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Candidate surname

Other names

Centre Number

Candidate Number

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Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Time 1 hour 30 minutes

Paper
reference

1MA1/3H

Mathematics PAPER 3 (Calculator) Higher Tier

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator, Formulae Sheet (enclosed). Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.



Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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B:1/1/1/1/

.CG Maths.
Worked Solutions


Pearson

Please note that these worked solutions have neither been provided nor approved by Pearson Education 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 questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 Make a the subject of the formula $p = 3a - 9$

$$p+9=3a$$

Adding 9 to both sides eliminates the -9 on the right and gets the a term on its own

Dividing both sides by 3 eliminates the 3 on the right and gets a on its own

$$\frac{p+9}{3} = a$$

(Total for Question 1 is 2 marks)

- 2 Rob has been asked to divide 120 in the ratio 3:5

Here is his working.

$$120 \div 3 = 40$$

$$120 \div 5 = 24$$

Rob's working is not correct.

Describe what Rob has done wrong.

Should divide by 8

There are 8 parts in total in the ratio as $3 + 5 = 8$. These 8 parts represent the 120 so dividing the 120 by 8 works out the value of 1 part. Then multiplying the value of 1 part by the 3 and by the 5 divides the 120 in the ratio

(Total for Question 2 is 1 mark)

- 3 200 students chose one language to study.
Each student chose one language from French or Spanish or German.

Of the 200 students,

- 90 are boys and the rest of the students are girls
- 70 chose Spanish
- 60 of the 104 students who chose French are boys
- 18 girls chose German.

Work out how many boys chose Spanish.

	F	S	G	
B	60		8	90
G			18	
	104	70	26	200

Completing a two-way table with the information given then continuing to fill it out until the number of boys who chose Spanish is worked out. B and G stands for boys and girls. F, S and G stands for French, Spanish and German. The totals are at the end of each row and column. If there is one missing number in a row or column, the other numbers in that row or column can be used to work out the missing number

$$200 - 104 - 70 = 26$$

This works out that 26 students chose German in total

$$26 - 18 = 8$$

This works out that 8 boys chose German

$$90 - 60 - 8 = 22$$

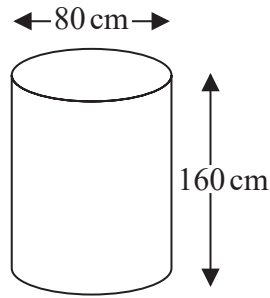
This works out that 22 boys chose Spanish

There is no need to complete the whole table

22

(Total for Question 3 is 3 marks)

- 4 Karina has 4 tanks on her tractor.
Each tank is a cylinder with diameter 80 cm and height 160 cm.



The 4 tanks are to be filled completely with a mixture of fertiliser and water.

The fertiliser has to be mixed with water in the ratio 1 : 100 by volume.
Karina has 32 litres of fertiliser.

$$1 \text{ litre} = 1000 \text{ cm}^3$$

Has Karina enough fertiliser for the 4 tanks?
You must show how you get your answer.

$$80 \div 2$$

This works out that the radius of each tank is 40cm. The radius is half the diameter

$$\pi \times 40^2 \times 160$$

This works out the volume of one of the tanks. Volume of cylinder = $\pi \times \text{radius}^2 \times \text{height}$

$$256000\pi \times 4$$

Multiplying the volume of one of the tanks by 4 works out the volume of all 4 tanks

$$1024000\pi \div 101$$

This works out the volume of the fertiliser needed. $100 + 1 = 101$ so there are this many parts in total in the ratio. 101 parts represent the total volume of all the tanks. Dividing the volume of all 4 tanks by 101 works out the value of 1 part of the ratio, which represents the volume of fertiliser

$$31851.3... \div 1000$$

Dividing the volume of fertiliser in cm^3 by 1000 converts it into litres as every 1000cm^3 is 1 litre

$$31.8...$$

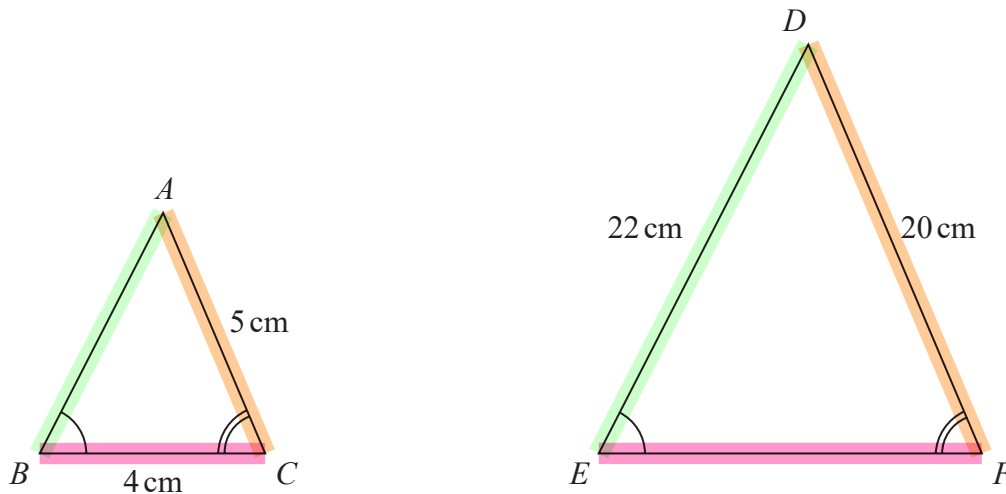
Yes

The 31.8... litres Karina needs is less than the 32 litres Karina has

(Total for Question 4 is 4 marks)

- 5 Triangle ABC and triangle DEF are similar.

Similar means that they are the same shape but one is an enlargement of the other



- (a) Work out the length of EF .

$$20 \div 5 = 4$$

The sides in orange are the same side (as they are opposite the same angle) but the 20 cm is the bigger version of the 5 cm . Dividing the 20 cm by the 5 cm works out that the scale factor (what all the sides are multiplied by) is 4

$$4 \times 4$$

The sides in pink are the same side (as they are opposite the same angle) but EF is the bigger version of the 4 cm . Multiplying the 4 cm by the scale factor works out EF

$$\dots\dots\dots 16 \dots\dots\dots \text{ cm}$$

(2)

- (b) Work out the length of AB .

$$22 \div 4$$

The sides in green are the same side (as they are opposite the same angle) but the 22 cm is the bigger version of AB . Dividing the 22 cm by the scale factor works out AB

$$\dots\dots\dots 5.5 \dots\dots\dots \text{ cm}$$

(2)

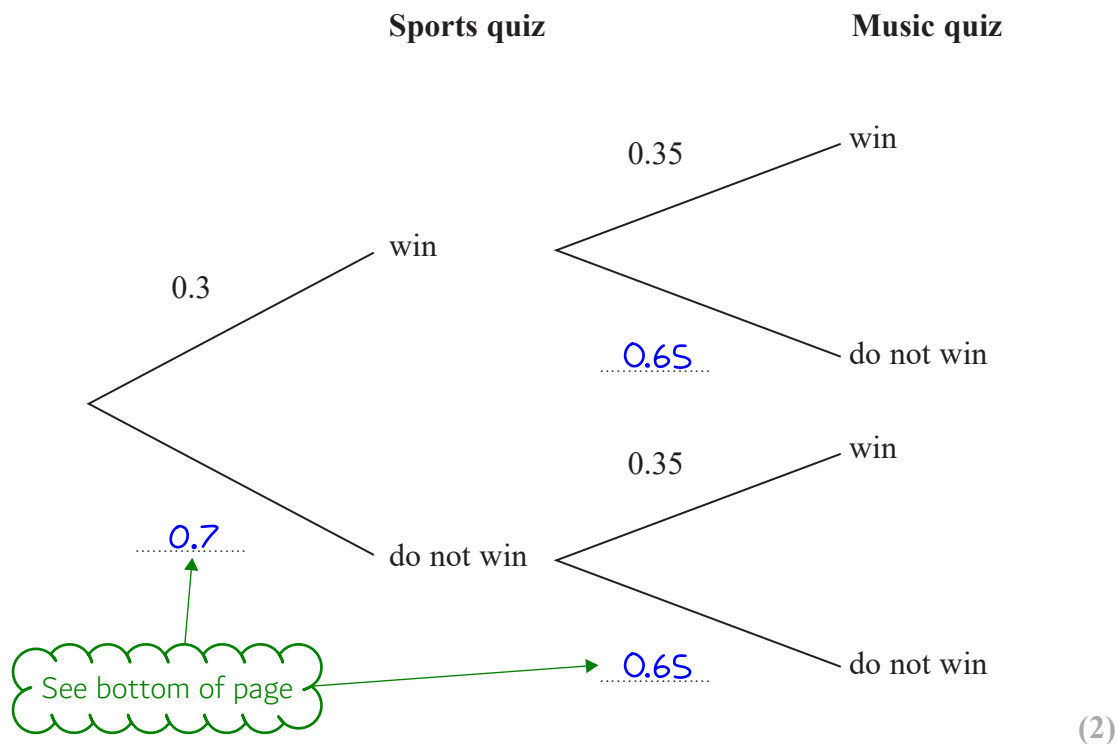
(Total for Question 5 is 4 marks)

- 6 One weekend the Keddie family is going to do a sports quiz and a music quiz.

The probability that the family will win the sports quiz is 0.3

The probability that the family will win the music quiz is 0.35

- (a) Complete the probability tree diagram.



- (b) Work out the probability that the Keddie family will win both the sports quiz and the music quiz.

$$0.3 \times 0.35$$

Win AND win. AND means to multiply the probabilities

$$0.105$$

(2)

(Total for Question 6 is 4 marks)

$$\begin{aligned} 1 - 0.3 &= 0.7 \\ 1 - 0.35 &= 0.65 \end{aligned}$$

It is certain to either win or not win so the probabilities need to add up to 1 as this is the probability of something which is certain. Subtracting the probabilities of winning from 1 leaves the probabilities of not winning

- 7 (a) Change 8000 cm^3 to m^3

$$8000 \div 100^3$$

There are 100cm in 1m. So dividing by 100 converts cm into m but as the unit is cubed the cm^3 must be divided by 100^3

$$0.008 \text{ m}^3$$

(1)

- (b) Change a speed of 180 km per hour to metres per second.

Metres per second means to divide the distance in metres by the time in seconds

$$180 \times 1000 = 180000$$

There are 1000m in 1km so multiplying the distance in km by 1000 converts it into metres

$$1 \times 60 \times 60 = 3600$$

There are 60 minutes in an hour so multiplying the 1 hour by 60 converts it into minutes. There are 60 seconds in a minute so multiplying by 60 again converts it into seconds

$$180000 \div 3600$$

Dividing the distance in metres by the time in seconds gives metres per second

$$50 \text{ metres per second}$$

(3)

(Total for Question 7 is 4 marks)

- 8 There are 30 women and 20 men at a gym.

The mean height of all 50 people is 167.6 cm

The mean height of the 20 men is 182 cm

Work out the mean height of the 30 women.

$$m^t_n$$

Mean = total \div number, where total is the total height of all the people and number is the number of people. Writing this as a formula triangle

$$167.6 \times 50 = 8380$$

From the formula triangle, total = mean \times number. Multiplying the mean of all the people by the 50 people works out that the total height of all the people is 8380cm

$$182 \times 20 = 3640$$

From the formula triangle, total = mean \times number. Multiplying the mean of all the men by the 20 men works out that the total height of all the men is 3640cm

$$8380 - 3640$$

Subtracting the total height of the men from the total height of all the people works out that the total height of the women is 4740cm

$$4740 \div 30$$

Mean = total \div number, so dividing the total height of the women by the number of women

$$158 \text{ cm}$$

(Total for Question 8 is 3 marks)

- 9 (a) Write 6.75×10^{-4} as an ordinary number.

$\times 10^{-4}$ means to divide by 10 4 times. So moving the decimal point 4 times to the left

0.000675

(1)

- (b) Work out $\frac{2.56 \times 10^6 \times 4.12 \times 10^{-3}}{1.6 \times 10^{-2}}$

Give your answer in standard form.

Put it into the calculator exactly as it is above

659200

The answer is an ordinary number. It must be divided by 10 5 times to get a decimal between 1 and 10 which must be multiplied by 10^5 to keep it equal

6.592 $\times 10^5$

(2)

(Total for Question 9 is 3 marks)

10 Peter has to subtract $(x^2 - 2x - 4)$ from $(x^2 + 3x + 5)$

Here is his working

$$(x^2 + 3x + 5) - (x^2 - 2x - 4)$$

$$= x^2 + 3x + 5 - x^2 - 2x - 4$$

$$= x + 1$$

Explain what is wrong with Peter's working.

Did not subtract $-2x$ and -4

These should become positive as everything in the bracket needs to be subtracted and subtracting a negative gives positive

(Total for Question 10 is 1 mark)

11 x and y are integers such that

$$3 < x < 8$$

$$4 < y < 10$$

$$\text{and } x + y = 14$$

Find all the possible values of x .

$$x = 14 - y$$

Rearranging the equation to make x the subject by subtracting y from both sides

Using table mode. $f(x) = 14 - x$. Start: 5. End: 9. Step: 1

This lists out the values of $14 - y$ for the possible values of y , therefore listing out the values of x which satisfy the equation. The minimum y can be is 5 (which is why the start is 5) and the maximum value of y is 9 (which is why the end is 9). y is an integer so goes up in 1s (which is why the step is 1). x cannot be 9 or 8 due to the inequality so these values are ignored

5, 6, 7

(Total for Question 11 is 2 marks)

12 Martin used his calculator to work out the value of a number P .

He wrote down the first two digits of the answer on his calculator.

He wrote down 1.2

Complete the error interval for P .

It is basically truncated. The smallest digit after the 2 could be 0 then there could be no other digits. So the smallest the number could be is 1.2. It could be anything greater than 1.2 up to 1.3 as this does not truncate to 1.2

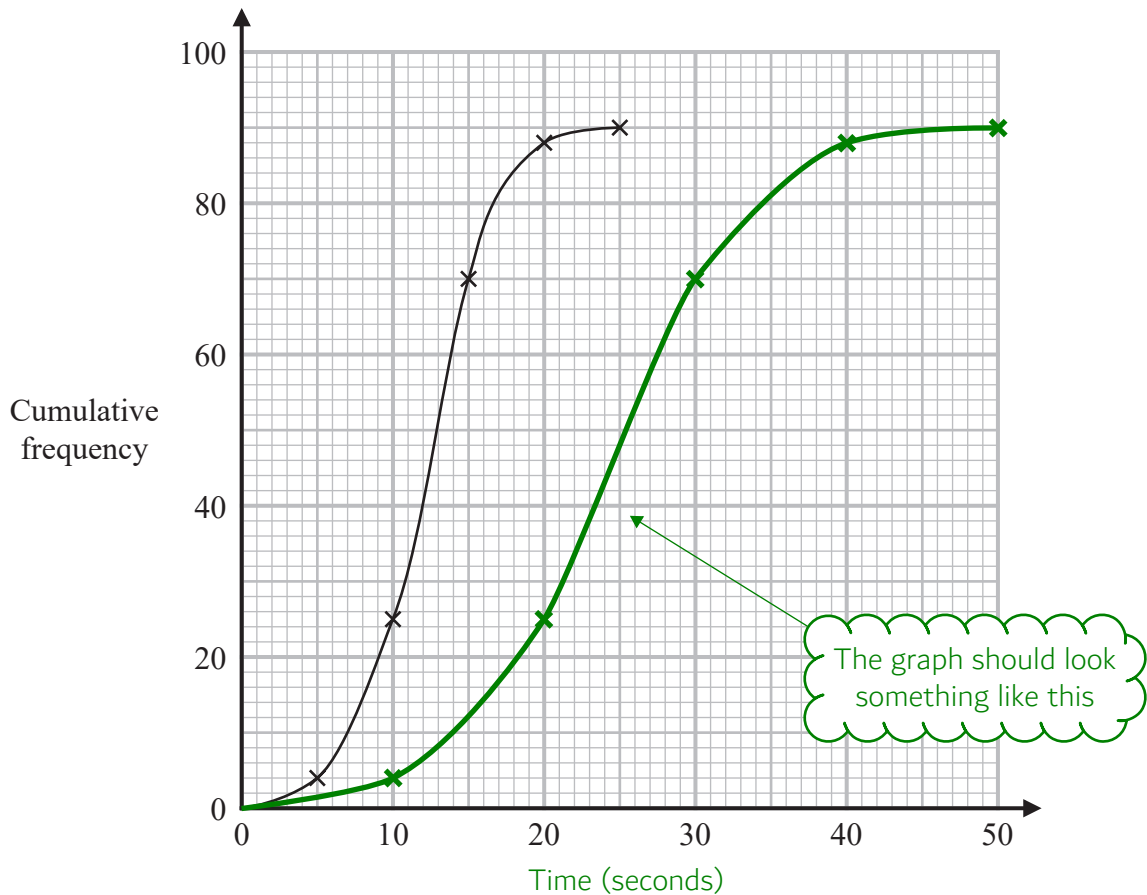
1.2 $\leq P <$ 1.3

(Total for Question 12 is 2 marks)

- 13 Chen has this information about the time that it took an operator at a call centre to answer each of 90 calls.

Time (t seconds)	Cumulative frequency
$0 < t \leq 10$	4
$0 < t \leq 20$	25
$0 < t \leq 30$	70
$0 < t \leq 40$	88
$0 < t \leq 50$	90

Chen draws this cumulative frequency graph for the information in the table.



Write down two different things that are wrong with this graph.

- 1 No label on horizontal axis

It should be labelled: time (seconds)

- 2 Points should be plotted at the end of each category

They have been plotted at the midpoints

(Total for Question 13 is 2 marks)

14 (a) Simplify fully $(3x^5y^6)^4$

Everything in the bracket is raised to the power of 4. To raise 3 to the power of 4, square it twice. $3^2 = 9$ then $9^2 = 81$. $(a^x)^y = a^{xy}$ so the powers should be multiplied

$$81x^{20}y^{24}$$

(2)

(b) Expand and simplify $(x+2)(x-3)(x+4)$

$$x^2 - 3x + 2x - 6$$

Expanding the first two brackets

$$(x^2 - x - 6)(x + 4)$$

Simplifying by collecting like terms then writing multiplied by the third bracket

$$x^3 + 4x^2 - x^2 - 4x - 6x - 24$$

Expanding these two brackets

Simplifying by collecting like terms

$$x^3 + 3x^2 - 10x - 24$$

(3)

(Total for Question 14 is 5 marks)

15 A pet shop has

- 7 guppy fish
- 13 tetra fish
- 5 angel fish.

David is going to choose one of the following combinations of fish

- a guppy fish and an angel fish
- or a tetra fish and an angel fish
- or a guppy fish, a tetra fish and an angel fish.

Show that there are 555 different ways for David to choose his fish.

$$7 \times 5 = 35$$

Multiplying the number of guppy fish by the number of angel fish works out that there are 35 ways of choosing a guppy fish and an angel fish

$$13 \times 5 = 65$$

Multiplying the number of tetra fish by the number of angel fish works out that there are 65 ways of choosing a tetra fish and an angel fish

$$7 \times 13 \times 5 = 455$$

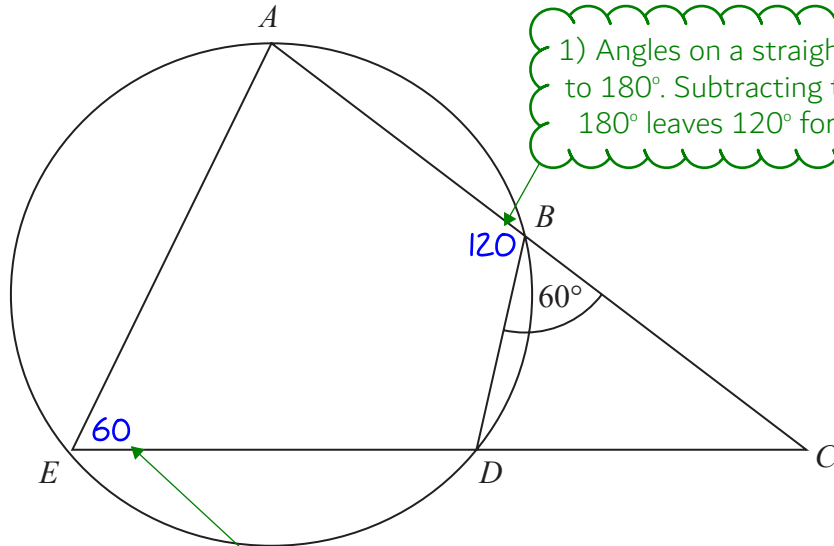
Multiplying the number of guppy fish, the number of tetra fish and the number of angel fish works out that there are 455 ways of choosing a guppy fish, a tetra fish and an angel fish

$$35 + 65 + 455 = 555$$

Adding the number of ways for each of the three combinations shows that there are 555 different ways for David to choose his fish

(Total for Question 15 is 2 marks)

Using the product rule for counting: multiplying the number of outcomes for each individual event works out the number of outcomes in total



1) Angles on a straight line add up to 180° . Subtracting the 60° from 180° leaves 120° for angle ABD

$ABDE$ is a cyclic quadrilateral.
 ABC and EDC are straight lines.
 Angle $DBC = 60^\circ$

2) Opposite angles in a cyclic quadrilateral add up to 180° . Subtracting the 120° from 180° leaves 60° for angle AED

Given that

$$\text{size of angle } EAB : \text{size of angle } BCD = 2 : 1$$

work out the size of angle BCD .

You must show all your working.

$$180 - 60$$

3) There are 180° in total in a triangle. Subtracting angle AED from 180° works out that the total of angles EAB and BCD is 120°

$$120 \div 3$$

4) $2 + 1 = 3$ so there are 3 parts in total in the ratio, which represent the total of 120° . So dividing the 120° by 3 works out the value of 1 part of the ratio, which represents angle BCD

40

(Total for Question 16 is 4 marks)

17 There are four boxes on a shelf, **A**, **B**, **C** and **D**.

The total weight of **A** and **B** is 3 times the total weight of **C** and **D**.

The weight of **A** is $\frac{2}{3}$ of the weight of **B**.

The weight of **C** is 75% of the weight of **D**.

Find the ratio

weight of **A** : weight of **B** : weight of **C** : weight of **D**

$$A:B = \frac{2}{3} : 1$$

Writing the ratio of **A** : **B**. **A** could be $\frac{2}{3}$ when **B** is 1, as $\frac{2}{3}$ of 1 is $\frac{2}{3}$

$$C:D = 75:100$$

Writing the ratio of **C** : **D**. **C** could be 75 when **D** is 100, as if **C** is 75%, **D** must be the full 100%

$$175 \times 3$$

There are 175 parts in total in the ratio of **C** : **D**. There needs to be 3 times as many parts for **A** : **B** as the total weight of **A** and **B** is 3 times the total weight of **C** and **D**

$$525 \div 1\frac{2}{3}$$

Working out that the total number of parts in the ratio **A** : **B** need to be 315 times greater by dividing the number of parts there should be by how many parts there currently are

$$\frac{2}{3} \times 315$$

Multiplying the number of parts in the ratio in the ratio **A** : **B** by 315 so that the total number of parts is 3 times the total number of parts in **C** : **D**. $1 \times 315 = 315$

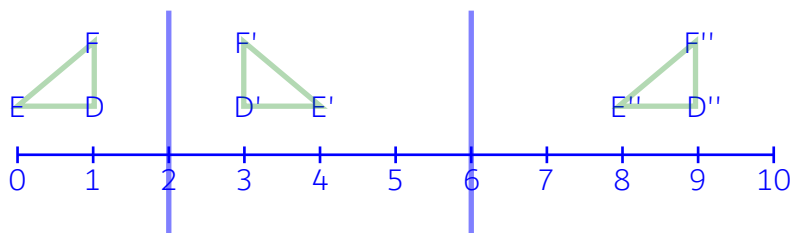
Writing the ratio **A** : **B** : **C** : **D**. It does not need to be simplified

$$210:315:75:100$$

(Total for Question 17 is 4 marks)

- 18 Shape A is reflected in the line with equation $x = 2$ to give shape B.
Shape B is reflected in the line with equation $x = 6$ to give shape C.

Describe fully the **single** transformation that maps shape A onto shape C.



Drawing an accurate diagram using a ruler to mark out the x-axis using 1cm to represent 1 unit. D, E and F represent the three corners of a triangle (which could be shape A). D', E' and F' show where the corners would be after reflecting in the line $x = 2$ (which could be shape B). D'', E'' and F'' represent where the corners would be after the reflection in the line $x = 6$ (which could be shape C)

Translation by $\left(\begin{smallmatrix} 8 \\ 0 \end{smallmatrix}\right)$

All the corners of the original shape have moved 8 to the right

(Total for Question 18 is 2 marks)

- 19 There are only blue counters, red counters and green counters in a box.

The probability that a counter taken at random from the box will be blue is 0.4
The ratio of the number of red counters to the number of green counters is 7 : 8

Sameena takes at random a counter from the box.
She records its colour and puts the counter back in the box.
Sameena does this a total of 50 times.

Work out an estimate for the number of times she takes a green counter.

$$1 - 0.4 = 0.6$$

It is certain to either get blue or not blue. So the probabilities have to add up to 1. Subtracting the probability of blue from 1 leaves the probability of not blue. So the probability of red or green must be 0.6

$$7 + 8$$

Working out that there are 15 parts in total in the ratio, which represent the total probability of red or green

$$0.6 \div 15$$

Dividing the probability of red or green by the 15 parts works out the value of 1 part of the ratio

$$0.04 \times 8$$

Multiplying the value of 1 part of the ratio by the 8 parts which represent green works out that the probability of green is 0.32

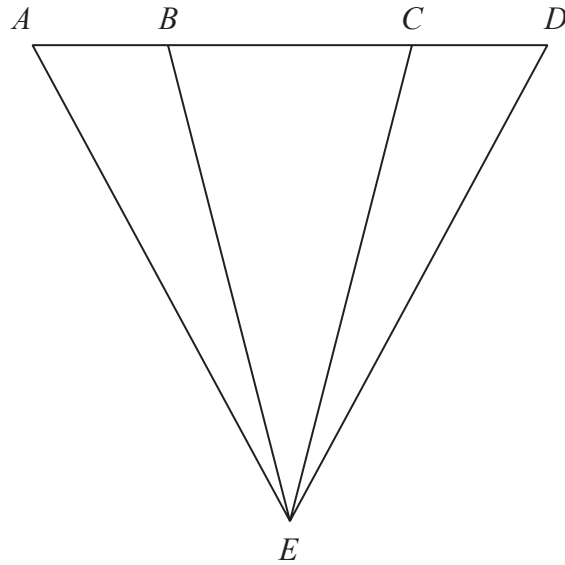
$$0.32 \times 50$$

Multiplying the probability of green by the 50 times works out an estimate of the number of times she takes a green counter

16

(Total for Question 19 is 3 marks)

20 The diagram shows a triangle ADE .



$$AE = DE$$

$$AB:BC:CD = 1:2:1$$

Prove that triangle ACE is congruent to triangle DBE .

$$AE = DE$$

$AC = BD$ as they are both 3 parts of the ratio

$$\begin{aligned} AB + BC &= AC. \text{ AB is 1 part and BC is 2 parts. } 1 + 2 = 3 \\ BC + CD &= BD. \text{ BC is 2 parts and CD is 1 part. } 2 + 1 = 3 \end{aligned}$$

Angles $CAE = BDE$ as base angles of an isosceles triangle are equal

As $AE = DE$, triangle ADE is isosceles. The base angles are opposite the equal sides

SAS

There are two sides the same with an equal angle between them in both triangles ACE and DBE . SAS stands for side-angle-side and is a proof that triangles are congruent

(Total for Question 20 is 3 marks)

- 21 The equation of a curve is $y = 4x^2 - 56x$
The curve has one turning point.

By completing the square, show that the coordinates of the turning point are $(7, -196)$
You must show all your working.

$$y = 4(x^2 - 14x)$$

Bringing 4 out as a factor to get rid of the 4 as the coefficient of x^2

$$= 4(x-7)^2 - 196$$

Completing the square by halving the coefficient of the x term, putting this in brackets with x and squaring the bracket. Subtracting the -7 squared multiplied by the 4

$$(x-7)^2 = 0$$

The turning point is when the square bracket is 0 as this is the smallest value a squared bracket can have

$$x = 7$$

Square rooting both sides then adding 7 to both sides shows that the x -coordinate must be 7

$$y = 4(7-7)^2 - 196 \\ = -196$$

Substituting the x -coordinate into the equation in completed the square form shows that the y -coordinate is -196

(Total for Question 21 is 3 marks)

22 $\frac{2x+3}{x-5} + \frac{x-4}{x+5} - 3$ can be written in the form $\frac{ax+b}{x^2-25}$ where a and b are integers.

Work out the value of a and the value of b .
You must show all your working.

$$\frac{(2x+3)(x+5)}{(x-5)(x+5)} + \frac{(x-4)(x-5)}{(x-5)(x+5)} - \frac{3(x-5)(x+5)}{(x-5)(x+5)}$$

Making the denominators the same and multiplying the numerators by the same as what the denominators are multiplied by

$$2x^2 + 10x + 3x + 15$$

Expanding out the brackets for the numerator of the first fraction

$$x^2 - 5x - 4x + 20$$

Expanding out the brackets for the numerator of the second fraction

$$3x^2 + 15x - 15x - 75$$

Expanding out the brackets for the numerator of the third fraction

$$x^2 + 5x - 5x - 25$$

Expanding out the brackets for the denominators

$$\frac{4x+110}{x^2-25}$$

Doing the numerator of the first fraction add the numerator of the second fraction subtract the numerator of the third fraction all over the denominator. Simplifying by collecting all the like terms

$$a = \dots\dots\dots 4 \dots\dots\dots$$

$$b = \dots\dots\dots 110 \dots\dots\dots$$

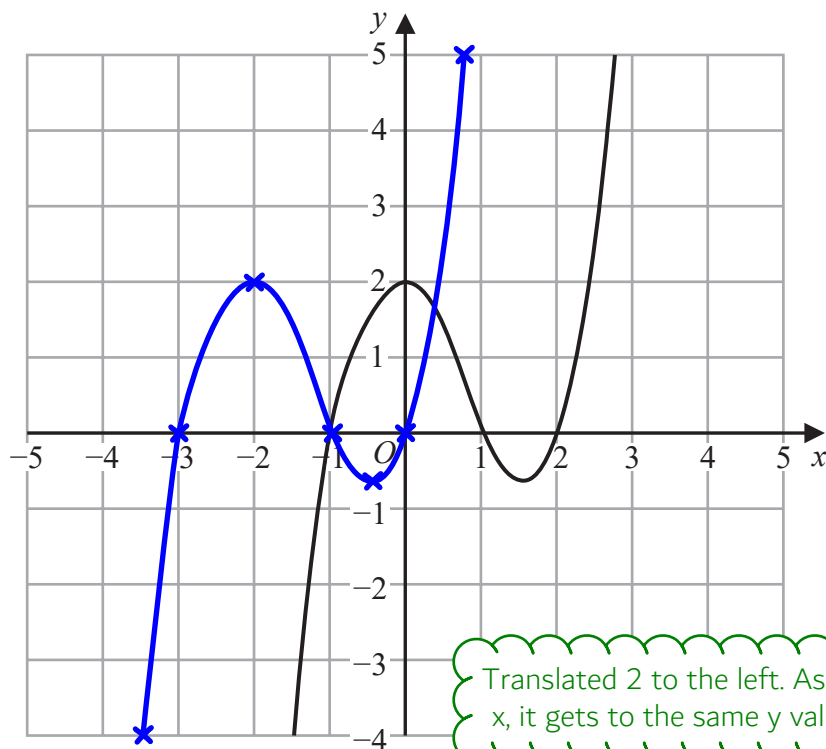
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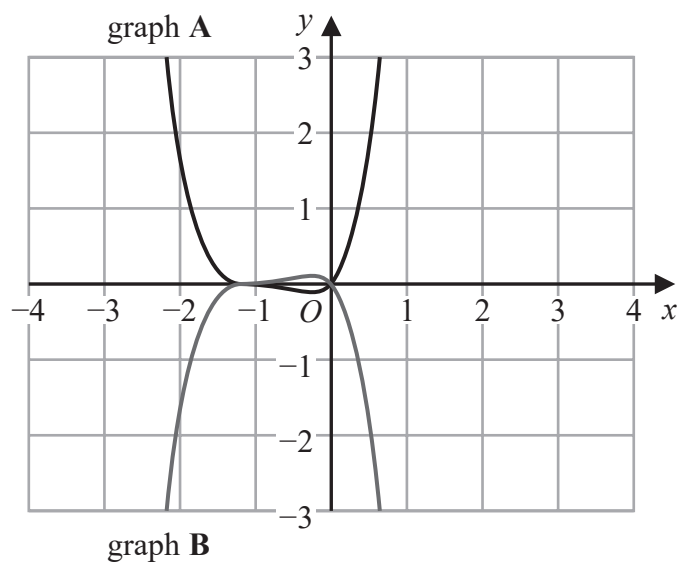
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23 The graph of $y = f(x)$ is shown on the grid below.



(a) On the grid above, sketch the graph of $y = f(x + 2)$

(1)



On this grid, graph A has been reflected to give graph B.

The equation of graph A is $y = g(x)$

(b) Write down an equation of graph B.

Reflection in the x-axis makes the whole right side of the equation negative

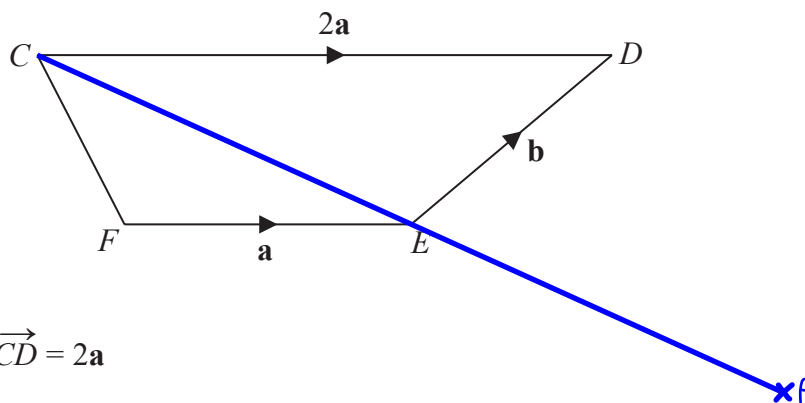
$y = -g(x)$

(1)

(Total for Question 23 is 2 marks)



24 $CDEF$ is a quadrilateral.



$$\vec{FE} = \mathbf{a} \quad \vec{ED} = \mathbf{b} \quad \vec{CD} = 2\mathbf{a}$$

The point P is such that CEP is a straight line and that $CE = EP$

Use a vector method to prove that CF is parallel to DP .

$$\vec{CF} = 2\mathbf{a} - \mathbf{b} - \mathbf{a} \leftarrow \vec{CF} = \vec{CD} + \vec{DE} + \vec{EF}. \vec{DE} \text{ and } \vec{EF} \text{ go the opposite direction to the arrow so are negative}$$

$$= \mathbf{a} - \mathbf{b} \leftarrow \text{Simplifying by collecting the like terms}$$

$$\vec{DP} = -\mathbf{b} + 2\mathbf{a} - \mathbf{b} \leftarrow \vec{DP} = \vec{DE} + \vec{EP}. \vec{EP} = \vec{CE}. \vec{CE} = \vec{CD} + \vec{DE}. \text{ So } \vec{DP} = \vec{DE} + \vec{CD} + \vec{DE}$$

$$= 2\mathbf{a} - 2\mathbf{b} \leftarrow \text{Simplifying by collecting the like terms}$$

$$= 2(\mathbf{a} - \mathbf{b}) \leftarrow \text{Bringing out 2 as a factor to show that } \vec{CF} \text{ can be multiplied to get } \vec{DP}$$

Therefore CF is parallel to DP \leftarrow As \vec{CF} can be multiplied to get \vec{DP} they must be in the same direction and therefore parallel

(Total for Question 24 is 4 marks)

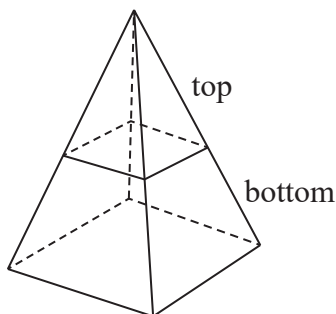
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25 The pyramid **P** is formed from two parts made of different materials.



The top part of **P** has a mass of 92.8 g and is made from material with a density of 2.9 g/cm^3

The bottom part of **P** has a mass of 972.8 g

The average density of **P** is 4.7 g/cm^3

Calculate the volume of the top part of **P** as a percentage of the total volume of **P**.

Give your answer correct to 1 decimal place.

You must show all your working.

$$d^m_v \leftarrow$$

Density = mass \div volume. Writing this as a formula triangle

$$92.8 \div 2.9 = 32 \leftarrow$$

From the formula triangle, volume = mass \div density. Dividing the mass of the top part by the density of the top part works out that the volume of the top part is 32 cm^3

$$92.8 + 972.8 \leftarrow$$

This works out that the total mass of **P** is 1065.6g

$$1065.6 \div 4.7 \leftarrow$$

From the formula triangle, volume = mass \div density. Dividing the total mass of **P** by the average density of **P** works out that the total volume of **P** is $10656/47 \text{ cm}^3$

$$\frac{32}{\left(\frac{10656}{47}\right)} \times 100 \leftarrow$$

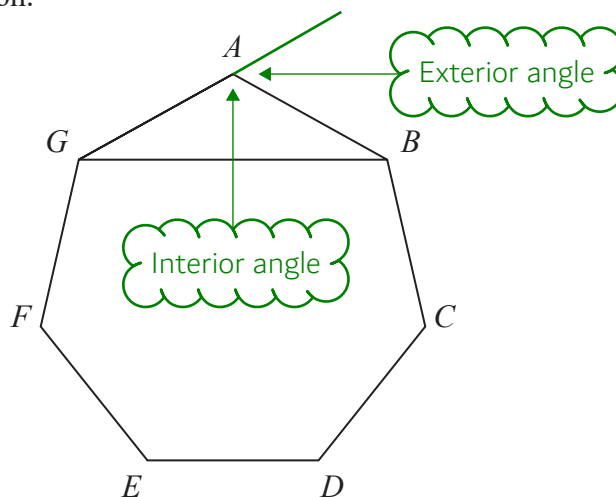
Expressing the volume of the top part of **P** as a fraction of the total volume. Multiplying this by 100 converts it into a percentage

The answer of 14.11... is rounded to 1 decimal place

.....14.1.....%

(Total for Question 25 is 5 marks)

26 $ABCDEFGG$ is a regular heptagon.



The area of triangle ABG is 30 cm^2

Calculate the length of GB .

Give your answer correct to 3 significant figures.

You must show all your working.

$$360 \div 7$$

The exterior angles of any polygon add up to 360° . So dividing 360° by the 7 sides (which is the same as the number of the exterior angles) works out that each exterior angle is $360/7^\circ$

$$180 - \frac{360}{7}$$

The interior angle and exterior angle lie on a straight line and there are 180° in total around a point on a straight line. So subtracting the exterior angle from 180° works out that the interior angle is $900/7^\circ$

$$\frac{1}{2}x^2 \sin \frac{900}{7} = 30$$

Area of triangle = $\frac{1}{2}ab \sin C$, where a and b are sides and C is the angle between them. Letting x be the side of the heptagon. Both a and b are x so $ab = x^2$. C is the interior angle. Setting the expression for the area of the triangle equal to the actual area of 30 cm^2

$$x = \sqrt{\frac{30}{\frac{1}{2} \sin \frac{900}{7}}} = 8.7\dots$$

Rearranging to find x by dividing both sides by the $\frac{1}{2}$ and $\sin(900/7)$ then square rooting both sides

Storing the exact value of 8.760301391 as A on the calculator

$$a^2 = b^2 + c^2 - 2bc \cos A$$

There are not opposite pairs of sides and angles in the triangle so the sine rule cannot be used. So the cosine rule is probably needed

$$GB = \sqrt{8.7\dots^2 + 8.7\dots^2 - 2 \times 8.7\dots \times 8.7\dots \times \cos \frac{900}{7}}$$

15.8 cm

a must be opposite the interior angle A . Square rooting both sides to make a the subject and substituting in GB as a , the $8.7\dots$ as b and c and the $900/7$ as C

(Total for Question 26 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS