

Writing the formula triangles for right-angled trigonometry. S: sin of the angle. C: cos of the angle. T: tan of the angle. O: opposite. H: hypotenuse. A: adjacent. Ticking O as the 10cm is the opposite (it is opposite the angle x). Ticking A as the 4cm is the adjacent (it is next to the angle x and is not the hypotenuse). The hypotenuse is the longest side

$\tan x = \frac{10}{4}$

There are two ticks on the TOA formula triangle so this one can be used. Tan of the angle involves the angle so covering over t finds that tan x = opposite/adjacent

$x = \tan^{-1}\left(\frac{10}{4}\right)$

Rearranging to make x the subject by doing the opposite of tan (inverse tan) to both sides

$x =$ 68.2 °

Turn over for the next question

4

Do not write outside the box

22 Laura works in a shop.

The table shows the number of hours she works on two weekends.

	Saturday	**Sunday**
Weekend 1	3	2
Weekend 2	$5\frac{1}{2}$	$3\frac{1}{2}$

Work out the percentage increase in her **total** hours from Weekend 1 to Weekend 2

[3 marks]

$3+2=5$ ← Adding the hours done on Saturday and Sunday for Weekend 1 works out that 5 hours were worked in total on Weekend 1

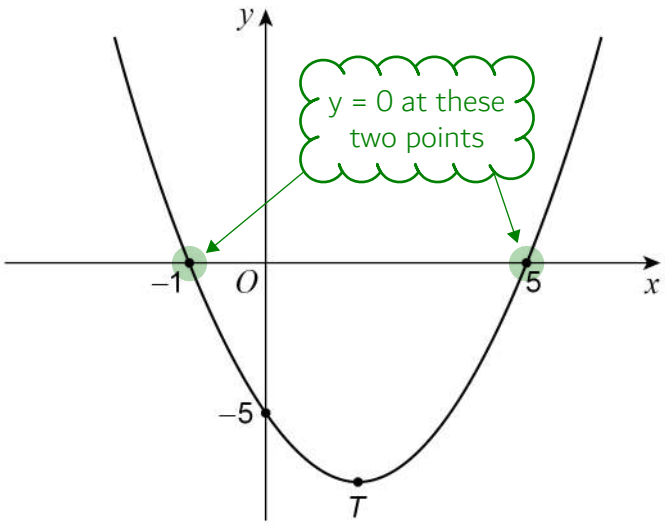
$5\frac{1}{2}+3\frac{1}{2}=9$ ← Adding the hours done on Saturday and Sunday for Weekend 2 works out that 9 hours were worked in total on Weekend 2

$\frac{9-5}{5}\times 100$ ← 9 - 5 expresses the difference in the number of hours between both of the weekends and therefore how many hours it increased by. Putting this over the 5 expresses the increase as a fraction of the original. Multiplying this fraction by 100 converts it into a percentage

Answer 80 %

Do not write outside the box

23 Here is a sketch of the curve $y = x^2 - 4x - 5$



23 (a) Write down the **two** roots of $x^2 - 4x - 5 = 0$

[1 mark]

Answer -1 and 5

y has been replaced with 0 in the equation. It is basically asking what the values of x are when y = 0

23 (b) Work out the coordinates of *T*, the turning point of the curve.

[2 marks]

This is a quadratic graph and they are symmetrical. So the x-coordinate of the turning point must be halfway between the two roots

5−1
4÷2

Adding 5 and -1 then dividing by 2 works out the mean of the two roots and therefore works out that the x-coordinate of the turning point is 2

2²−4×2−5

Answer (2 , -9)

Substituting in the x-coordinate into the equation finds that the y-coordinate must be -9

6

Do not write outside the box

24 A is an **arithmetic** progression.

Here are the first four terms.

13 16 19 22

G is a **geometric** progression.

Here are the first four terms.

2 4 8 16

nth term of A = 8th term of G

Work out the value of n.

[4 marks]

32,64,128,256 ← Geometric means that it multiplies by the same amount between each term. G is multiplying by 2 between each term. Continuing to multiply by 2 works out that the 8th term of G is 256

3n+10=256 ← The nth term of A is 3n + 10. It must be 3n as it increases by 3 between each term. It must be +10 as the 0th term (the one before the first term) would be 10. Setting the nth term of A equal to the 8th term of G

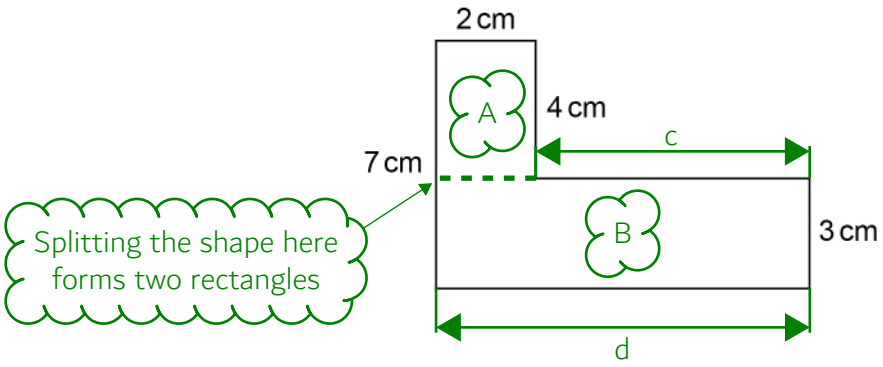
3n=246 ← Subtracting 10 from both sides to get the n term on its own

$n =$ 82

↑ Dividing both sides by 3 gets n on its own

Do not write outside the box

25 The L-shape is made from rectangles.



Not drawn accurately

The area is 44 cm^2

Work out the perimeter.

[3 marks]

4x2 ← Area of rectangle = length x width. The length of A is 4cm and the width of A is 2cm. So the area of A is 8cm^2

44-8 ← Subtracting the area of A from the area of the L-shape finds that the area of B must be 36cm^2

36÷3 ← Area of rectangle = length x width, so length = area ÷ width. The area of B is 36cm^2 and the width of B is 3cm. So the length of B is 12cm

12-2 ← This finds that length c is 10cm

7+2+4+10+3+12 ← Answer 38 cm

Adding all of the outside sides of the shape finds the perimeter

26 Work out $3\begin{pmatrix}1\\6\end{pmatrix}+\begin{pmatrix}2\\5\end{pmatrix}$

Column vectors are in the form $\begin{pmatrix}x\\y\end{pmatrix}$

[1 mark]

3x1+2 ← Multiplying the x-component of the first vector by 3 and adding the x-component of the second vector works out that the x-component must be 5

3x6+5 ← Multiplying the y-component of the first vector by 3 and adding the y-component of the second vector works out that the y-component must be 23

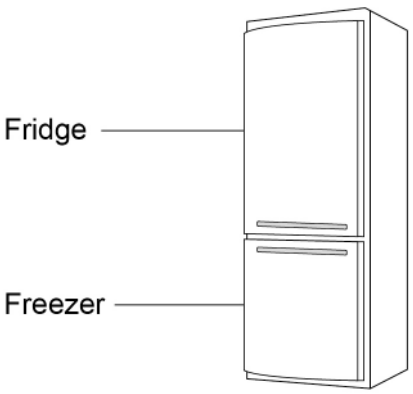
Answer $\begin{pmatrix}5\\23\end{pmatrix}$

8

Do not write outside the box

27 Information about two fridge-freezers, A and B, is shown.

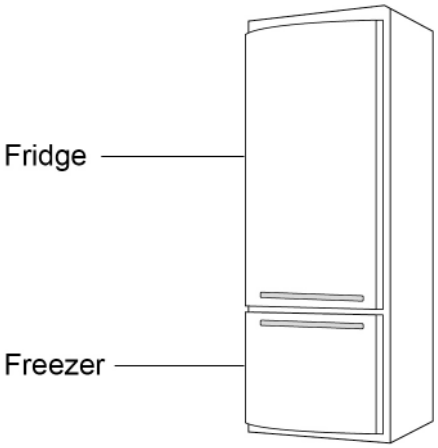
A



Total capacity is 330 litres

fridge capacity : freezer capacity = 3 : 2

B



Fridge capacity is 294 litres

fridge capacity : freezer capacity = 7 : 3

Do not write outside the box

Grace buys one of these fridge-freezers.

She buys the one with the greater **freezer** capacity.

Which one does she buy?

You **must** show your working.

[4 marks]

3+2 ← The total capacity of A is given. 3 + 2 works out that there are 5 parts in total for the ratio of A

330÷5 ← Dividing the total capacity of A by 5 works out that 1 part of the ratio is worth 66

66×2=132 ← Multiplying the value of 1 part of the ratio by 2 works out what 2 parts of the ratio represent, which is the capacity of the freezer of A

294÷7 ← 7 parts of the second ratio represent the fridge capacity of B. Dividing the fridge capacity of B by 7 works out that 1 part of the ratio is worth 42

42×3=126 ← Multiplying the value of 1 part of the second ratio by 3 works out what 3 parts of the ratio represent, which is the capacity of the freezer of B

Answer A

The freezer capacity of A (which is 132 litres) is more than the freezer capacity of B (which is 126 litres)

Turn over for the next question

4

Do not write outside the box

28 Tom and Adil are the two runners in a 200-metre race.

Tom completes the race in 24 seconds.

Adil completes the race at an average speed of 28.8 kilometres per hour.

Who wins the race?

You **must** show your working.

[3 marks]

$200 \div 1000 = 0.2$ ← There are 1000 metres in a kilometre so dividing the 200 metres by 1000 converts it into 0.2 kilometres

$24 \div 60$ ← There are 60 seconds in a minute so dividing the 24 seconds by 60 converts it into 0.4 minutes

$0.4 \div 60$ ← There are 60 minutes in an hour so dividing the 0.4 minutes by 60 converts it into 1/150 hours

$0.2 \div \frac{1}{150} = 30$ ← Dividing the distance in kilometres by the time in hours finds Tom's speed in kilometres per hour

Answer Tom

Tom had a greater average speed so must have won the race

Do not write outside the box

29 The mass of a baby is 3.6 kilograms to 1 decimal place.

What is the error interval for the mass in kilograms?

Tick **one** box.

[1 mark]

- ☐ $3.5 \leqslant \text{mass} \leqslant 3.6$
- ☐ $3.55 \leqslant \text{mass} \leqslant 3.65$
- ☐ $3.5 \leqslant \text{mass} < 3.6$
- ☑ $3.55 \leqslant \text{mass} < 3.65$

$3.6 \pm \frac{0.1}{2}$

Adding and subtracting half of the resolution of the measurement works out the upper and lower bounds of the measurement. The resolution is 0.1 as this is what the first decimal place goes up by. So the lower bound is 3.55 and the upper bound is 3.65

The mass of the baby could be equal to 3.55 as this rounds to 3.6.
The mass of the baby could not be equal to 3.65 as this rounds to 3.7

END OF QUESTIONS

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