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Worked Solutions

F

Monday 13 June 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

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

.CG Maths.

Answer **all** the questions.

1 **(a)** Write down a factor of 18.

18 is divisible by 1 to get a whole number so 1 is a factor

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

(b) Write down a square number between 10 and 20.

$4^2 = 4 \times 4 = 16$, so 16 is a square number

(b) ..... 16 ..... **[1]**

(c) Write $\frac{1}{4}$ as a decimal.

Typing it into the calculator then converting it to a decimal

(c) ..... 0.25 ..... **[1]**

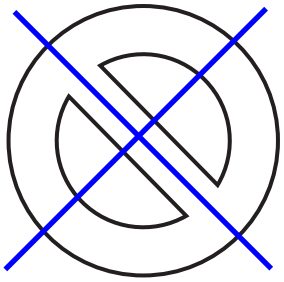
(d) Find the two numbers which multiply together to make 40 **and** add together to make 13.

Using table mode. f(x) = 40/x. Start: 1. End: 30. Step: 1

This lists out the factor pairs of 40, where the pair multiply to give 40. Going through the list until the pair which adds to 13 is found

(d) ..... 5 ..... and ..... 8 ..... **[2]**

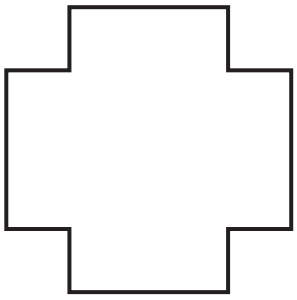
2 **(a)** Here is a shape.



Lines of symmetry cut the shape into two identical halves which are a reflection of each other

On the diagram, draw the shape's two lines of symmetry. **[1]**

(b) Here is another shape.

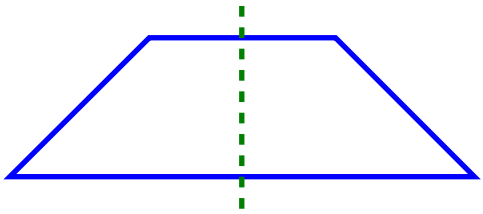


Write down the order of rotation symmetry of the shape.

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

(b) 4 **[1]**

(c) **(i)** Sketch a quadrilateral that has exactly one line of symmetry. **[1]**



Quadrilaterals are shapes with 4 straight sides

(ii) Write down the mathematical name of your quadrilateral.

(c)(ii) Trapezium **[1]**

3 Here are the first four dot patterns in a sequence.

Pattern 1 Pattern 2 Pattern 3 Pattern 4

(a) Draw Pattern 5 in the sequence. **[1]**

(b) Without drawing, work out how many dots are in Pattern 8 of the sequence.
Explain how you worked out your answer.

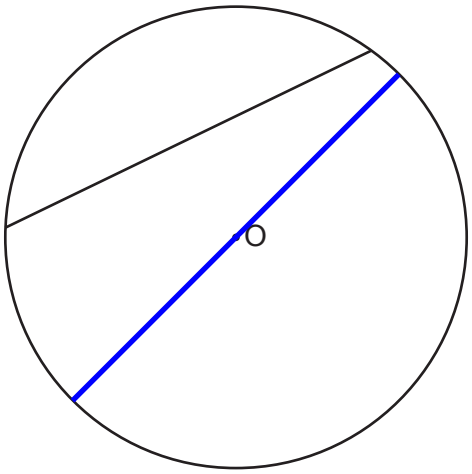
4×2 Pattern 8 is 4 patterns after Pattern 4 so has 4 lots of 2 more dots.
This works out that there are 8 more dots in Pattern 8 than Pattern 4

7+8 Adding the 8 more dots to the 7 dots in Pattern 4 works out that there are 15 dots in Pattern 8

15 because it goes up in 2s

[2]

4 The diagram shows a circle, centre O, and a line that meets the circle twice.



(a) On the diagram, draw a diameter. **[1]**

(b) Write down the mathematical name of the line shown on the diagram.

(b) Chord **[1]**

5 A student flips a fair coin and rolls a fair four-sided dice.
The coin can land on heads (H) or on tails (T).
The dice has sides numbered from 5 to 8.

(a) Complete this table to show all the possible outcomes.

Coin \ Dice	5	6	7	8
H	H5	H6	H7	H8
T	T5	T6	T7	T8

[2]

(b) Find the probability of getting a tail with an even number.
Give your answer as a fraction in its simplest form.

$\frac{2}{8}$ ← Even numbers end in 0, 2, 4, 6, 8. 2 out the 8 possibilities are tail with an even number

2/8 is simplified to 1/4 by dividing both the numerator and denominator by 2 → $\frac{1}{4}$

(b) $\frac{1}{4}$ **[2]**

6 A test has 20 questions.

Amaya attempts all of the questions.
She gets 65% of the questions correct.
Kai gets six of the questions wrong.

Who has the smallest number of questions wrong?
Show working to support your answer.

$\frac{65}{100} \times 20$ ← Percentage is out of 100 so putting the 65 over 100 converts 65% into a fraction. Multiplying this fraction by the 20 questions works out that 65% of 20 is 13 so Amaya gets 13 correct

$20 - 13$ ← They are either correct or wrong. So subtracting the 13 Amaya gets correct from the 20 questions works out that she gets 7 wrong

Kai ..... because Amaya gets 7 wrong .....

..... 7 is more than the 6 Kai gets wrong ..... **[3]**

7 **(a)** In a recipe, the ratio of the amount of flour needed to the amount of butter needed is 4 : 1.
Rowan mixes 4 kg of flour with 1 g of butter.

Explain what Rowan has done wrong.

The units are different

4kg of flour should be mixed with 1kg of butter

[1]

(b) Azmi gives $\frac{1}{10}$ of their earnings to charity and keeps the remainder.

For Azmi's earnings, find the ratio of the amount they give to charity to the amount they keep.

Give your answer in its simplest form.

$1 - \frac{1}{10}$ ← There is 1 lot of earnings. Subtracting the 1/10 which is given to charity works out that they keep 9/10 of the earnings

$\frac{1}{10} : \frac{9}{10}$ ← Writing the 1/10 which is given to charity to the 9/10 they keep as a ratio

Multiplying both sides of the ratio by 10 gets rid of the denominators. The ratio cannot be simplified further as 1 and 9 cannot be divided by the same amount to get smaller whole numbers

(b) 1 : 9 **[2]**

8 **(a)** Simplify.

$2 \times 3a$

2 x 3 = 6

(a) 6a **[1]**

(b) Simplify.

$\frac{2x^5}{4x}$

Dividing both the numerator by 2 and by x. There is now nothing else both the numerator and denominator can be divided by

(b) $\frac{x^4}{2}$ **[2]**

9 Ling is paid £23.40 per hour for working on a weekday.
On a Sunday, Ling is paid at $1\frac{1}{3}$ times this hourly rate.

How much does Ling earn for working 8 hours on a Sunday?

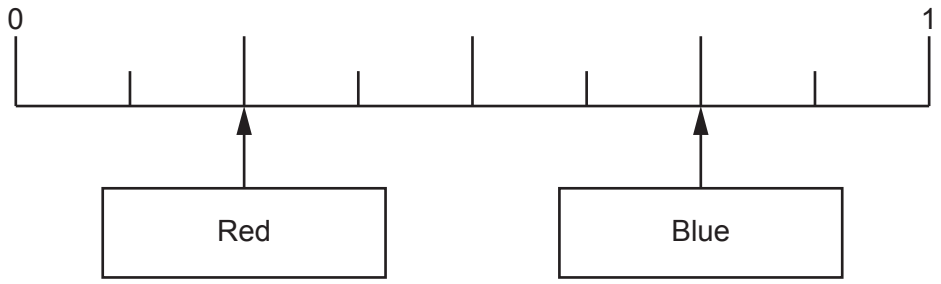
$23.40 \times 1\frac{1}{3}$ ← This works out that Ling is paid £31.20 per hour on a Sunday

31.20×8 ← Multiplying the £31.20 per hour by the 8 hours works out how much Ling earns

£ 249.60 **[3]**

10 Each edge of a fair spinner is coloured either red or blue.

The scale shows the probability of the spinner landing on red and of landing on blue.



(a) Write down, as a fraction, the probability of the spinner landing on red.

The large lines split the scale into quarters. Red is on the first line after 0

(a) $\frac{1}{4}$ **[1]**

(b) Show that the spinner could not have 15 edges. **[2]**

$\frac{1}{4} \times 15 = 3.75$ ← Multiplying the probability of red by the 15 edges works out how many of the edges would be red

There would not be a whole number of red edges

11 Mr Fox invests £400 in a savings account that pays 3% simple interest per year.

Work out the **total** amount of interest Mr Fox will have earned at the end of the 5th year.

$\frac{3}{100} \times 400$ ← Percentage is out of 100 so putting the 3 over 100 converts 3% into a fraction. Multiplying the £400 by this fraction works out that 3% of the £400 is £12

12×5 ← Simple interest means that the same amount of interest is earned each year. Multiplying the £12 by the 5 years works out how much interest there will be after the 5th year

£ 60 **[2]**

12 Frankie goes on holiday.
They change £375 into euros (€) at a rate of £1 = €1.15.
They spend €217.49 of this money.
After the holiday, Frankie changes the remaining euros back into pounds at a rate of £1 = €1.28.

Work out how many pounds Frankie gets back.

375×1.15 ← This converts the £375 into €431.25, as every £1 is €1.15

431.25−217.49 ← Subtracting the €217.49 they spend from the €431.25 works out that the remaining euros is €213.76

213.76÷1.28 ← Every €1.28 is £1 after the holiday so dividing the €213.76 by €1.28 works out how many lots of €1.28 it is and therefore that it is £167

£ ..... 167 ..... **[4]**

13 In a fish tank, the fish are either blue or gold or red.

There are 22 red fish.

$\frac{2}{5}$ of the fish are blue.

$\frac{5}{12}$ of the fish are gold.

Work out the total number of fish in the fish tank.
You must show your working.

$1-\frac{2}{5}-\frac{5}{12}$ ← There are 1 lot of fish. Subtracting the 2/5 which are blue and the 5/12 which are gold works out that 11/60 are red

$22\div 11$ ← Dividing the 22 red fish by 11 works out that 1/60 of the fish is 2

2×60 ← Multiplying the 1/60 of the fish by 60 works out the total number of fish

120 ..... **[5]**

14 In a dance competition, four judges award marks to each dancer.
Each judge can award 1, 2, 3, 4 or 5 marks.

The four judges' median mark, m, is put into the formula

$S = 10m - 5$

to get the dancer's score, S.

(a) Sam is awarded marks of 4, 3, 1 and 4.
Work out Sam's score.

1,3,4,4 ← Working out the median mark. Putting the marks in order then crossing out from both ends until the middle numbers are found

$\frac{3+4}{2}$ ← The median is halfway between the 3 and 4. Doing the mean of 3 and 4 works out this. This means to add them together and divide by 2, as there are 2 numbers

10(3.5)−5 ← Putting the median mark of 3.5 into the formula

(a) 30 **[3]**

(b) Taylor gets a score of 40.
Taylor says

> The judges must have awarded marks of 4, 4, 5 and 5
> because the median is 4.5
> and $4.5 \times 10 - 5 = 40$.

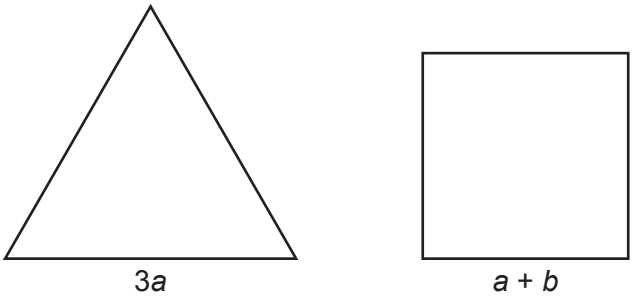
Why is Taylor not correct?
Show working to support your reason.

The marks could have been 3, 4, 4, 5

The first score doesn't make an impact on the median but needs to be less than or equal to 4 so that a 4 and a 5 are in the middle **[2]**

15 In this question, all lengths are in centimetres.

The diagram shows an equilateral triangle and a square.



Not to scale

The perimeter of each shape is 36 cm.

Find the value of b.

$3a \times 3$ ← Each side of the equilateral triangle is the same so multiplying the side length of 3a by 3 works out that the perimeter is 9a

$9a = 36$ ← Setting the expression of the perimeter equal to the actual perimeter of 36cm

$a = 4$ ← Dividing both sides by 9 works out that a is 4cm

$36 \div 4$ ← Dividing the perimeter of the square by its 4 equal sides works out that each side is 9cm

$9 - 4$ ← The side length of 9cm is equal to a + b. Subtracting the value of a from the 9cm finds b

$b =$ ..... 5 ..... **[4]**

16 For each statement, complete the box to show the power of 10.

(a) One million = $10^{\boxed{6}}$ ← 1,000,000 = 10 x 10 x 10 x 10 x 10 x 10 **[1]**

(b) One thousandth = $10^{\boxed{-3}}$ ← One thousandth is dividing by 10 3 times **[1]**

17 Some boxes are each in the shape of a cuboid.
The base of each box is exactly 35 cm by 45 cm.

The boxes are to be placed on their base, side by side against a wall.
If all the shorter sides or if all the longer sides are against the wall, they fit perfectly with no gaps.

Find the shortest possible length of the wall.

The length of the wall needs to be both a multiple of 35cm and a multiple of 45cm. When it is as short as possible this will be the lowest common multiple of 35 and 45

$35 = 5 \times 7$
$45 = 3^2 \times 5$
Expressing 35 and 45 as a product of prime factors

$3^2 \times 5 \times 7$ ← The lowest common multiple is the highest power of each prime multiplied together

The Casio fx-85GT CW can calculate the lowest common multiple of two numbers without having to do this method

..... 315 ..... cm **[4]**

18 The mass of a stone is 680 g.
The density of the stone is 1.6 g/cm^3.

(a) Work out the volume of the stone.

$d \frac{m}{v}$ ← Writing the formula triangle for density, mass, volume

$680 \div 1.6$ ← From the formula triangle, volume = mass ÷ density

(a) ..... 425 ..... cm^3 **[2]**

(b) Write 1.6 g/cm^3 in kg/m^3.

$\frac{1.6 \div 1000}{1 \div 100^3}$ ← 1.6g/cm^3 means 1.6g per 1cm^3. There are 1000g in 1kg so dividing the 1.6g by 1000 converts it into kg. There are 100cm in 1m and the unit is cubed so dividing 1cm^3 by 100^3 converts it into m^3. kg/m^3 can be worked out by dividing the mass in kg by the volume in m^3

(b) ..... 1600 ..... kg/m^3 **[1]**

19 **(a)** Multiply out and simplify.

$(x-4)(x+5)$

$x^2+5x-4x-20$ ← Expanding the brackets

Collecting like terms to simplify → x^2+x-20

(a) x^2+x-20 **[2]**

(b) Factorise.

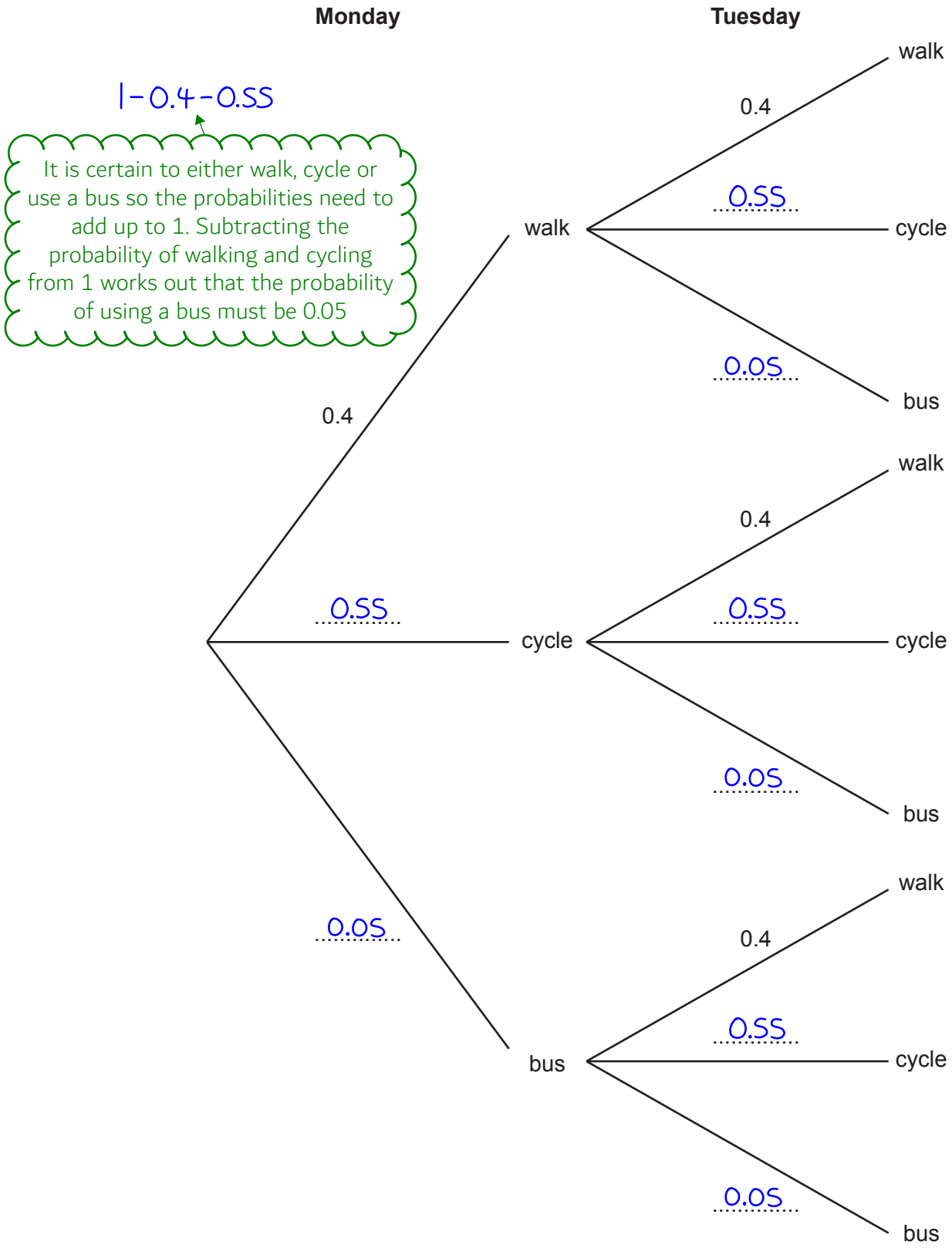
x^2-25

Difference of two squares can be used: $A^2 - B^2 = (A + B)(A - B)$

(b) $(x+5)(x-5)$ **[1]**

20 Reece travels to school by either walking, cycling or using a bus.
The probability that Reece walks is always 0.4.
The probability that Reece cycles is always 0.55.

(a) Complete the tree diagram for Monday and Tuesday.



[3]

(b) Show that the probability that Reece travels to school by the same method on Monday and Tuesday is 0.465. **[3]**

$0.4\times0.4+0.55\times0.55+0.05\times0.05=0.465$

Walk AND walk OR cycle AND cycle OR bus AND bus. AND means to multiply the probabilities. OR means to add the probabilities

21 Solve the simultaneous equations.

$3x + y = 11$ ← First equation

$x + y = 3$ ← Second equation

$2x=8$ ← Subtracting the second equation from the first equation cancels out the y and gives an equation just in terms of x

$x=4$ ← Dividing both sides by 2 eliminates the 2 on the left and gets x on its own

$4+y=3$ ← Substituting the value of x into the second equation

$x =$ ..... 4 .....

Subtracting 4 from both sides gets y on its own → $y =$ ..... -1 ..... **[3]**

22 A sports club has 250 members.

Some of the members wish to change a club rule.
To change a club rule, at least 70% of **all** the members must vote 'yes'.

At a meeting of the sports club, 10 members were absent and did not vote.
The other members voted yes : no : don't know in the ratio 11 : 3 : 1.

Did enough members vote 'yes' to change the rule?
Show how you decide.

$\frac{70}{100} \times 250 = 175$ ← Percentage is out of 100 so putting the 70 over 100 converts 70% into a fraction. Multiplying this fraction by the 250 members finds that 70% of all the members is 175 members. 175 members must vote 'yes' to change the rule

$11+3+1=15$ ← Adding the number of parts in the ratio works out that there are 15 parts in total in the ratio

$250-10$ ← Subtracting the 10 members who were absent from the 250 total members works out that 240 members voted in total

$240 \div 15$ ← The 15 parts in total represent the 240 members who voted in total. Dividing the 240 members by the 15 parts works out that 1 part of the ratio is worth 16 members

$16 \times 11 = 176$ ← Multiplying the value of 1 part of the ratio by the 11 parts which represent the members who voted 'yes' works out that 176 members voted 'yes'

Yes ..... because 175 members is 70% of all the members and 176 vote 'yes' .....

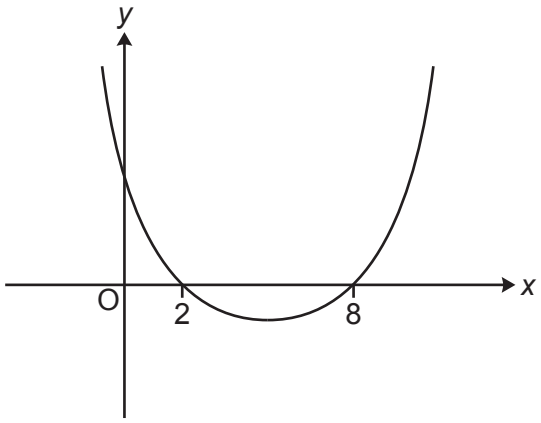
.....

.....

.....

..... **[5]**

23 This is a sketch of the graph of $y = x^2 - 10x + 16$.



Not to scale

(a) Write down the value of the *y*-intercept.

x = 0 at the y-intercept. Substituting this in the equation finds that $y = 0^2 - 10(0) + 16 = 16$

(a) 16 **[1]**

(b) Write down the *x*-coordinate of the turning point.

(b) 5 **[1]**

Quadratic graphs are symmetrical so the x-coordinate of the turning point must be halfway between the two points where the curve crosses the x-axis. This can be found by doing the mean of the two x-coordinates where the curve crosses the x-axis. (2 + 8) ÷ 2 = 5

24 1600 fish are released into a new lake which has no fish.
The number of fish is expected to increase by 5% each year.

(a) The table shows the expected number of fish in the lake at the end of 1 year and at the end of 2 years.

Complete the table.
Round your answers to the nearest integer.

$1764 \times \frac{100+5}{100}$

$1852 \times \frac{100+5}{100}$

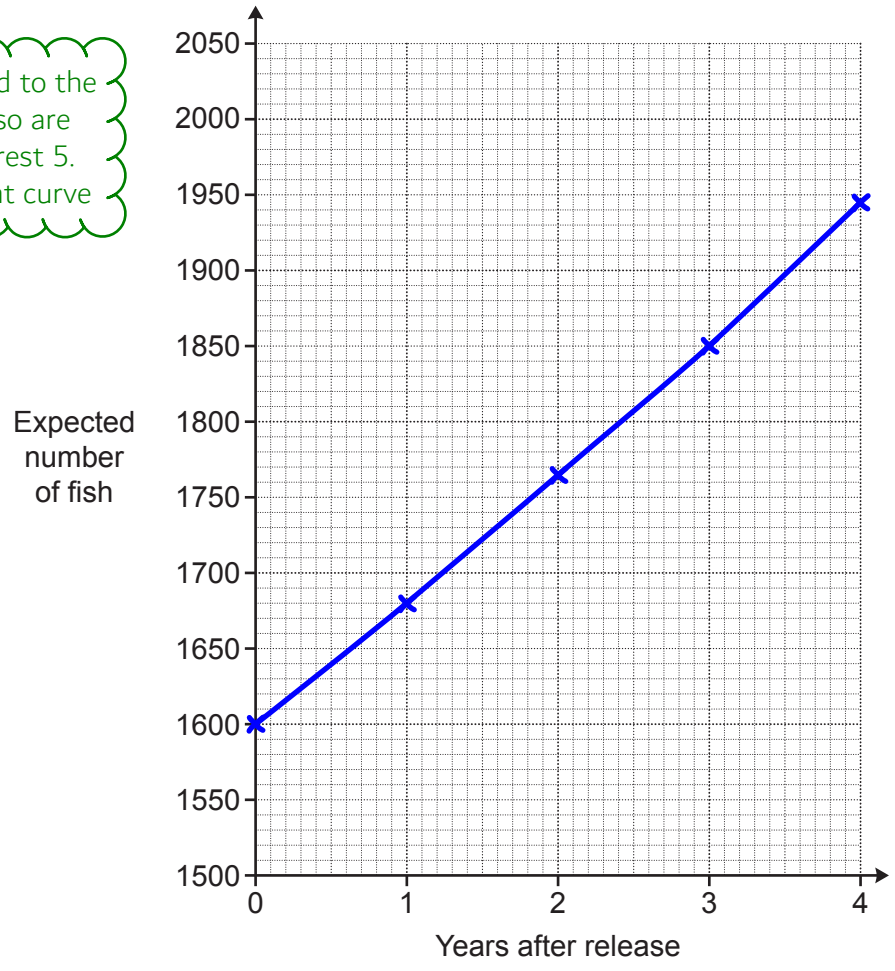
100 + 5 expresses the percentage it will increase to each year. Putting this over 100 converts it into a fraction, which when multiplied by increases by 5%. The value of 1852.2 is rounded to 1852 and the value of 1944.6 is rounded to 1945

Years after release	0	1	2	3	4
Expected number of fish	1600	1680	1764	1852	1945

[3]

(b) Use the table to draw a suitable graph to show the expected number of fish in the lake.

The points are plotted to the nearest half a box, so are rounded to the nearest 5. The graph has a slight curve



[3]

(c) A maximum of 2000 fish can live in the lake.

What effect would you expect this to have on the shape of your graph after 4 years?

Increase up to 2000 and then level off

..... **[2]**

TURN OVER FOR QUESTIONS 25 AND 26

25 A garage is trying to sell a car.
The price of the car is normally £18000.

In a sale, the price of the car is reduced by 30%.
As a special offer, the sale price is then reduced by r%.
The special offer price is £9450.

Find the value of r.
You must show your working.

$18000 \times \frac{100-30}{100}$

100 - 30 expresses the percentage it decreases to in the sale. Putting this over 100 converts it into a fraction. Multiplying the £18000 by this reduces it by 30% to work out that the sale price is £12600

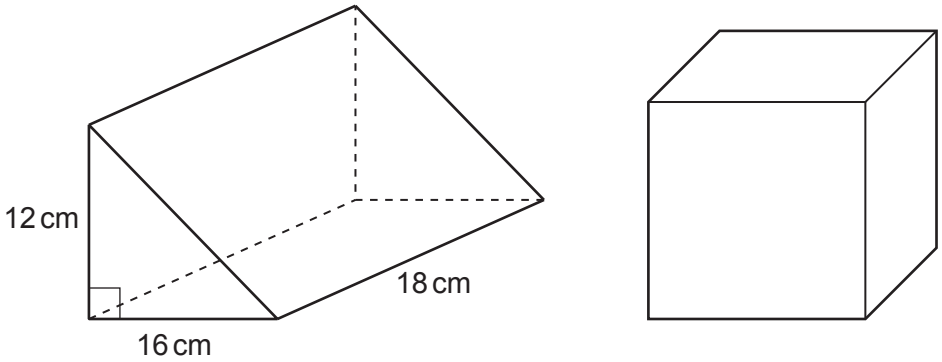
$\frac{9450-12600}{12600} \times 100$

Working out the percentage change between the sale price and the special offer price. Subtracting the sale price from the special offer price expresses the change. Putting this over the sale price expresses the change as a fraction. Multiplying this by 100 converts it into a percentage and finds that the percentage change is -25%

r is the percentage reduction so the negative is ignored

$r =$ 25 ..... **[5]**

26 The diagram shows a triangular prism and a cube.
The ends of the prism are right-angled triangles with base 16 cm and height 12 cm.
The prism is 18 cm long.



The volume of the prism is equal to the volume of the cube.

Find the **surface area of the cube**.
You must show your working.

$\frac{1}{2} \times 16 \times 12 \times 18$ ← Volume of prism = cross sectional area x length. The cross section is a triangle. Area of triangle = 1/2 x base x height. The base is 16cm and the height is 12cm. The length of the prism is 18cm. So this works out that the volume of the prism is 1728cm^3. This is also the volume of the cube

$\sqrt[3]{1728}$ ← Volume of cube = length^3. So cube rooting the volume of the cube works out that its side length is 12cm

12^2 ← Area of square = length^2. So squaring the side length of the cube works out that the area of one of its square faces is 144cm^2

144×6 ← There are 6 square faces on a cube so multiplying the area of one of its square faces by 6 works out the surface area of the cube

..... 864 ..... cm^2 **[6]**

END OF QUESTION PAPER