

Please check the examination details below before entering your candidate information

Candidate surname	Other names
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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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Pearson

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 $p = 3a - 9$

$$p + 9 = 3a$$

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

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

(Total for Question 1 is 2 marks)

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

8 parts

Here is his working.

$$120 \div 3 = 40$$

$$120 \div 5 = 24$$

Rob's working is not correct.

Describe what Rob has done wrong.

He should divide by 8.

(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.

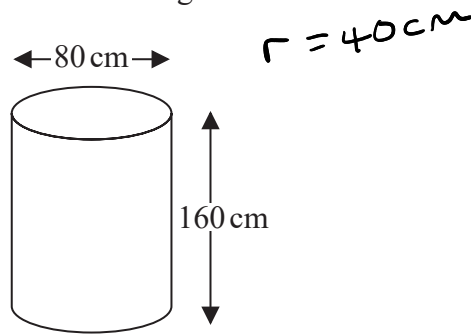
	French	Spanish	German	Total
Boys	60	22	8	90
Girls	44	48	18	110
Total	104	70	26	200

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.



Volume

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.

101 parts

1 litre = 1000 cm³

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

$$\begin{aligned} \text{volume} &= \pi r^2 h \\ &= \pi (40)^2 (160) \\ &= 256000\pi \end{aligned}$$

$$4 \text{ tanks} \quad 4 \times 256000\pi = 3216990.877 \text{ cm}^3$$

$$3216990 \div 1000 = \underline{3216.99 \text{ litres}} \quad \begin{array}{l} \text{volume} \\ \text{of} \\ \text{all} \\ \text{tanks} \end{array}$$

$$\frac{3216.99}{101} = 31.85 \text{ litres (for each part)}$$

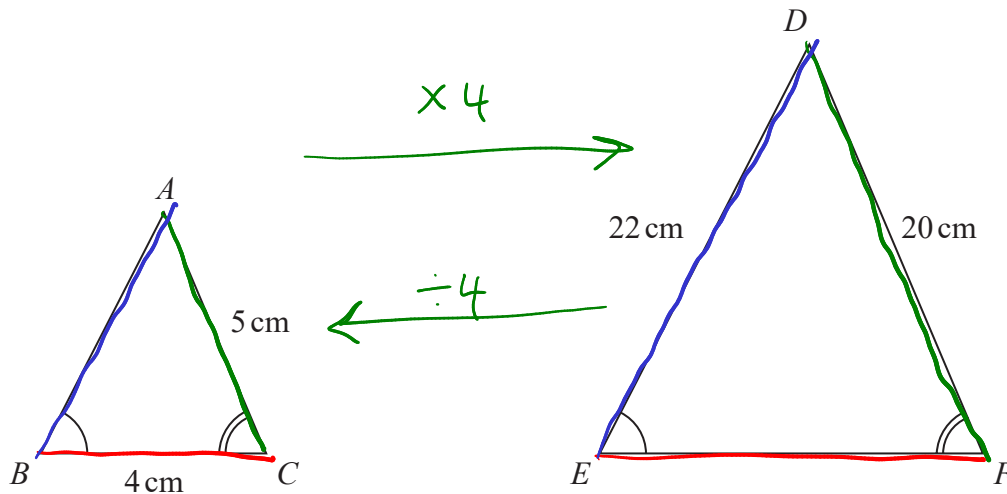
\therefore 31.85 litres of fertiliser

Yes

(Total for Question 4 is 4 marks)



5 Triangle ABC and triangle DEF are similar.



(a) Work out the length of EF .

$$\frac{20}{5} = 4$$

$$\underline{SF = 4}$$

$$4 \times 4 = 16$$

..... 16 cm
(2)

(b) Work out the length of AB .

$$22 \div 4 = 5.5$$

..... 5.5 cm
(2)

(Total for Question 5 is 4 marks)

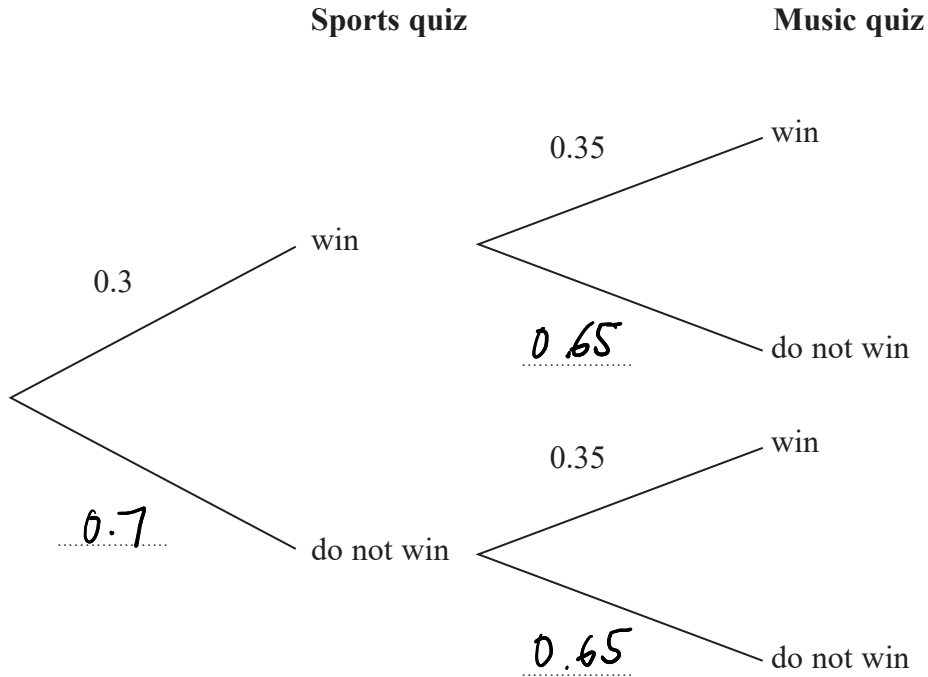


- 6 One weekend the Keddie family is going to do a sports quiz and a music quiz.

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.



(2)

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

$$0.3 \times 0.35$$

$$\frac{21}{200}$$

(2)

(Total for Question 6 is 4 marks)



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

$$1 \text{ m}^3 = 100 \times 100 \times 100 \text{ cm}^3 \\ = 1000000 \text{ cm}^3$$

$$8000 \div 1000000$$

$$\underline{\quad 0.008 \quad} \text{ m}^3 \\ (1)$$

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

$$180000 \text{ m per hour} \\ \div 60$$

$$3000 \text{ m per minute} \\ \div 60$$

$$50 \text{ m/s}$$

$$\underline{\quad 50 \quad} \text{ metres per second} \\ (3)$$

(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.

$$\text{Total height of 50 people} = 50 \times 167.6 \\ = 8380 \text{ cm}$$

$$\text{Total height of men} = 20 \times 182 \\ = 3640 \text{ cm}$$

$$\text{Total height of women} = 8380 - 3640 \\ = 4740$$

$$4740 \div 30 = 158 \quad \underline{\quad 158 \quad} \text{ cm}$$

(Total for Question 8 is 3 marks)



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

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.

659200

6.592×10^5

(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

$$\begin{aligned} &(x^2 + 3x + 5) - (x^2 - 2x - 4) \\ &= x^2 + 3x + 5 - x^2 - 2x - 4 \\ &= x + 1 \end{aligned}$$

Explain what is wrong with Peter's working.

He did not take away the $-2x$ and -4
It should be $x^2 + 3x + 5 - x^2 + 2x + 4$

(Total for Question 10 is 1 mark)

11 x and y are integers such that

$$\begin{aligned} 3 < x < 8 & \quad 4, 5, 6, 7 \\ 4 < y < 10 & \quad 5, 6, 7, 8, 9 \\ \text{and } x + y = 14 & \end{aligned}$$

Find all the possible values of x .

$$\begin{aligned} 4 + 10 &= 14 & \times \\ 5 + 9 &= 14 & \checkmark \\ 6 + 8 &= 14 & \checkmark \\ 7 + 7 &= 14 & \checkmark \end{aligned}$$

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

truncated

Complete the error interval for P .

$$1.2 \leq P < 1.3$$

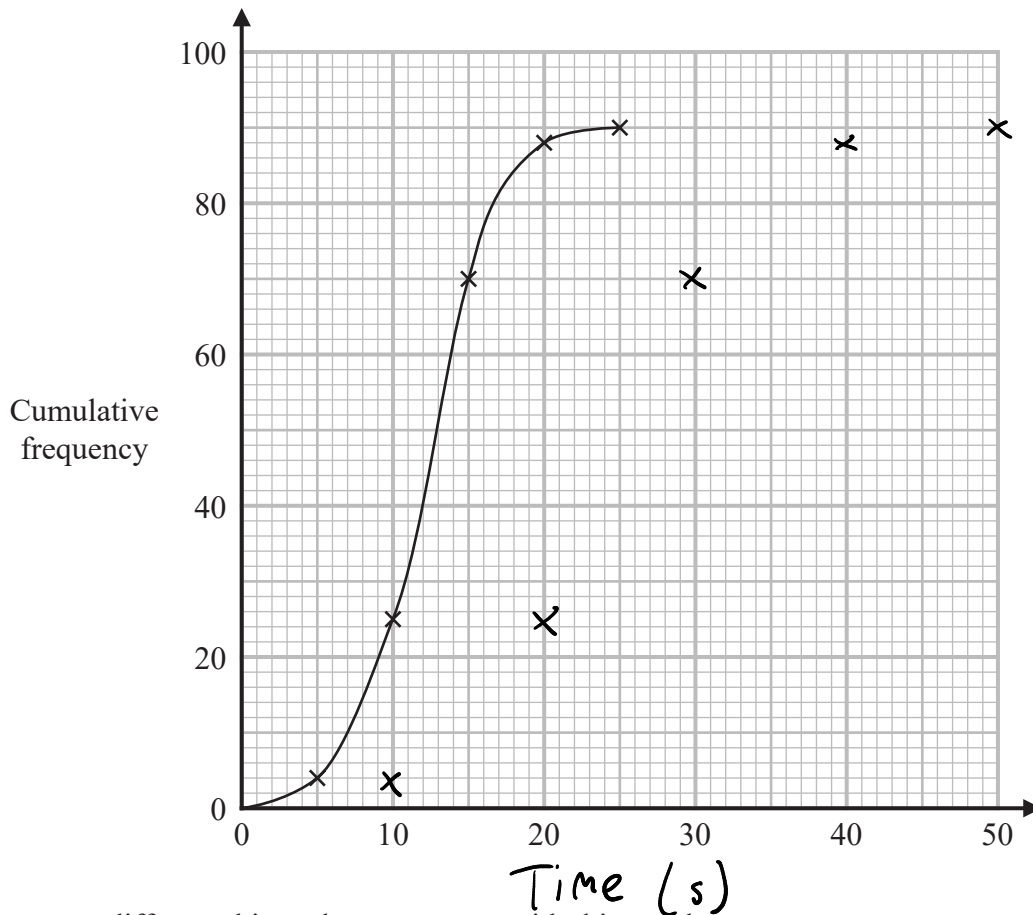
(Total for Question 12 is 2 marks)



- 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.

- points should be plotted on the top point of each class interval (10, 20, 30, 40 and 50)
- There is no label for the horizontal axis

(Total for Question 13 is 2 marks)



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

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

(2)

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

$$(x^2 - 3x + 2x - 6)(x + 4)$$

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

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

$$\underline{x^3 + 3x^2 - 10x - 24}$$

(3)

(Total for Question 14 is 5 marks)

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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.

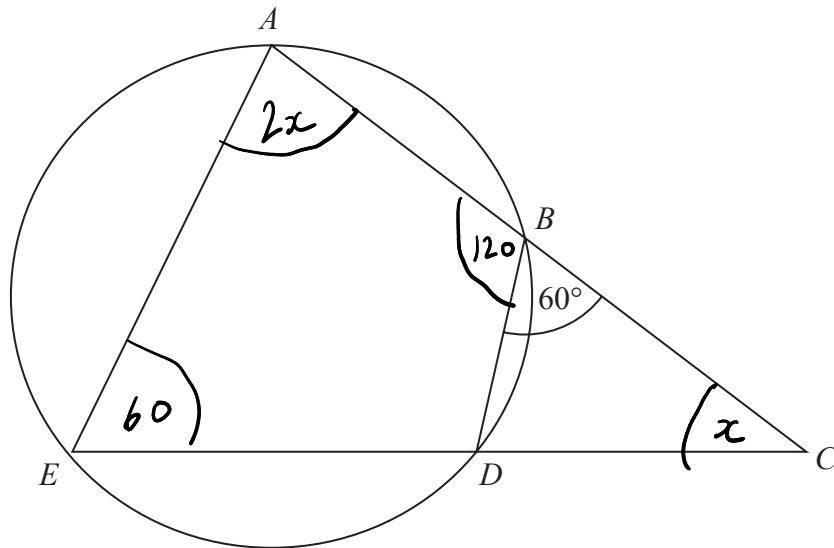
Show that there are 555 different ways for David to choose his fish.

$$\begin{aligned}7 \times 5 &= 35 \\13 \times 5 &= 65 \\7 \times 13 \times 5 &= 455\end{aligned}$$

$$35 + 65 + 455 = \underline{\underline{555}}$$

(Total for Question 15 is 2 marks)





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

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.

$$ABD = 120^\circ \quad (\text{Angles on a straight line})$$

$$AED = 180 - 120 = 60^\circ \quad (\text{opp. angles in cyclic quadrilateral})$$

$$60 + x + 2x = 180$$

$$3x = 120$$

$$x = 40^\circ$$

(angles in a triangle)

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. $\frac{3}{4}$

Find the ratio

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

$$A : B$$

$$C : D$$

$$2 : 3$$

$$3 : 4$$

5 parts

7 parts

$\times 7$

$\times 5$

$$14 : 21$$

$$15 : 20$$

$\times 3$

$$42 : 63$$

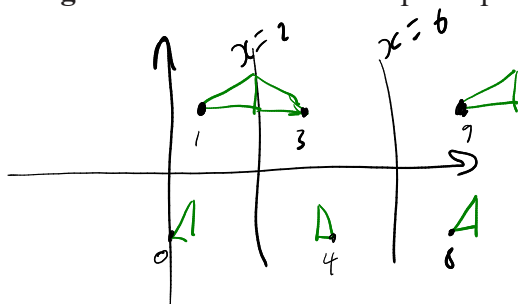
$$42 : 63 : 15 : 20$$

(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.



Translation by the vector $\begin{pmatrix} 8 \\ 0 \end{pmatrix}$

(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

15 parts

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.

$$\frac{0.6}{15} = 0.04$$

$$0.04 \times 7 = 0.28$$

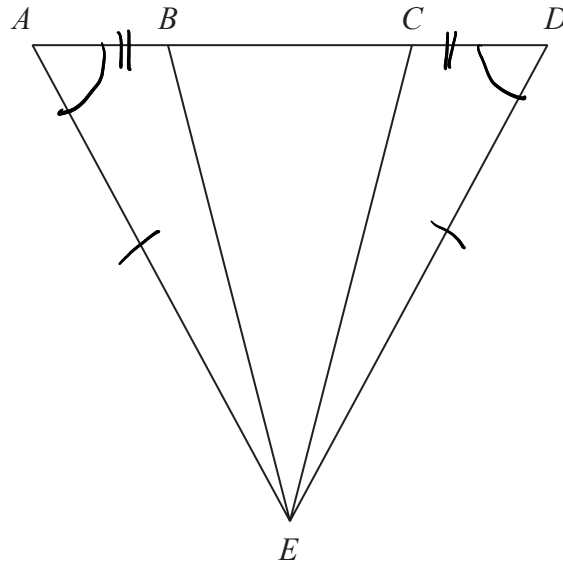
$$0.04 \times 8 = 0.32$$

$$50 \times 0.32 = \underline{16}$$

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 .

$AE = DE$ Given
 $\angle BAE = \angle CDE$ Angles at the base of an isosceles triangle are equal
 $AC = BD$ Given (both 3 parts of the given ratio)

SAS \therefore 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.

$$\begin{aligned}y &= 4(x^2 - 14x) \\y &= 4[(x-7)^2 - 49] \\&= 4(x-7)^2 - 196\end{aligned}$$

turning point is when $x=7 \therefore y=-196$

$$\underline{(7, -196)}$$

(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.

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

$$\frac{2x^2 + 10x + 3x + 15 + x^2 - 5x - 4x + 20 - 3(x^2 - 25)}{x^2 - 25}$$

$$\frac{3x^2 + 4x + 35 - 3x^2 + 75}{x^2 - 25}$$

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

$$a = \dots \frac{4}{\dots}$$

$$b = \dots \frac{110}{\dots}$$

(Total for Question 22 is 3 marks)

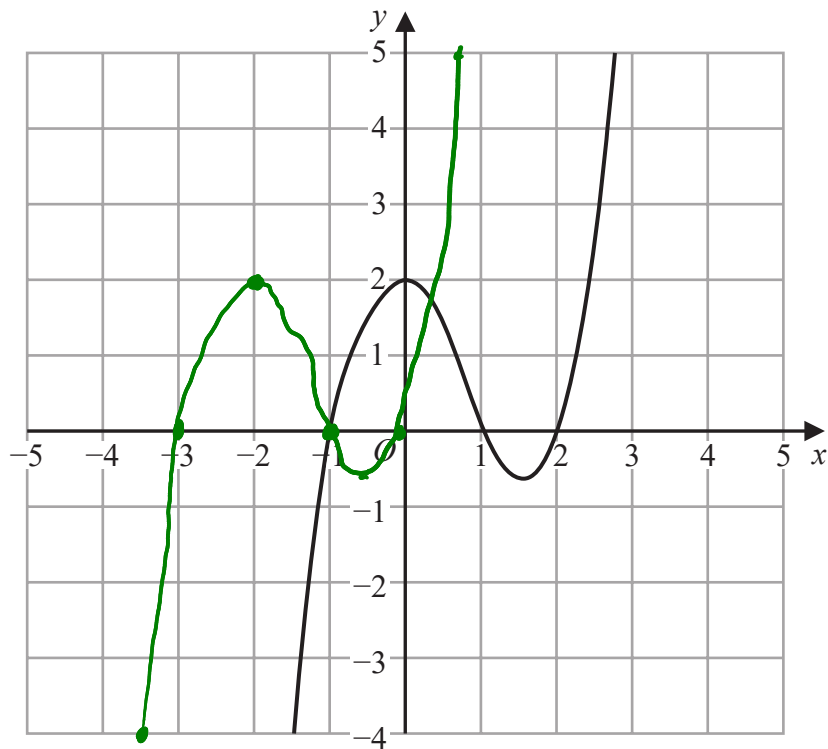
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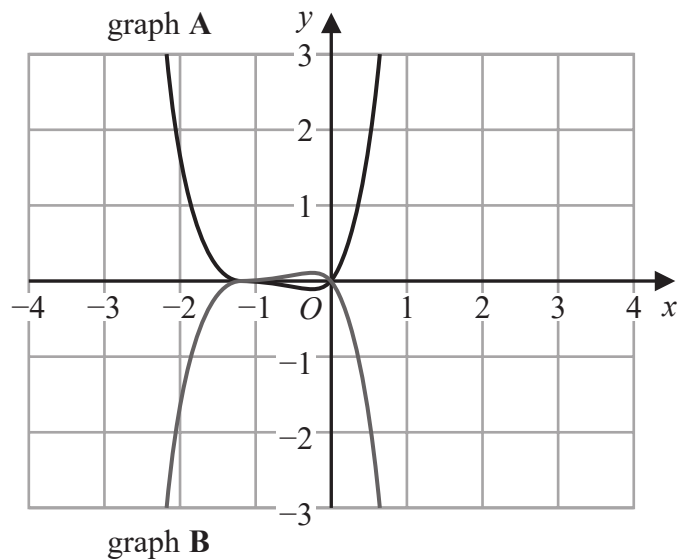


23 The graph of $y = f(x)$ is shown on the grid below.



(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.

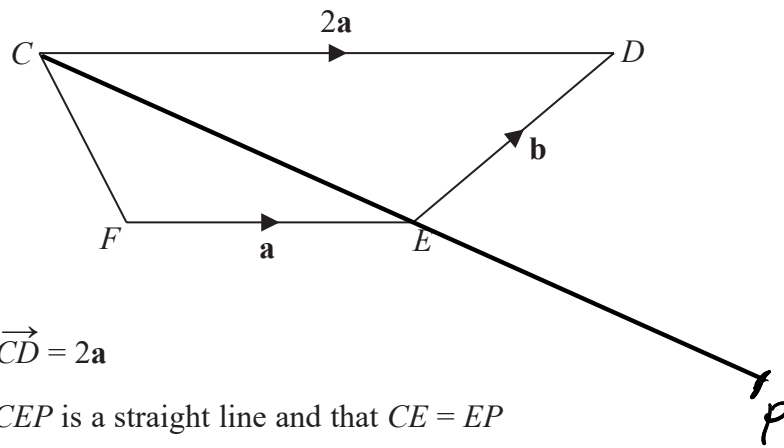
$$y = -g(x)$$

(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 .

$$\begin{aligned} \vec{CF} &= 2\mathbf{a} - \mathbf{b} - \mathbf{a} \\ &= \mathbf{a} - \mathbf{b} \end{aligned}$$

$$\begin{aligned} \vec{CE} &= \vec{CF} + \vec{FE} \\ &= \mathbf{a} - \mathbf{b} + \mathbf{a} \\ &= 2\mathbf{a} - \mathbf{b} \end{aligned}$$

$$\therefore \vec{EP} = 2\mathbf{a} - \mathbf{b}$$

$$\begin{aligned} \vec{DP} &= \vec{DE} + \vec{EP} \\ &= -\mathbf{b} + 2\mathbf{a} - \mathbf{b} \\ &= \underline{2\mathbf{a} - 2\mathbf{b}} \end{aligned}$$

$$\begin{aligned} \vec{CF} &= \mathbf{a} - \mathbf{b} \\ \vec{DP} &= 2\mathbf{a} - 2\mathbf{b} \\ \therefore \vec{DP} &= 2\vec{CF} \end{aligned}$$

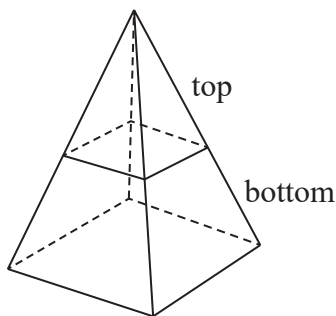
same direction \therefore parallel

(Total for Question 24 is 4 marks)



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

$$\text{density} = \frac{\text{Mass}}{\text{Volume}}$$



The top part of P has a mass of 92.8 g and is made from material with a density of 2.9 g/cm³

The bottom part of P has a mass of 972.8 g

The average density of P is 4.7 g/cm³

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.

$$\text{Top part volume} = \frac{\text{Mass}}{\text{density}} = \frac{92.8}{2.9} = \underline{32 \text{ cm}^3}$$

$$\text{Total density} = \frac{\text{Total Mass}}{\text{Total Volume}}$$

$$4.7 = \frac{92.8 + 972.8}{\text{Total Volume}}$$

$$\begin{aligned} \text{Total V} &= \frac{92.8 + 972.8}{4.7} \\ &= 226.72 \text{ cm}^3 \end{aligned}$$

$$\frac{32}{226.72} \times 100 = 14.1\%$$

..... 14.1 %

(Total for Question 25 is 5 marks)

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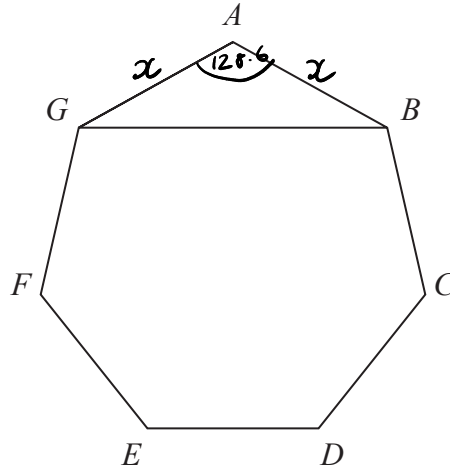
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P 6 8 7 2 5 A 0 2 1 2 4

26 $ABCDEFG$ 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.

$$\frac{360}{7} = 51.4$$

$$180 - 51.4 = \frac{900}{7} = 128.6$$

exterior angle

interior angle

$$\frac{1}{2} ab \sin C = 30$$

$$\frac{1}{2} x^2 \sin(128.6) = 30$$

$$x^2 = \frac{30}{\frac{1}{2} \sin(128.6)}$$

$$x^2 = 76.74$$

$$x = 8.76 \text{ cm}$$

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

$$a^2 = 8.76^2 + 8.76^2 - 2(8.76)(8.76) \cos(128.6)$$

$$a^2 = 249.18$$

$$a = 15.8$$

..... 15.8 cm

(Total for Question 26 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS



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