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Worked Solutions

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
MATHEMATICS

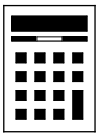
F

Foundation Tier Paper 2 Calculator

Thursday 7 June 2018 Morning Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a calculator
- mathematical instruments.



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.
- 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	
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

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Answer **all** questions in the spaces provided

Do not write outside the box

1 Circle the expression that can be written as $2y$

[1 mark]

$y + y$ — There are 2 lots of y

y^2 — These cannot be simplified and are not 2y

$2 + y$ — These cannot be simplified and are not 2y

$y \times y$ — This simplifies to y^2

2 Circle the decimal that is greater than $\frac{3}{10}$ and less than $\frac{2}{5}$

[1 mark]

0.32 0.035 0.4 0.24

Putting 3/10 into the calculator and formatting it as a decimal gives 0.3. Putting 2/5 into the calculator and formatting it as a decimal gives 0.4. Only 0.32 is greater than 0.3 and less than 0.4

3 What is 625 as a power of 5 ?

Circle your answer.

[1 mark]

5^3 — 125

5^4 — 625

5^5 — 3125

5^{125} — 2.35×10^{87}

Putting each of the options into the calculator to find their values

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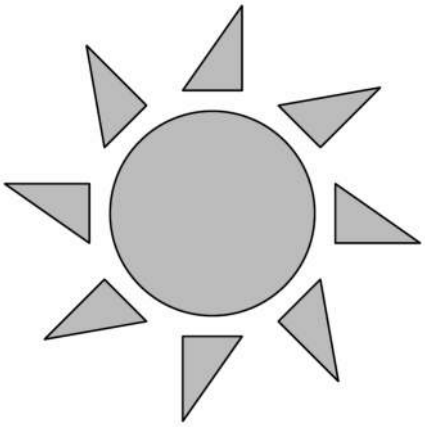
4 Circle the order of rotational symmetry of this drawing.



[1 mark]

0 2 4 8

The drawing can be rotated 8 times within 360° and look the same

5 Work out the value of $3^6 - \sqrt{841}$

[2 marks]

Typing it into the calculator exactly as it is above

Answer 700

Turn over for the next question

6

Do not write outside the box

6 Gemma has four groups of friends on a social media site.

The table shows the number of friends in each group.

Group	Number of friends
Family	8
Netball	8
School	26
Guides	11

6 (a) Which group is the mode?

[1 mark]

Answer School

School had the highest number of friends

6 (b) Gemma wants a pictogram to show the information.

She has drawn the first two rows.

Complete the pictogram.

Remember to complete the key.

[3 marks]

There are 8 friends in Family and this is represented by 2 symbols. 8 ÷ 2 = 4, so each symbol must represent 4 friends

Key: ◯ represents 4 friends

Family	◯ ◯
Netball	◯ ◯
School	◯ ◯ ◯ ◯ ◯ ◯ ◗
Guides	◯ ◯ ◔

Dividing the number of friends in School and Guides by 4 then formatting the answers as mixed fractions works out how many symbols should be drawn

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7 e is 3 **more** than d.

f is 5 **less** than d.

7 (a) Write an expression for e in terms of d.

[1 mark]

Answer $d+3$

Adding 3 to d expresses 3 more than d

7 (b) Write an expression for f in terms of d.

[1 mark]

Answer $d-5$

Subtracting 5 from d expresses 5 less than d

7 (c) Work out $e-f$

Simplify your answer.

[2 marks]

$d+3-(d-5)$ ← Expressing both e and f in terms of d then subtracting them. -(d - 5) becomes -d + 5. Collecting like terms cancels out d and gives 3 + 5

Answer 8

Turn over for the next question

8

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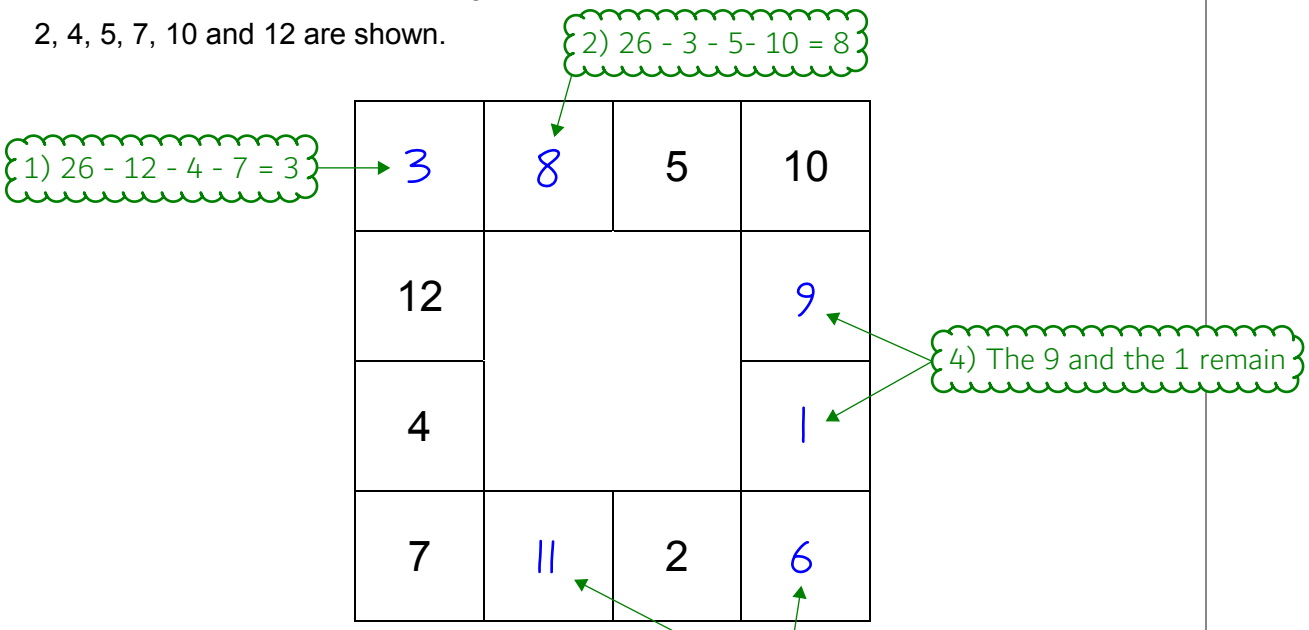
8 The numbers 1 to 12 are put in a grid.

2, 4, 5, 7, 10 and 12 are shown.



Each of the four sides of the grid must add up to 26

Complete the grid using the numbers

1, 3, 6, 8, 9 and 11

[3 marks]

3) 26 - 7 - 2 = 17. The only way of making 17 with the remaining numbers is 6 + 11 so these numbers must go in these two squares. If 11 went in the bottom right square, in the column on the right 26 - 10 - 11 = 5, which cannot be possibly made using the remaining 9 and 1. So 6 must go in the bottom right square

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9 In this question, use

1 foot = 12 inches

1 inch = 2.5 centimetres

Change 5 feet 8 inches to centimetres.

[3 marks]

5×12 ← Multiplying the 5 feet by 12 converts it into 60 inches

60+8 ← Adding the 8 inches to the 60 inches works out that it is 68 inches in total

68×2.5 ← Multiplying the 68 inches by 2.5 converts it into 170 centimetres

Answer 170 cm

10 Which of these numbers has **exactly four** factors?

Circle your answer.

[1 mark]

4 (8) 12 16

The factors of 4 are 1, 4, 2, so 4 has three factors. The factors of 8 are 1, 8, 2, 4, so 8 has four factors. The factors of 12 are 1, 12, 2, 6, 3, 4. so 12 has 6 factors. The factors of 16 are 1, 16, 2, 8, 4, so 16 has 5 factors

Turn over for the next question

7

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11 Nick has a 6-digit code.

He remembers it as three 2-digit numbers.

The first number is between 10 and 20

The second number is 3 times the first number.

The third number is 5 times the first number.

All six digits are **different**.

Work out the code.

[3 marks]

Enter table mode on the calculator. Set f(x) = 3x. Set g(x) = 5x. Start: 11. End: 19. Step: 1. This lists out the possible codes. In the x column are the first numbers. In the f(x) column are the second numbers. In the g(x) column are the third numbers. The possibilities which have repeating digits are: 113355, 123660, 133965, 144270, 154575, 164880, 175185, 195795

Answer 1 8 5 4 9 0

12 How many minutes are there in $5\frac{1}{4}$ hours?

Circle your answer.

[1 mark]

(315) 325 515 525

There are 60 minutes in an hour so multiplying the number of hours by 60 converts it into minutes. $5^1/_4 \times 60 = 315$

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13 Here is a formula for the amount of water needed to cook rice.

$$w = 1.5r + 0.5$$

w is the number of cups of water needed

r is the number of cups of rice to be cooked

13 (a) How many cups of water are needed to cook 7 cups of rice?

[2 marks]

1.5(7)+0.5 ← w is the subject so the formula tells us how to work out the number of cups of water needed. Substituting 7 for r in the right side finds w

Answer 11

13 (b) How many cups of rice can be cooked with 20 cups of water?

[3 marks]

20=1.5r+0.5 ← Substituting 20 for w in the formula

19.5=1.5r ← Subtracting 0.5 from both sides to get the r term on its own

Answer 13

Dividing both sides by 1.5 finds that r = 13

Turn over for the next question

9

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14 (a) Use your calculator to work out $9.95^2 \times 29.8$

Give your answer as a decimal.

Write down your full calculator display.

[1 mark]

Typing it into the calculator exactly as it is above

Answer 2950.2745

14 (b) Is your answer to part (a) sensible?

Use approximations to decide.

You **must** show your working.

[3 marks]

$10^2 \times 30$ ← Rounding each number to 1 significant figure

3000 ← 2950.2745 is close to the estimation of 3000 so it must be sensible

Tick a box.

☑ Sensible ☐ Not sensible

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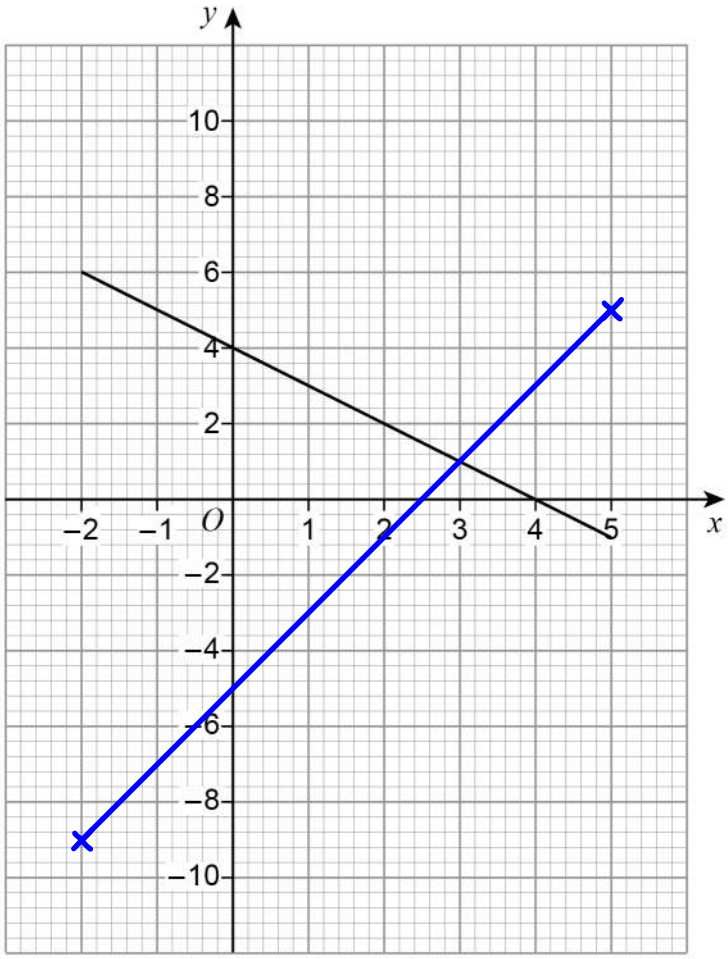
15 The graph of $y = 4 - x$ for values of x from –2 to 5 is shown on the grid.

15 (a) On the grid, draw the graph of $y = 2x - 5$ for values of x from –2 to 5

[3 marks]

Working out the first and last point on the graph then joining them up with a straight line. It must be a straight line as the equation is in the form $y = mx + c$. When $x = -2$, $y = 2 \times -2 - 5 = -9$, so the coordinate (-2, -9) is plotted. When $x = 5$, $y = 2 \times 5 - 5 = 5$, so the coordinate (5, 5) is plotted



15 (b) Use your graph to solve $2x - 5 = 4 - x$

[1 mark]

$x =$ 3

The two graphs cross when x = 3. At this point the two graphs are equal to each other

8

Turn over ►

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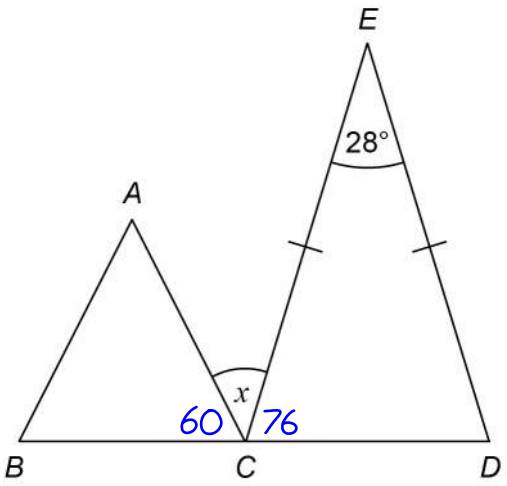
16 (a) *BCD* is a straight line.

Triangle *ABC* is equilateral.

CE = *DE*

Not drawn accurately



Work out the size of angle x.

[4 marks]

180/3 ← This works out that each of the angles in the equilateral triangle is 60°. There are 180° in total in a triangle and all the angles are equal in an equilateral

180−28/2 ← This works out that the base angles in the triangle CDE (which must be isosceles as two of its sides are equal) are 76°. 180 - 28 works out how many degrees remain in the triangle. Dividing this by 2 works out the two remaining angles as they are equal

180−60−76 ← This works out angle x. The 60°, the 76° and angle x are all angles around point C on the straight line BCD. Angles on a straight line add up to 180° so subtracting the other angles from 180 leaves angle x

Answer 44 degrees

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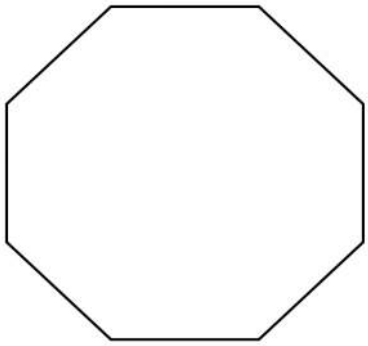
16 (b) Amba is working out the size of an **interior** angle of a regular octagon.



Not drawn accurately

Her method is Interior angle = 360 ÷ 8

Is her method correct?

Tick a box.

☐ Yes ☑ No

Give a reason for your answer.

[1 mark]

There are more than 360° in an octagon

There are 360 degrees in a 4-sided shape. Adding more sides makes the total of the interior angles more. 360 ÷ 8 actually works out the exterior angle

Turn over for the next question

5

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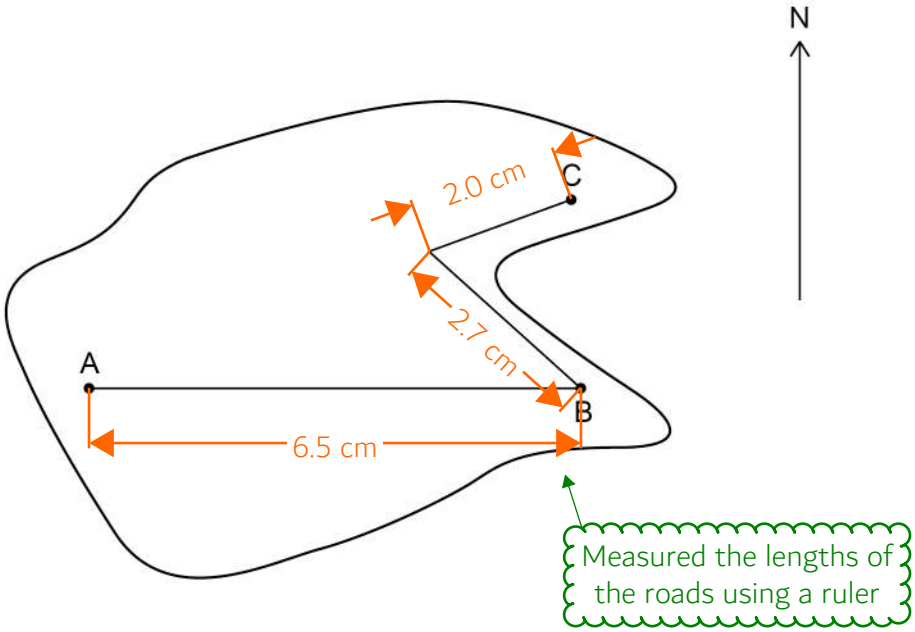
17 Here is a map of an island with cities A, B and C.

The straight lines represent roads.

Scale: 1 cm represents 200 km



17 (a) A is due West of B.

Write down the bearing of A from B.

[1 mark]

Answer 270 °

If facing north at B, 270° must be turned clockwise to face toward A

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17 (b) Umar drives from A to B on the route shown.

Kaz drives from B to C on the route shown.

Use the map to work out how much further Umar drives than Kaz.

You **must** show your working.

[5 marks]

2+2.7 ← Adding the 2 cm and 2.7 cm measured on the map for the roads from B to C works out that Kaz drives 4.7 cm on the map

6.5−4.7 ← Subtracting the 4.7 cm Kaz drives from the 6.5 cm Umar drives on the map works out that Umar drives 1.8 cm further than Kaz on the map

1.8×200 ← Multiplying the 1.8 cm by 200 works out that 1.8 cm on the map represents 360 km in real life

Answer 360 km

Turn over for the next question

6

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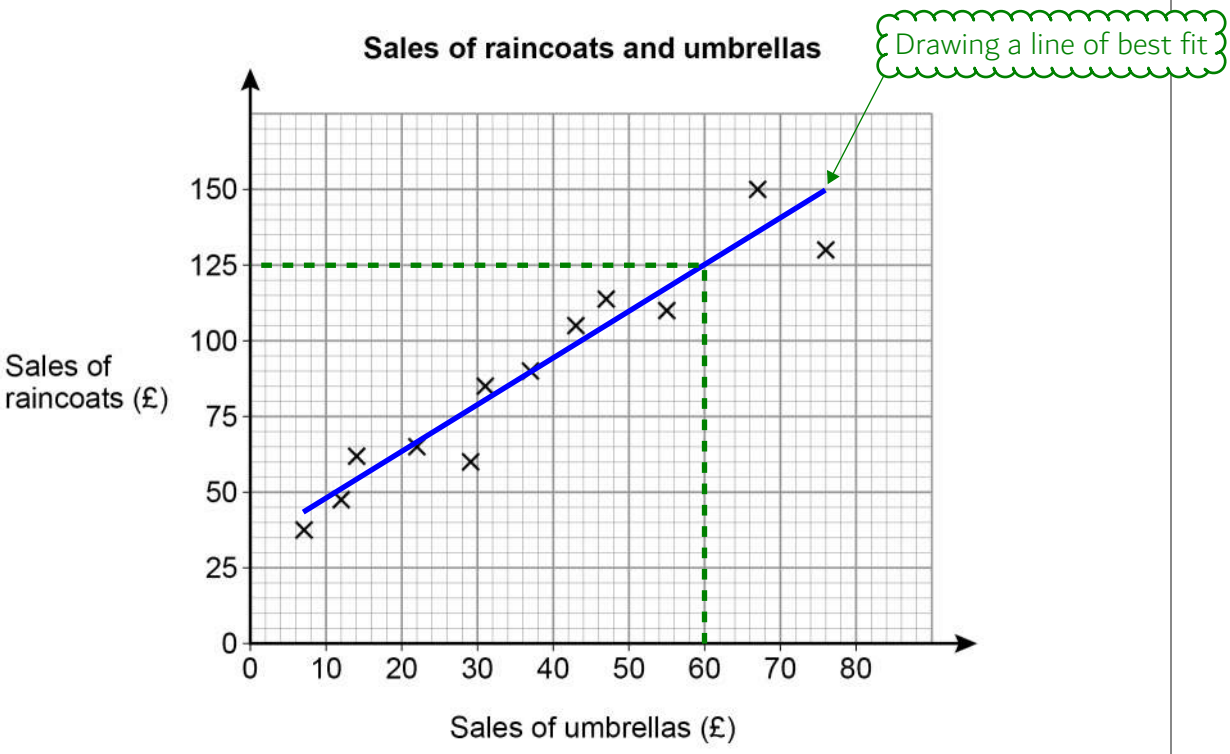
18 A shop sells raincoats and umbrellas.

The scatter graph shows the monthly sales for 12 months.



18 (a) Write down the type of correlation shown by the graph.

[1 mark]

Answer Positive

It is positive correlation as both variables increase together. There would be a positive gradient on the line of best fit

18 (b) The manager expects the sales of umbrellas next month to be £60

Draw a line of best fit to estimate the sales of raincoats next month.

[3 marks]

Answer £ 125

Reading up from £60 on the x-axis to the line of best fit then across to the y-axis makes the estimate

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19 Multiply out $x(x-4)$

Circle your answer.

[1 mark]

$x^2 - 4$ $\quad$ $2x - 4$ $\quad$ $x^2 - 4x$ $\quad$ $-3x^2$

$x \times x = x^2$. $x \times -4 = -4x$

20 $a : b = 5 : 2$

How many times larger is a than b?

Circle your answer.

[1 mark]

0.4 $\quad$ 1.5 $\quad$ 2.5 $\quad$ 3

a could be 5 while b could be 2.
2 x 2.5 = 5

6

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21 (a) A circle has radius 4.2 cm

Work out the length of the circumference.

Give your answer to 1 decimal place.

[3 marks]

$\pi \times 2 \times 4.2$ ← Circumference = π x diameter. Diameter = 2 x radius

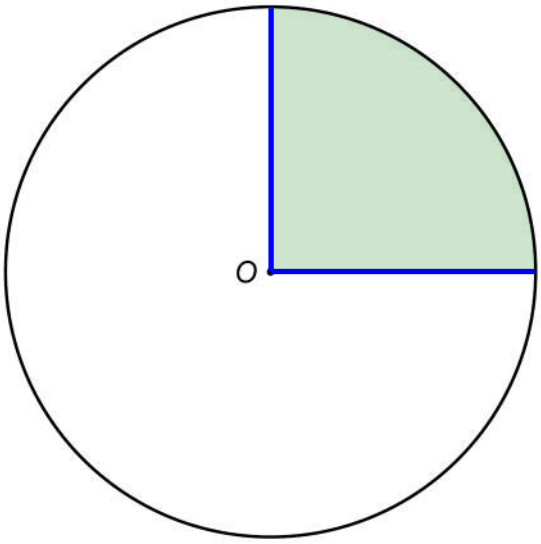
The answer of 26.38... is rounded to 1 decimal place. The 3 in the first decimal place rounds up to a 4 as there is an 8 in the next decimal place. Then everything after the first decimal place is set to 0 and ignored

Answer 26.4 cm

21 (b) The circle below has centre *O*.

Draw a sector on the circle.

[1 mark]



The sector is highlighted in green. There is no need to shade it in

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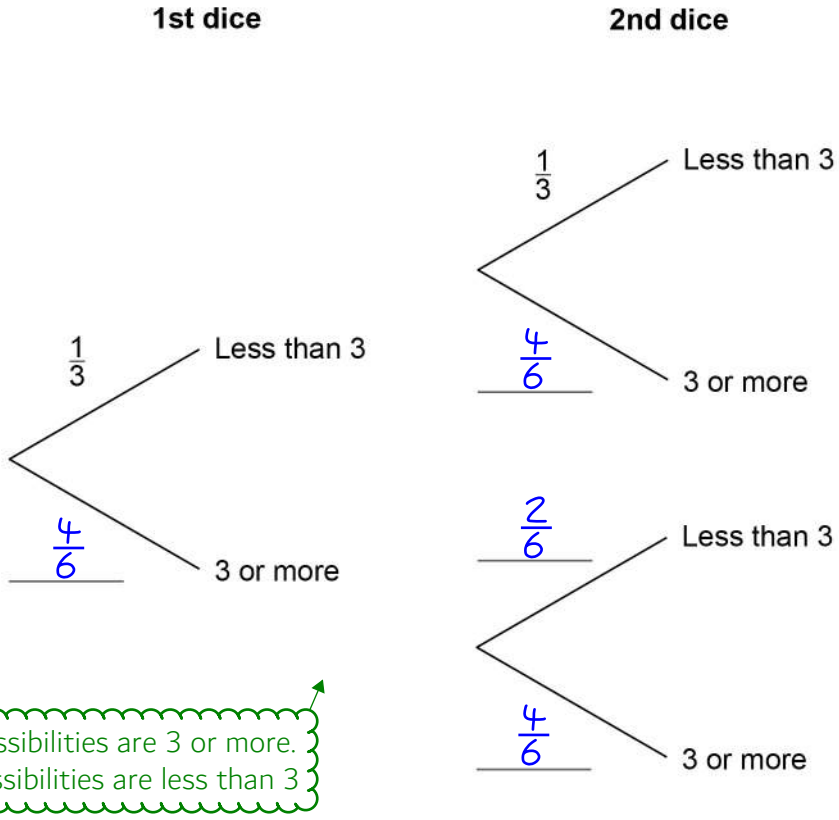
22 Two ordinary fair dice are rolled.

22 (a) Complete the tree diagram.

[1 mark]



4 out of the 6 possibilities are 3 or more.
2 out of the 6 possibilities are less than 3

22 (b) Work out the probability that **both** dice land on a number less than 3

[1 mark]

$\frac{1}{3} \times \frac{1}{3}$ ← Less than 3 AND less than 3. AND means to multiply the probabilities

Answer $\frac{1}{9}$

Turn over for the next question

6

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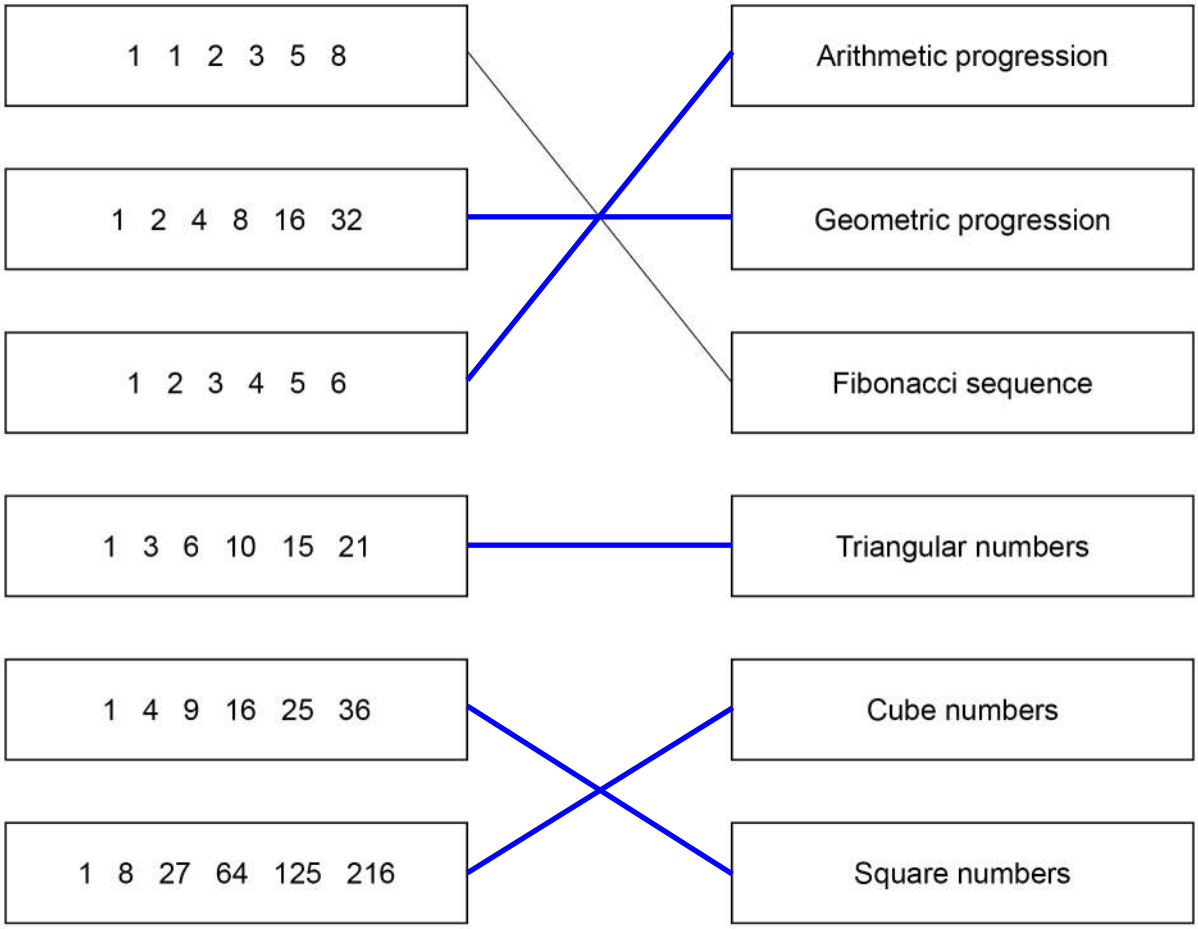
23 Match each sequence to its description.

One has been done for you.

[4 marks]



1, 2, 4, 8, 16, 32 is a geometric progression as it is multiplying by the same amount (2) between each term.

1, 2, 3, 4, 5, 6 is an arithmetic progression as the same amount (1) is being added between each term.

1, 3, 6, 10, 15, 21 are triangular numbers as it starts with 1, then adds 2, then adds 3, then adds 4, then adds 5, then adds 6.

1, 4, 9, 16, 25, 36 are square numbers as they are 1^2, 2^2, 3^2, 4^2, 5^2, 6^2.

1, 8, 27, 64, 125, 216 are cube numbers as they are 1^3, 2^3, 3^3, 4^3, 5^3, 6^3.

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24 The table shows information about the population of a city.

Population in 2001	Population in 2011
420 000	480 000

Liam claims,

"From 2011 to 2021 the population of the city will increase by the same percentage as from 2001 to 2011"

He works out,

population increase from 2001 to 2011 = 480 000 – 420 000
= 60 000

population in 2021 = 480 000 + 60 000
= 540 000

Does the population of 540 000 match his claim?

You **must** show your working.

[3 marks]

$\frac{60000}{420000} \times 100 = 14.2...\%$ ← 60000/420000 expresses the increase as a fraction of the population in 2001. Multiplying this by 100 converts it into a percentage

$\frac{60000}{480000} \times 100 = 12.5\%$ ← 60000/480000 expresses the same increase as a fraction of the population in 2011. Multiplying this by 100 converts it into a percentage

Answer NO

The percentage increases are different so 540000 does not match Liam's claim

7

Do not write outside the box

25 On three days, Ali throws darts at a target.

Here are his results.

	Number of throws	Number of hits	Number of misses
Monday	20	15	5
Tuesday	30	22	8
Wednesday	40	17	23
Total	90	54	36

25 (a) Work out **two** different estimates for the probability of Ali hitting the target.

[2 marks]

Answer $\frac{54}{90}$ and $\frac{17}{40}$

54 out of the total number of throws were hits.
17 out of the 40 throws on Wednesday were hits

25 (b) Which of your two answers is the better estimate for the probability of Ali hitting the target?

Give a reason for your answer.

[1 mark]

Answer $\frac{54}{90}$

Reason It was based on more throws

Doing more throws means that the estimate is more likely to be accurate, making it a better estimate

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26 Theo starts with savings of £18

James starts with no savings.

Each week from now,

Theo will save £4.50 and James will save £4

In how many weeks will Theo and James have savings in the ratio 15 : 8 ?

[3 marks]

45:24

Using table mode on the calculator. Set f(x) = 18 + 4.50x. Set g(x) = 4x. Start: 1. End: 30. Step: 1. This lists out the amount of money that Theo and James have for each of the first 30 weeks. The x column is the number of weeks. The f(x) column is the amount of money Theo has. The g(x) column is the amount of money James has. Scrolling down until the amount Theo has to the amount James has simplifies to 15 : 8. 45 : 24 can be simplified to 15 : 8 by dividing both sides by 3

Answer 6

The number of weeks is 6 as x = 6 when f(x) = 45 and g(x) = 24

Turn over for the next question

6

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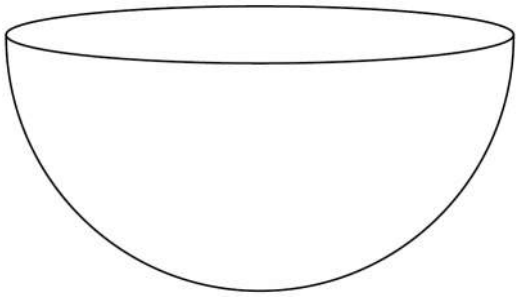
27

Volume of a sphere = $\frac{4}{3}\pi r^3$ where r is the radius

A container is a hemisphere of radius 30 cm



Sand fills the container at a rate of 4000 cm^3 per minute.

Does it take **less than** a quarter of an hour to fill the container?

You **must** show your working.

[3 marks]

s d t ← This is basically a speed, distance, time problem so writing the formula triangle. The speed is the rate the sand fills the container and the distance is the volume of the container

$\frac{4}{3}\pi \times 30^3$ ← Substituting 30 for r in the volume of a sphere formula works out that the volume of a sphere with radius 30 cm is 36000π cm^3

36000π ÷ 2 ← The container is a hemisphere, which is half of the volume of the sphere with radius 30 cm. So dividing the 36000π by 2 works out that the volume of the container is 18000π cm^3

18000π ÷ 4000 ← Covering t in the formula triangle finds that time = distance ÷ speed, or volume ÷ rate

14.1 ← The time is 14.1 minutes. The rate was in terms of minutes so the unit of time calculated will be minutes

Answer Yes

Quarter of an hour is 15 minutes (as there are 60 minutes in an hour and 1/4 of this is 15). 14.1 minutes is less than this

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28 The length of each side of a regular pentagon is 8.4 cm to 1 decimal place.

28 (a) Complete the error interval for the length of one side.

[2 marks]

$8.4 \pm \frac{0.1}{2}$ Adding and subtracting half of the resolution works out the upper and lower bound. The resolution is 0.1 as this is the place value of the first decimal place

8.35 cm ⩽ length < 8.45 cm

8.35: Lower bound; 8.45: Upper bound

28 (b) Complete the error interval for the perimeter.

[1 mark]

8.35×5, 8.45×5 Pentagons have 5 sides. The perimeter is found by multiplying the side length by 5. Using the upper and lower bound of the side lengths works out the upper and lower bounds of the perimeter

41.75 cm ⩽ perimeter < 42.25 cm

END OF QUESTIONS

6

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