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| Candidate surname | Other names |
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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/



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 $p = 3a - 9$

$$\begin{array}{r} +9 \quad +9 \\ p + 9 = 3a \\ \div 3 \qquad \qquad \div 3 \\ \hline \frac{p+9}{3} = a \end{array}$$

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

(Total for Question 1 is 2 marks)

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

Here is his working.

$$120 \div 3 = 40 \qquad 120 \div 5 = 24$$

Rob's working is not correct.

Describe what Rob has done wrong.

He should have divided 120 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.

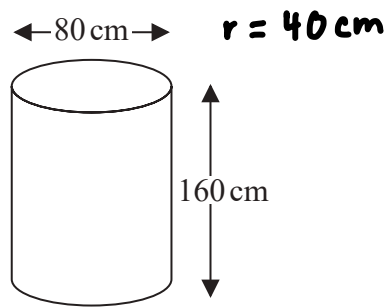
| | French | Spanish | German | Total |
|-------|--------|---------|--------|-------|
| Boys | 60 | 22 | 8 | 90 |
| Girls | 44 | 48 | 18 | 110 |
| Total | 104 | 70 | 26 | 200 |

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.



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 litre = 1000 cm³

$\div 1000$

Has Karina enough fertiliser for the 4 tanks?

You must show how you get your answer.

$$\begin{aligned} \text{Volume} &= \pi r^2 h \quad r = 40 \quad h = 160 \\ &= \pi (40)^2 (160) \\ &= 256,000 \pi \text{ cm}^3 \end{aligned}$$

$$4 \times 256,000 \pi = 3,216,990.877 \text{ cm}^3$$

$$3,216,990.877 \div 1000 = 3216.990877 \text{ litres}$$

$$1 : 100 = 101 \text{ parts}$$

$$3216.990877 \div 101 = 31.85139... \text{ litres}$$

$$31.85... < 32 \quad \text{Yes, she has enough.}$$

(Total for Question 4 is 4 marks)

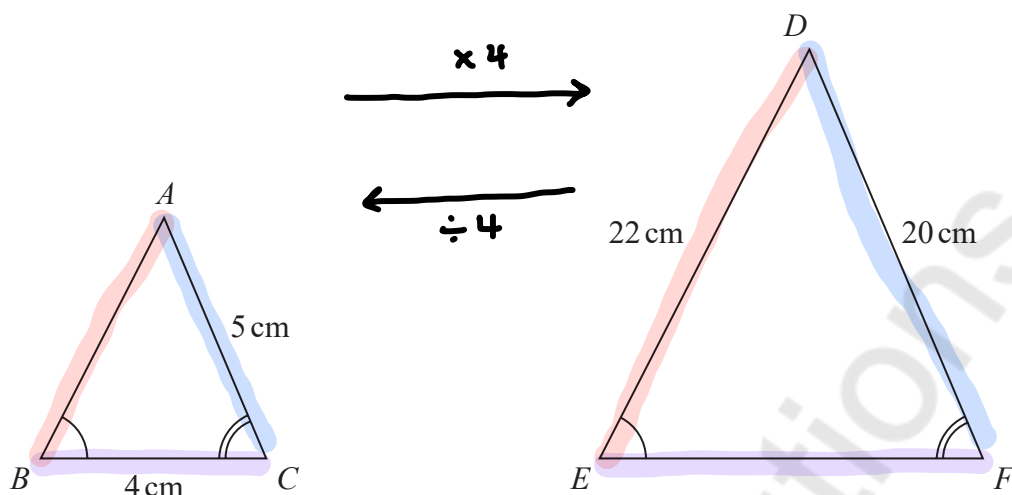


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5 Triangle ABC and triangle DEF are similar.



(a) Work out the length of EF .

$$\text{Scale factor} = \frac{20}{5} = 4$$

$$4 \text{ cm} \times 4 = 16 \text{ cm}$$

..... **16** cm
(2)

(b) Work out the length of AB .

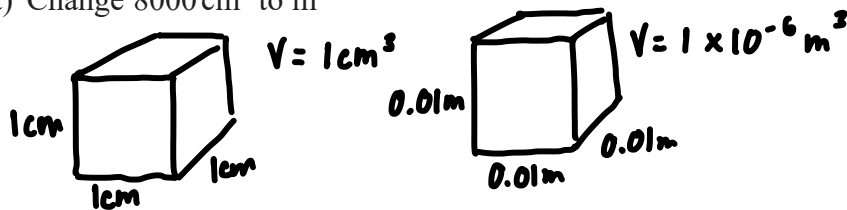
$$22 \div 4 = 5.5 \text{ cm}$$

..... **5.5** cm
(2)

(Total for Question 5 is 4 marks)



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



$$8000 \times (1 \times 10^{-6})$$

$$8 \times 10^{-3} = 0.008$$

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

(1)

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

$$\frac{180 \text{ km}}{1 \text{ hour}} \xrightarrow{\times 1000} \frac{180,000 \text{ m}}{1 \text{ hour}} \xrightarrow{\times 3600} \frac{180,000 \text{ m}}{3600 \text{ s}} = 50$$

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

(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.

$$\text{Mean} = \frac{\text{total}}{\text{no. of values}}$$

All people

$$167.6 = \frac{\text{total}}{50}$$

$$\times 50 \qquad \times 50$$

$$\text{total} = 8380 \text{ cm}$$

Women

$$\text{total} = 8380 - 3640 = 4740$$

$$\text{mean} = \frac{4740}{30}$$

$$= 158 \text{ cm}$$

Men

$$182 = \frac{\text{total}}{20}$$

$$\times 20 \qquad \times 20$$

$$3640 = \text{total}$$

$$\dots\dots\dots 158 \text{ cm}$$

(Total for Question 8 is 3 marks)



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

0.0006.75

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.

659,200

6.592×10^5

6.592×10^5

(2)

(Total for Question 9 is 3 marks)

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

Here is his working

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

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

$$= x + 1$$

$$3x - - 2x = 5x$$

$$5 - - 4 = 9$$

Explain what is wrong with Peter's working.

The answer should be $5x + 9$

(Total for Question 10 is 1 mark)

11 x and y are integers such that

$$3 < x < 8$$

$$4 < y < 10$$

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

4, 5, 6, 7

5, 6, 7, 8, 9

Find all the possible values of x .

$$5 + 9 = 14$$

$$6 + 8 = 14$$

$$7 + 7 = 14$$

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 .

1.2 or more

Less than 1.3

$$1.2 \leq P < 1.3$$

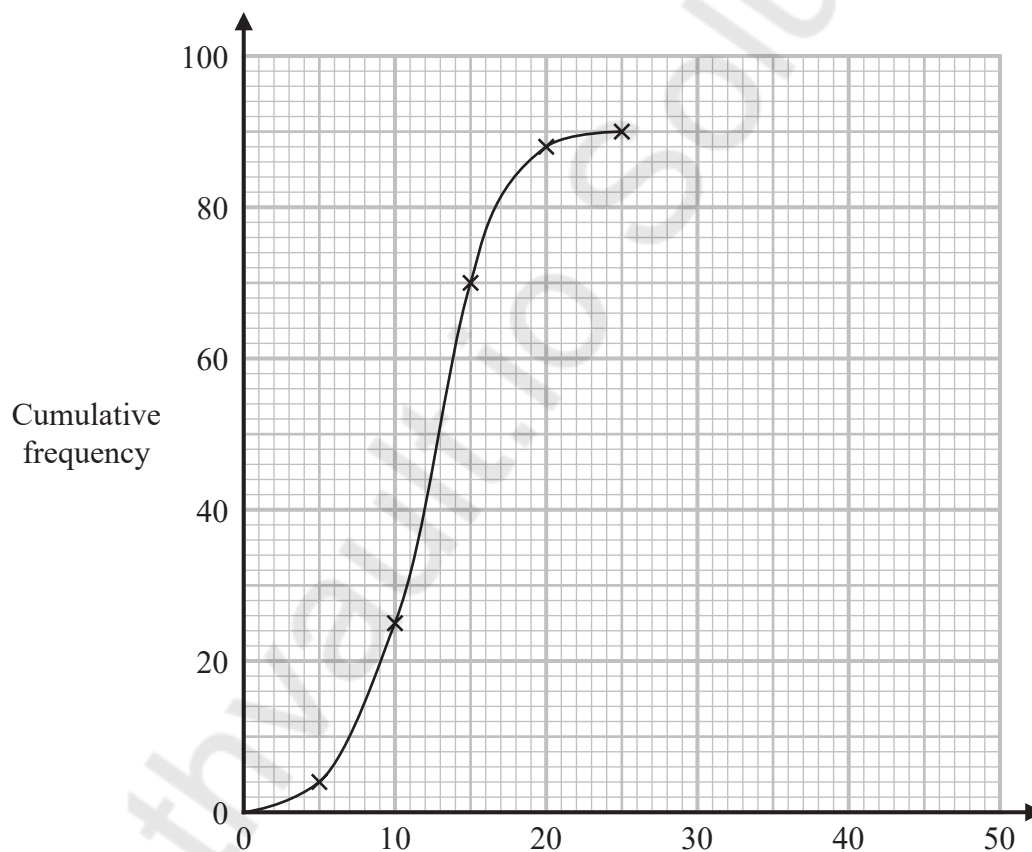
(Total for Question 12 is 2 marks)



- 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. *Midpoints have been plotted*
2. *No label for horizontal axis*

(Total for Question 13 is 2 marks)



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

$$3^4 = 81$$

$$x^{20}$$

$$y^{24}$$

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

(2)

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

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

$$= x^2 - x - 6$$

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

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

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

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

(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

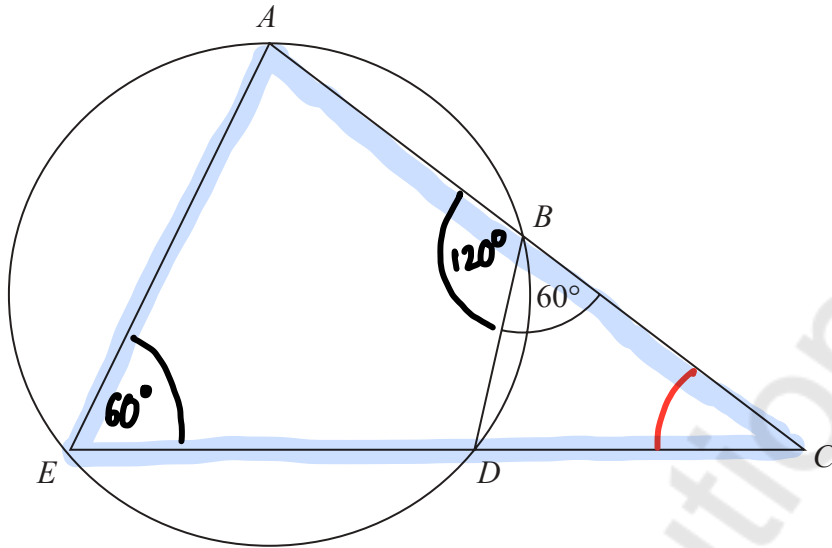
- a guppy fish and an angel fish
- or a tetra fish and an angel fish
- or a guppy fish, a tetra fish and an angel fish.

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

$$(7 \times 5) + (13 \times 5) + (7 \times 13 \times 5)$$
$$35 + 65 + 455 = 555$$

(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.

$$180^\circ - 60^\circ = 120^\circ$$

$$2 : 1 \quad 3 \text{ total parts}$$

$$120^\circ \div 3 = 40^\circ$$

$$BCD = 40^\circ$$

..... 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. $75\% = \frac{3}{4}$

Find the ratio

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

$$\begin{array}{rcl}
 A : B & & C : D \\
 2 : 3 & & 3 : 4 \\
 (5 \text{ parts}) & & (7 \text{ parts}) \\
 \times 7 & & \times 5 \\
 14 : 21 & & 15 : 20 \\
 \times 3 & & \\
 42 : 63 & &
 \end{array}$$

$$\begin{array}{r}
 A : B : C : D \\
 42 : 63 : 15 : 20
 \end{array}$$

$$42 : 63 : 15 : 20$$

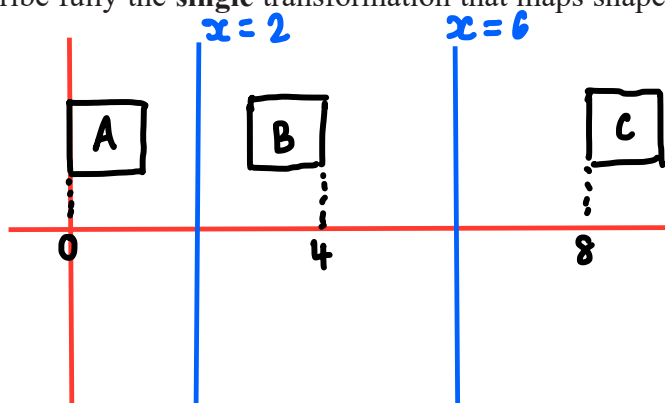
(Total for Question 17 is 4 marks)



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- 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

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.

$$p(\text{not blue}) = 1 - 0.4 \\ = 0.6$$

$$7:8 \quad 15 \text{ parts}$$

$$0.6 \div 15 = 0.04$$

$$p(\text{red}) = 0.04 \times 7 = 0.28$$

$$p(\text{green}) = 0.04 \times 8 = 0.32$$

$$50 \times 0.32 = 16$$

16

(Total for Question 19 is 3 marks)

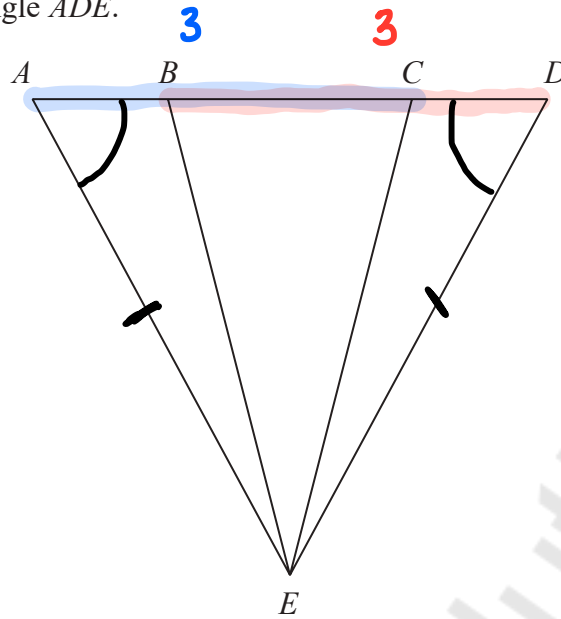
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P 6 8 7 2 5 A 0 1 5 2 4

20 The diagram shows a triangle ADE .



$$AE = DE$$

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

Prove that triangle ACE is congruent to triangle DBE .

$$AE = DE \quad [\text{sides}]$$

$$\angle BAE = \angle CDE \quad \text{Base angles of an isosceles are equal} \quad [\text{angles}]$$

$$AC = BD \quad \text{Same number of parts in the ratio} \quad [\text{sides}]$$
$$AB : BC : CD$$

$$\text{SAS} \quad \therefore \text{congruent.}$$

(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.

$$\begin{aligned}y &= 4x^2 - 56x \\ &= 4(x^2 - 14x) \\ &= 4[(x - 7)^2 - 7^2] \\ &= 4[(x - 7)^2 - 49] \\ &= 4(x - 7)^2 - 196\end{aligned}$$

Turning point $(7, -196)$

(Total for Question 21 is 3 marks)

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

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.

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

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

$$\frac{(2x^2 + 13x + 15) + (x^2 - 9x + 20)}{x^2 - 25}$$

$$\frac{3x^2 + 4x + 35}{x^2 - 25} - \frac{3}{1}$$

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

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

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

$$a = 4$$

$$b = 110$$

(Total for Question 22 is 3 marks)

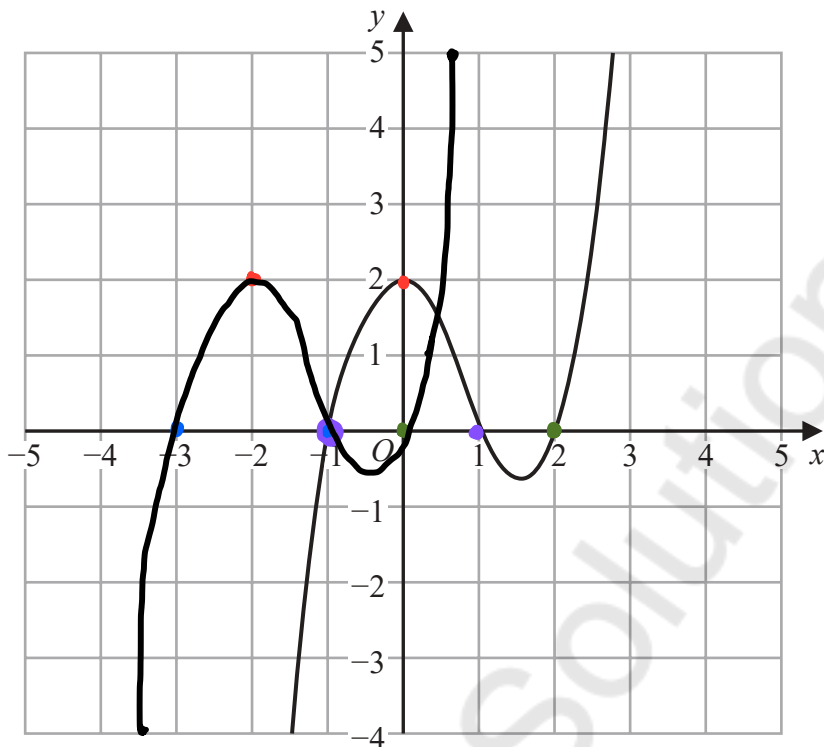


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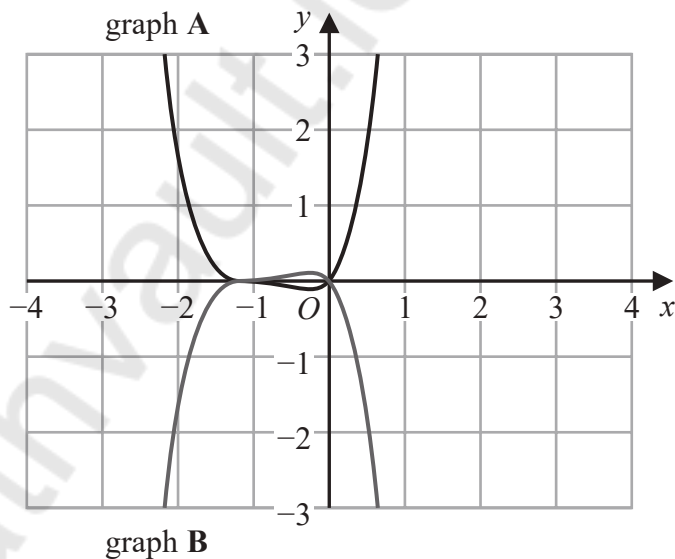
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23 The graph of $y = f(x)$ is shown on the grid below.



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

(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.

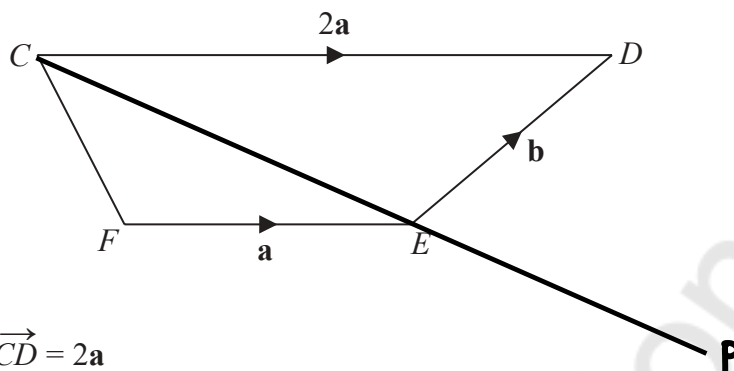
$y = -g(x)$
(1)

(Total for Question 23 is 2 marks)



P 6 8 7 2 5 A 0 1 9 2 4

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 .

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

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

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

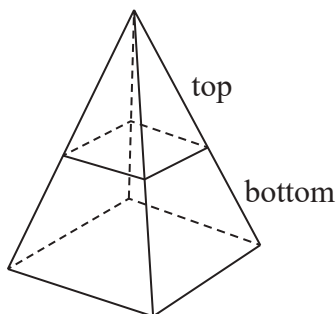
$$\begin{aligned} \vec{DP} &= \vec{DE} + \vec{EP} \\ &= -\mathbf{b} + 2\mathbf{a} - \mathbf{b} \\ &= 2\mathbf{a} - 2\mathbf{b} \end{aligned}$$

Same direction \therefore parallel.

(Total for Question 24 is 4 marks)



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



m
D V

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.

| | Top | Bottom | P |
|----------|-----------------------|---------|-----------------------------|
| m | 92.8 g | 972.8 g | 1065.6 g |
| D | 2.9 g/cm ³ | | 4.7 g/cm ³ |
| V | 32 cm ³ | | 226.7234... cm ³ |
| | $92.8 \div 2.9$ | | $1065.6 \div 4.7$ |

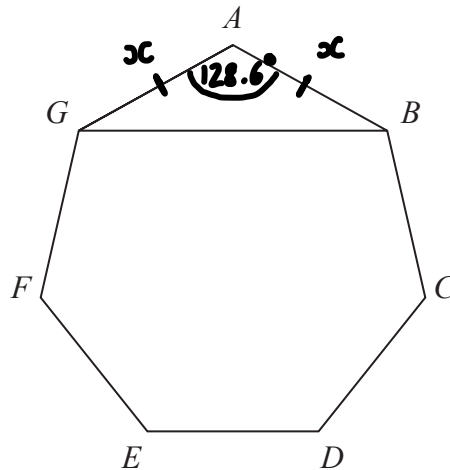
$$\frac{32}{226.7234...} \times 100 = 14.114$$

$$\approx 14.1\%$$

..... 14.1 %

(Total for Question 25 is 5 marks)

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.

$$\text{Exterior angle} = \frac{360}{7} = 51.4^\circ$$

$$\text{Interior angle} = 180^\circ - 51.4^\circ = 128.6^\circ$$

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

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

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

$$60 = x^2 \sin(128.6)$$

$$\div \sin(128.6)$$

$$x^2 = 76.74$$

$$\sqrt{\quad} \quad \sqrt{\quad}$$

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

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

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

$$GB^2 = 249.18$$

$$\sqrt{\quad} \quad \sqrt{\quad}$$

$$GB = 15.8$$

.....15.8..... cm

(Total for Question 26 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

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