Cambridge Assessment International Education

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MATHEMATICS **0580/42**

Paper 4 (Extended) **October/November 2021**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π, use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [ ].

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1 **(a)** Malena has 450 fruit trees.
The fruit trees are in the ratio apple : pear : plum = 8 : 7 : 3.

View solution

(i) Show that Malena has 200 apple trees.

[2]

(ii) Find the number of plum trees.

View solution

..... [1]

(iii) Malena wants to increase the number of pear trees by 32%.

View solution

Calculate the number of extra pear trees she needs.

..... [2]

(iv) Each apple tree produces 48.5 kg of apples.
The apples have an average mass of 165 g each.

View solution

Calculate the total number of apples produced by the 200 trees.
Give your answer correct to the nearest 1000 apples.

..... [3]

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(b) Malena's land is valued at three million and seventy-five thousand dollars.

View solution

(i) Write this number in figures.

..... [1]

(ii) Write your answer to **part (b)(i)** in standard form.

View solution

..... [1]

(c) In 2020, each plum tree produced 37.7 kg of plums.
This was 16% more than in 2019.

View solution

Calculate the mass of plums produced by each plum tree in 2019.

..... kg [2]

(d) Malena invests $1800 at a rate of 2.1% per year compound interest.

View solution

Calculate the value of her investment at the end of 15 years.

$ ..... [2]

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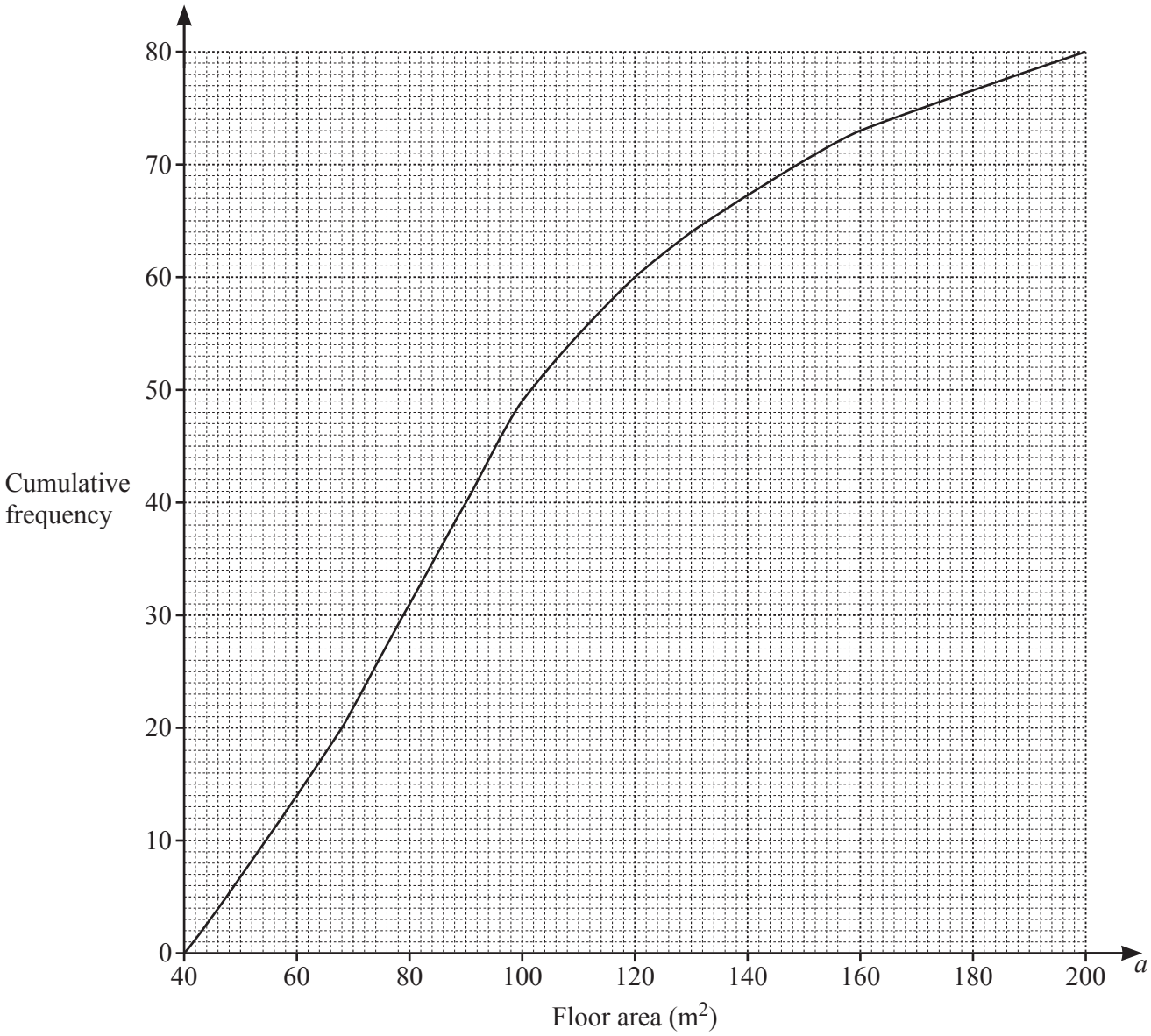
2 **(a)** The cumulative frequency diagram shows information about the floor area, $a\,m^2$, of each of 80 houses.

View solution



Use the diagram to find an estimate of

(i) the median,

..... m^2 [1]

(ii) the lower quartile,

..... m^2 [1]

(iii) the interquartile range,

..... m^2 [1]

(iv) the number of houses with a floor area greater than $120\,m^2$.

..... [2]

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(b) The information about the 80 floor areas is shown in this frequency table.

Floor area ($a\,m^2$)	$40 < a \leqslant 60$	$60 < a \leqslant 80$	$80 < a \leqslant 100$	$100 < a \leqslant 130$	$130 < a \leqslant 160$	$160 < a \leqslant 200$
Frequency	14	17	18	15	9	7

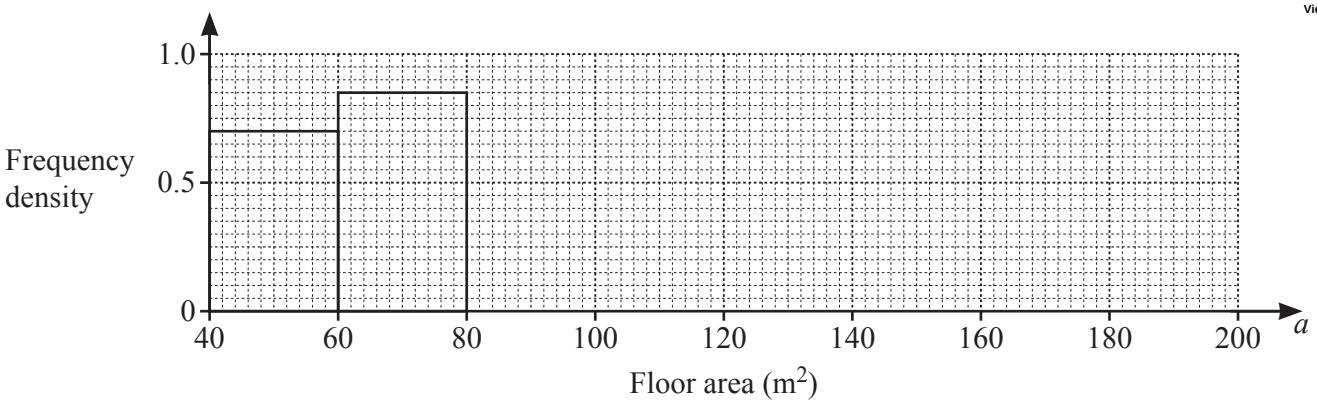
(i) Calculate an estimate of the mean floor area.

View solution

..... m^2 [4]

(ii) Complete the histogram to show the information in the frequency table.

View solution



[4]

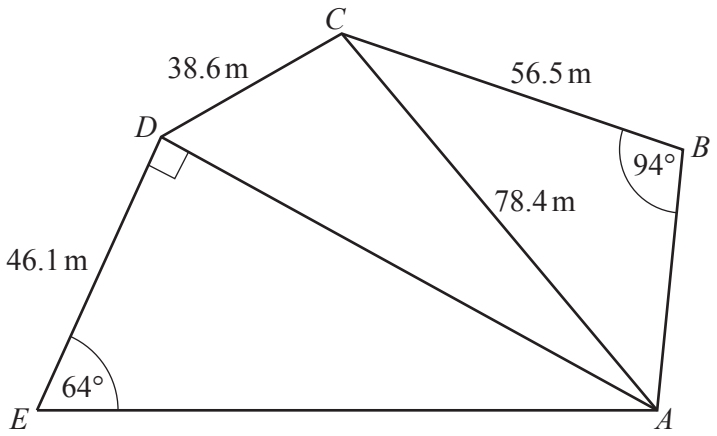
(iii) Two of the houses are picked at random.

Find the probability that one of the houses has a floor area greater than $130\,m^2$ and the other has a floor area $60\,m^2$ or less.

View solution

..... [3]

3 (a)



NOT TO SCALE

ABCDE is a pentagon.

(i) Calculate *AD* and show that it rounds to 94.5 m, correct to 1 decimal place.

[2]

(ii) Calculate angle *BAC*.

Angle *BAC* = ... [3]

(iii) Calculate the largest angle in triangle *CAD*.

..... [4]

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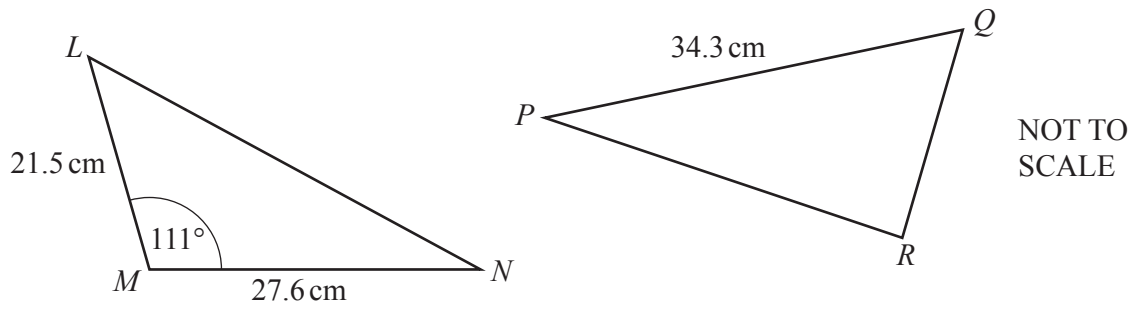
(b)

View solution

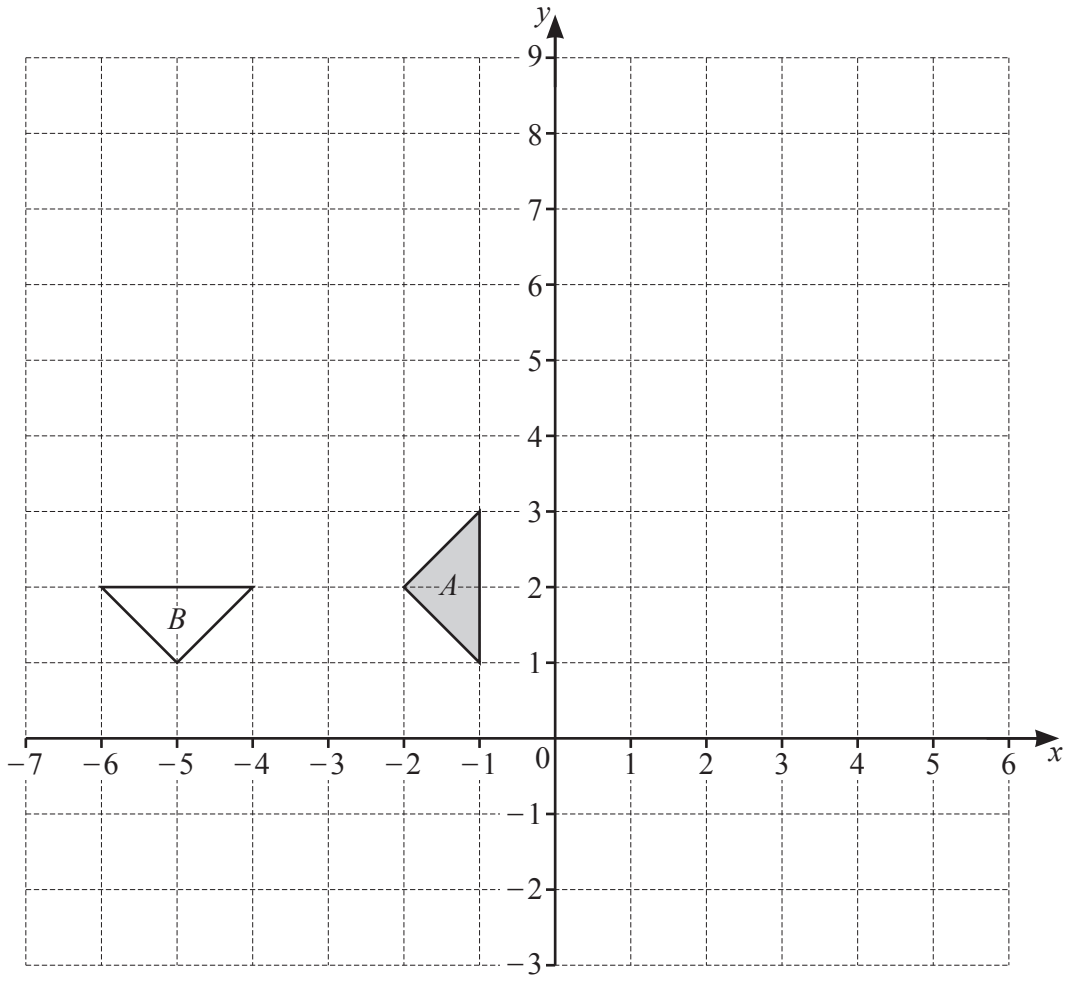


Triangle *PQR* has the same area as triangle *LMN*.

Calculate the shortest distance from *R* to the line *PQ*.

..... cm [3]

4



(a) On the grid, draw the image of triangle A after

View solution

(i) a translation by the vector $\begin{pmatrix} -4 \\ 5 \end{pmatrix}$, [2]

(ii) a reflection in the line $x = 1$, [2]

(iii) an enlargement, scale factor 2 and centre $(-5, -2)$. [2]

(b) Describe fully the **single** transformation that maps triangle A onto triangle B.

View solution

.....

..... [3]

5 The table shows some values for $y = x^3 - 3x^2 + 3$.

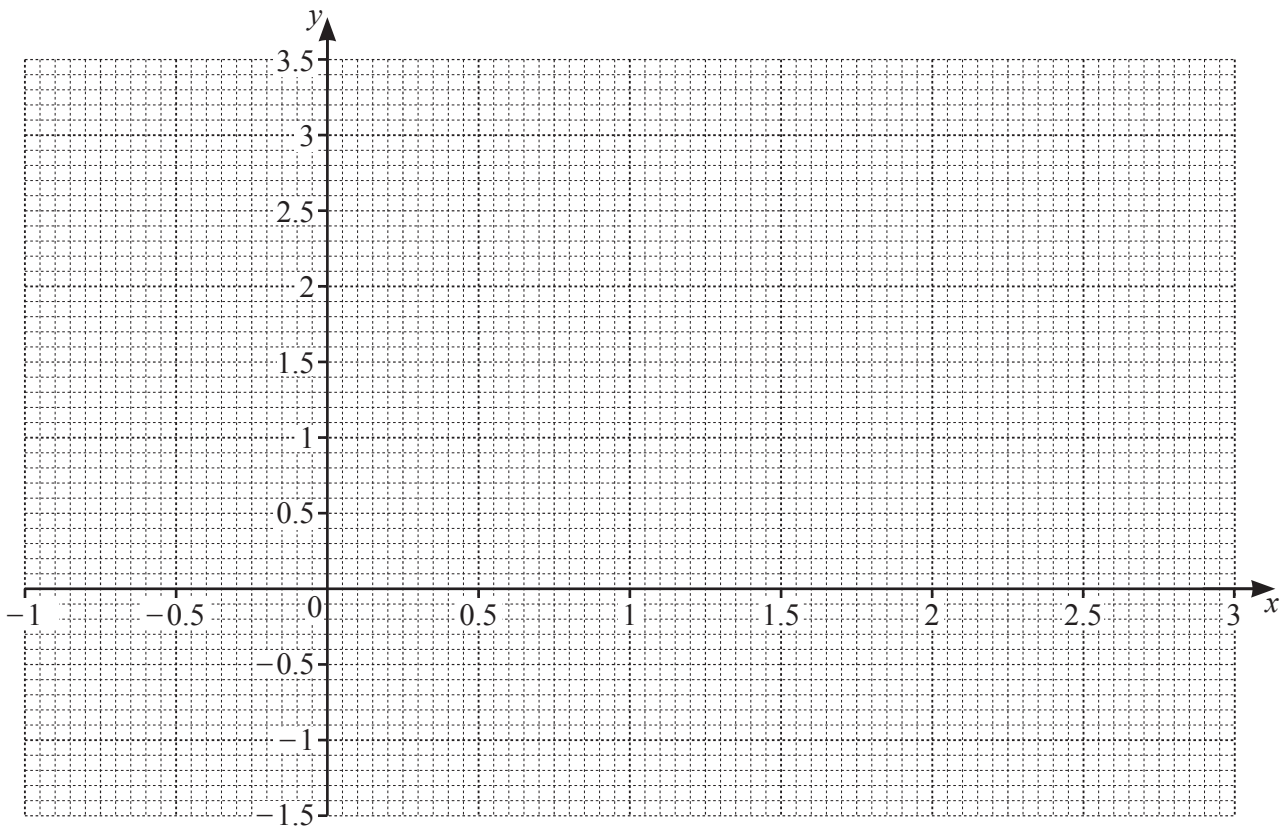
x	-1	-0.5	0	0.5	1	1.5	2	2.5	3
y		2.125	3	2.375	1		-1	-0.125	

(a) Complete the table. [3]

View solution

(b) On the grid, draw the graph of $y = x^3 - 3x^2 + 3$ for $-1 \leqslant x \leqslant 3$.

View solution



[4]

(c) By drawing a suitable straight line on the grid, solve the equation $x^3 - 3x^2 + x + 1 = 0$.

View solution

$x =$ ..... or $x =$ ..... or $x =$ ..... [4]

6 **(a)** Solve.

(i) $4(2x-3)=24$

View solution

$x =$ ..... [3]

(ii) $6x+14>6$

View solution

..... [2]

(b) Rearrange the formula $V=2x^3-3y^3$ to make y the subject.

View solution

$y =$ ..... [3]

(c) Show that $(2n-5)^2-13$ is a multiple of 4 for all integer values of n.

View solution

[3]

(d) The expression $5+12x-2x^2$ can be written in the form $q-2(x+p)^2$.

View solution

(i) Find the value of p and the value of q.

$p =$ ..... , $q =$ ..... [3]

(ii) Write down the coordinates of the maximum point of the curve $y = 5+12x-2x^2$.

View solution

(..... , ...) [1]

(e) The energy of a moving object is directly proportional to the square of its speed.
The speed of the object is increased by 30%.

View solution

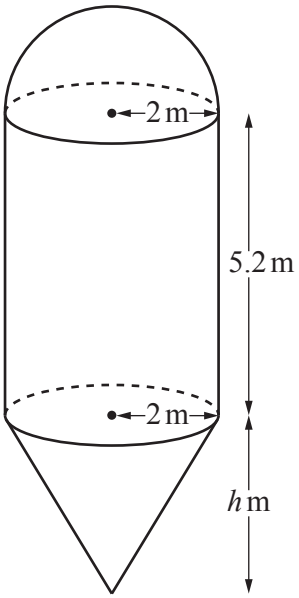
Calculate the percentage increase in the energy of the object.

..... % [2]

7 **(a)** The diagram shows a container for storing grain.

View solution

The container is made from a hemisphere, a cylinder and a cone, each with radius 2 m. The height of the cylinder is 5.2 m and the height of the cone is h m.



NOT TO SCALE

(i) Calculate the volume of the hemisphere. Give your answer as a multiple of π.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... m^3 [2]

(ii) The total volume of the container is $\frac{88\pi}{3}$ m^3.

View solution

Calculate the value of h.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

$h =$ ..... [4]

(iii) The container is full of grain.
Grain is removed from the container at a rate of 35 000 kg per hour.
$1\,m^3$ of grain has a mass of 620 kg.

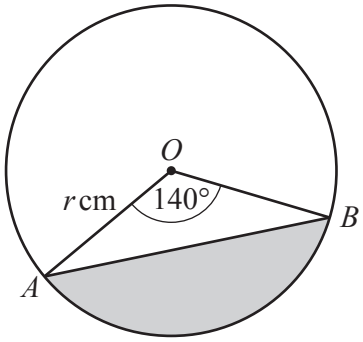
View solution

Calculate the time taken to empty the container.
Give your answer in hours and minutes.

..... h ..... min [3]

(b)

View solution



NOT TO SCALE

A and B are points on a circle, centre O, radius r cm.
The area of the shaded segment is $65\,cm^2$.

Calculate the value of r.

$r =$ ..... [4]

8 **(a)** Kaito runs along a 12 km path at an average speed of x km/h.

View solution

(i) Write down an expression, in terms of x, for the number of hours he takes.

..... hours [1]

View solution

(ii) Yuki takes 1.5 hours longer to walk along the same path as Kaito.
She walks at an average speed of $(x-4)$ km/h.

Write down an equation, in terms of x, and show that it simplifies to $x^2-4x-32=0$.

[4]

View solution

(iii) Solve by factorisation.

$$x^2-4x-32=0$$

$x =$ ..... or $x =$ ..... [3]

View solution

(iv) Find the number of hours it takes Yuki to walk along the 12 km path.

..... hours [2]

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(b) A bus travels 440 km, correct to the nearest 10 km.
The time taken to complete the journey is 6 hours, correct to the nearest half hour.

View solution

Calculate the lower bound of the speed of the bus.

..... km/h [3]

9 **(a)** F is the point $(5, -2)$ and $\overrightarrow{FG} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$.

View solution

Find

(i) the coordinates of point G,

(..... , ...) [1]

(ii) $5\overrightarrow{FG}$,

View solution

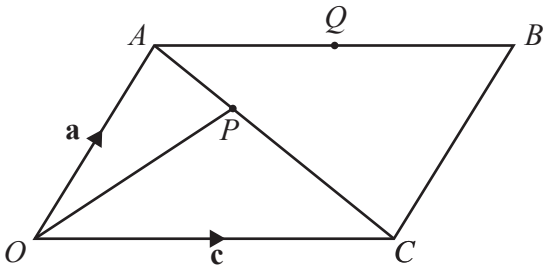
$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(iii) $\left|\overrightarrow{FG}\right|$.

View solution

..... [2]

(b)



NOT TO SCALE

OABC is a parallelogram.
P is a point on *AC* and *Q* is the midpoint of *AB*.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.

(i) Find, in terms of **a** and/or **c**

(a) $\overrightarrow{AQ}$,

$\overrightarrow{AQ} =$ ..... [1]

(b) $\overrightarrow{OQ}$.

$\overrightarrow{OQ} =$ ..... [1]

(ii) $\overrightarrow{OP} = \frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{c}$

(a) Show that *O*, *P* and *Q* lie on a straight line.

[2]

(b) Write down the ratio *OP* : *OQ*.
Give your answer in the form 1 : *n*.

1 : ..... [1]

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10 **(a)** Find the coordinates of the turning points of the graph of $y = x^3 - 12x + 6$.
You must show all your working.

View solution

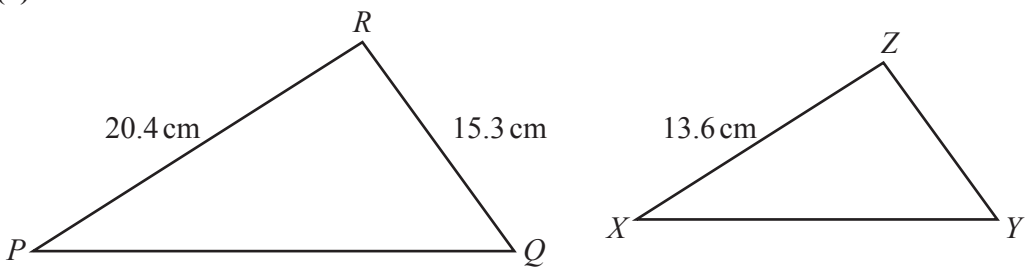
(..... , ...) and (..... , ...) [5]

(b) Determine whether each turning point is a maximum or a minimum.
Show how you decide.

View solution

[3]

11 (a)



NOT TO SCALE

View solution

Triangle *PQR* is mathematically similar to triangle *XYZ*.

(i) Find *YZ*.

YZ = ... cm [2]

(ii) The area of triangle *XYZ* is $63.6\,cm^2$.

View solution

Calculate the area of triangle *PQR*.

..... cm^2 [3]

(b) Two containers are mathematically similar.
The larger container has a capacity of 64.8 litres and a surface area of $0.792\,m^2$.
The smaller container has a capacity of 37.5 litres.

View solution

Calculate the surface area of the smaller container.

..... m^2 [3]

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