Cambridge Assessment International Education

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CANDIDATE NAME									
CENTER NUMBER						CANDIDATE NUMBER				

5647773549

MATHEMATICS (US) **0444/43**

Paper 4 (Extended) **October/November 2022**

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, center 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 work 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 parentheses [ ].

This document has **20** pages. Any blank pages are indicated.

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Formula List

For the equation $ax^2 + bx + c = 0$ $\quad x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Lateral surface area, A, of cylinder of radius r, height h. $\quad A = 2\pi rh$

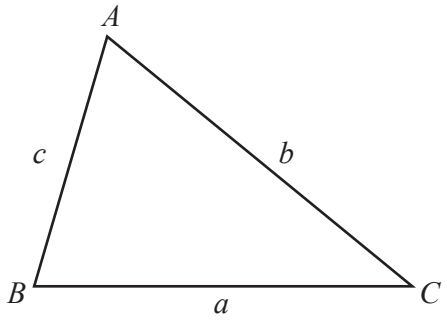
Lateral surface area, A, of cone of radius r, sloping edge l. $\quad A = \pi rl$

Surface area, A, of sphere of radius r. $\quad A = 4\pi r^2$

Volume, V, of pyramid, base area A, height h. $\quad V = \frac{1}{3}Ah$

Volume, V, of cone of radius r, height h. $\quad V = \frac{1}{3}\pi r^2 h$

Volume, V, of sphere of radius r. $\quad V = \frac{4}{3}\pi r^3$

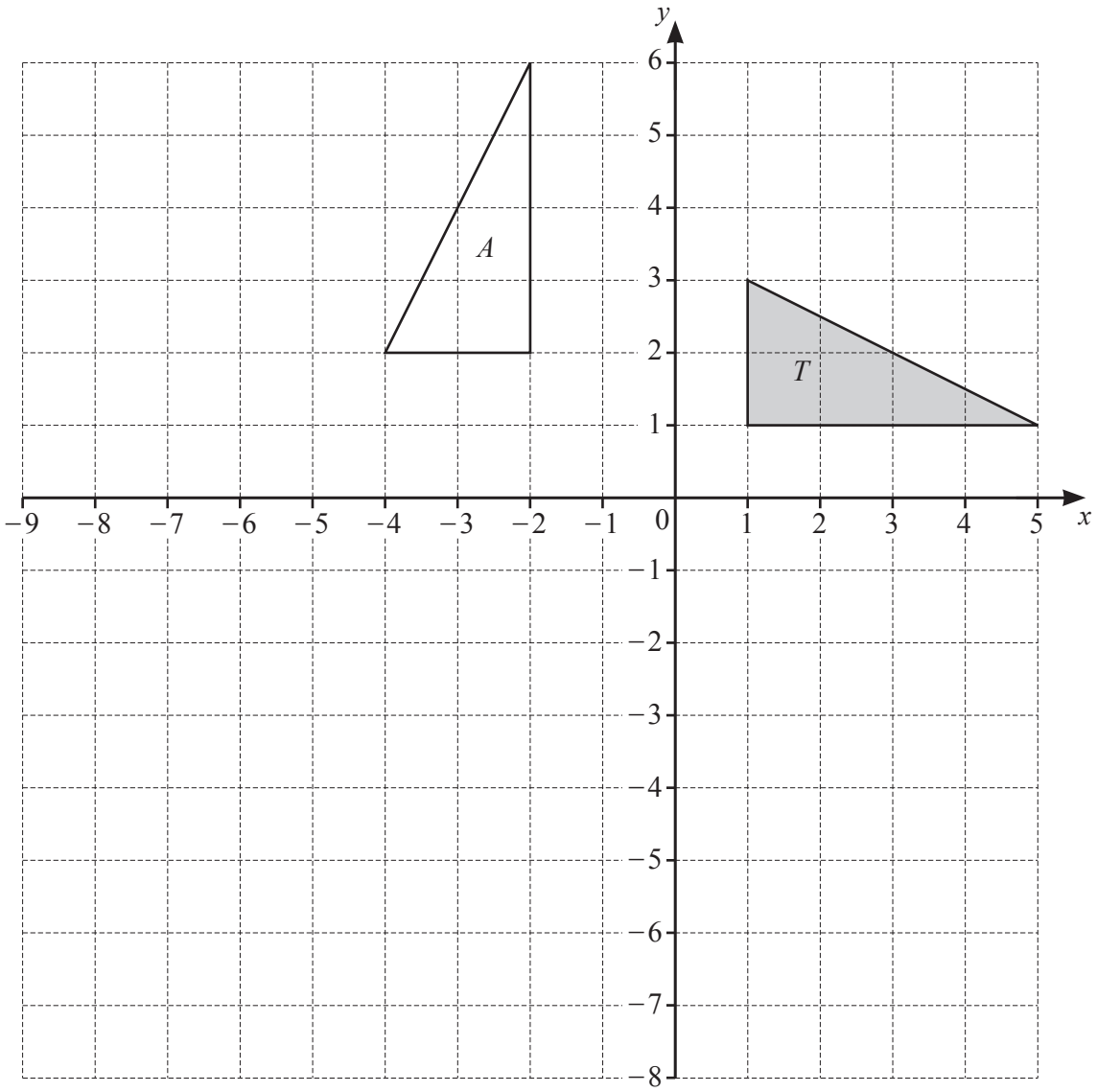


$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

$$\text{Area} = \frac{1}{2}bc\sin A$$

1



(a) Draw the reflection of triangle T in the line $y = -2$. [2]

(b) Draw the enlargement of triangle T with scale factor $\frac{1}{2}$ and center of enlargement $(-5, -3)$. [2]

(c) Describe fully the **single** transformation that maps triangle T onto triangle A.

.....

..... [3]

2 **(a)** Here are the ingredients needed to make a pasta bake to serve 12 people.

250 g butter
600 g pasta
460 g mushrooms
280 g cheese
800 ml milk

(i) Find the mass of the cheese as a percentage of the mass of the mushrooms.

..... % [1]

(ii) Find the mass of butter needed to make a pasta bake to serve 18 people.

..... g [2]

(iii) Monica has 2.2 liters of milk and 1.5 kg of each other ingredient.

Calculate the greatest number of people she can serve with pasta bake.

..... [3]

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(b) In 2019, a packet of pasta cost \$2.40.
This was an increase of 25% of the cost of a packet in 2018.

(i) Work out the cost in 2018.

\$ ..... [2]

(ii) In 2020, the cost of a packet increased by 15% from the cost in 2019.

Work out the total percentage increase in the cost of a packet from 2018 to 2020.

..... % [3]

(c) The pasta bake for 12 people uses 250 g of butter, 460 g of mushrooms and 280 g of cheese.
A new type of pasta bake is made using the same amounts of butter and mushrooms but the amount of cheese is increased by x grams.
The new ratio butter : mushrooms : cheese = 50 : 92 : 59.

Find the value of x.

$x =$ ..... [2]

3 **(a)** Simplify fully.

(i) $p^3 \times p^{11}$

..... [1]

(ii) $\dfrac{18m^6}{3m^2}$

..... [2]

(iii) $\left(\dfrac{27x^9y^{27}}{64}\right)^{-\frac{1}{3}}$

..... [3]

(b) A sequence has nth term $3n^2$.

Write down the first 3 terms of this sequence.

..... , ... , ... [2]

(c) Find the nth term for each of these sequences.

(i) 13, 16, 19, 22, 25, …

..... [2]

(ii) 3, 17, 55, 129, 251, …

..... [2]

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(d) Solve.

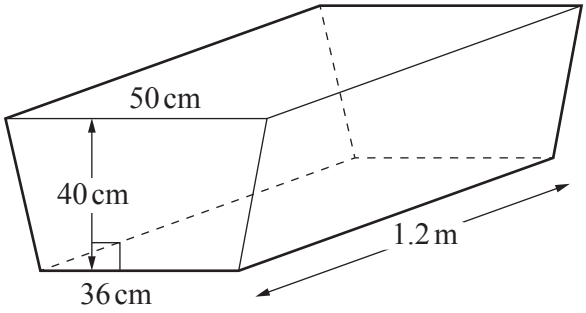
$$\frac{3x-22}{4} = 23$$

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

(e) Use the quadratic formula to solve $3x^2 + 8x - 20 = 0$.
Show all your work and give your answers correct to 2 decimal places.

$x =$ ..... , $x =$ ..... [4]

4



NOT TO SCALE

The diagram shows a water trough in the shape of a prism.
The prism has a cross-section in the shape of an isosceles trapezoid.
The trough is completely filled with water.

(a) Show that the volume of water in the trough is 206.4 liters.

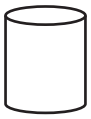
[3]

(b) The water from the trough is emptied at a rate of 600 ml per second.

Calculate the time taken, in minutes and seconds, for the trough to be emptied.

..... minutes ..... seconds [3]

(c) All the water from the trough is emptied into a vertical cylindrical tank.
The depth of the water in the tank is 84 cm.



(i) Calculate the radius of the tank.

..... cm [3]

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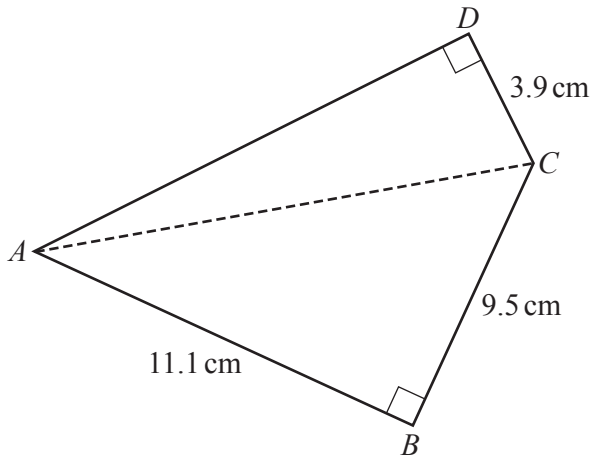
(ii) The tank is 60% full.

Calculate the height of the tank.

..... cm [2]

(d)



NOT TO SCALE

The diagram shows a quadrilateral with right angles at B and D.
$AB = 11.1$ cm, $BC = 9.5$ cm and $CD = 3.9$ cm.

Calculate the perimeter of the quadrilateral.

..... cm [4]

5 **(a)** $P = 5k^2 - 7$

(i) Find the value of P when $k = 3$.

$P =$ ..... [2]

(ii) Solve for k.

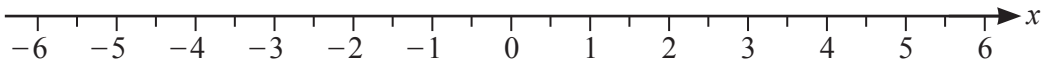
$k =$ ..... [3]

(b) **(i)** Solve.

$$x - 3 \leqslant 5x + 7$$

..... [2]

(ii) Show your answer to **part (b)(i)** on the number line.



[1]

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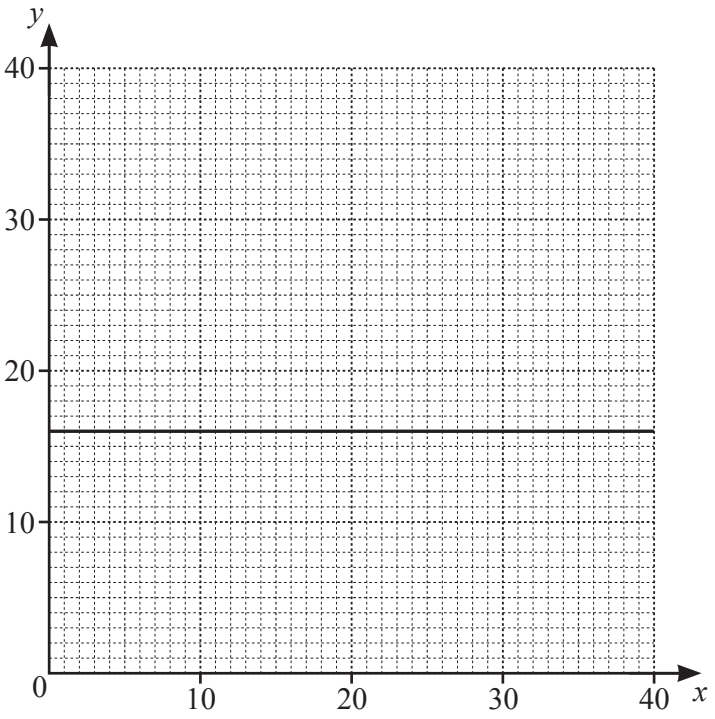
(c) The line $y = 16$ is drawn on the grid.



The region R satisfies the following inequalities.

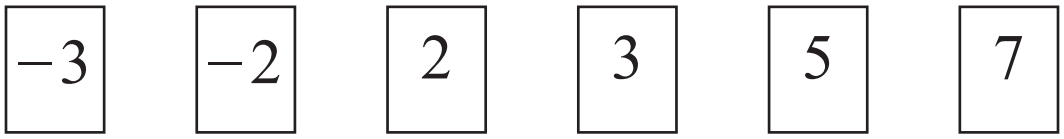
$y \geqslant 16$ $x > 2$ $2x + 3y \geqslant 72$ $y \leqslant 32 - x$

(i) By drawing three more lines and shading the region **not required**, find and label region R. [6]

(ii) Find the integer coordinates (x, y) of the point in the region R that give the maximum value of $2x + y$.

(..... , ...) [2]

6 Regan is playing a game with these six number cards.



(a) She takes two cards at random, without replacement, and **multiplies** the two numbers to give a score.

Find the probability that

(i) the score is 35

..... [3]

(ii) the score is a positive number.

..... [3]

(b) Regan now takes three cards at random from the six cards, without replacement, and **adds** the three numbers to give a total.

Find the probability that her total is 5.

..... [4]

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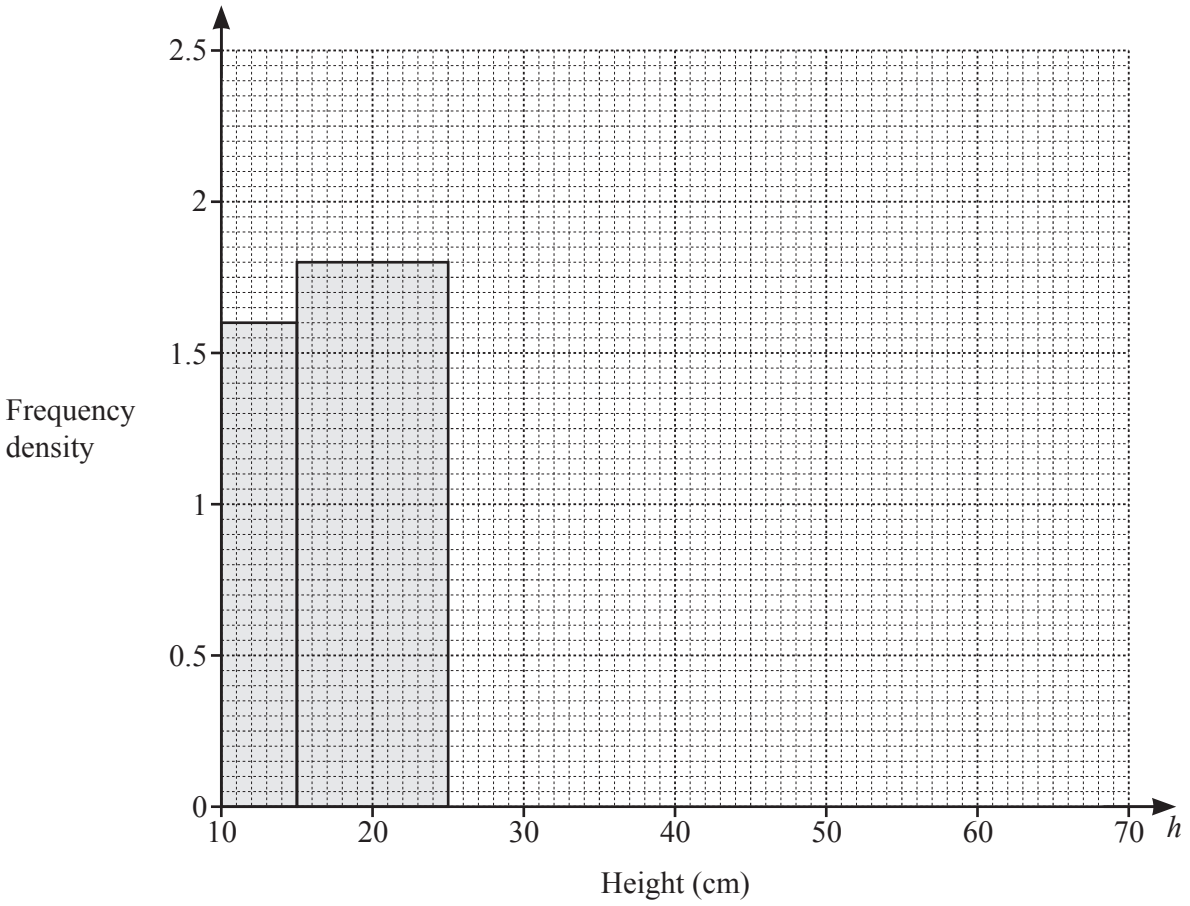
7 The height, h cm, of each of 100 plants is recorded.
The table shows information about the heights of these plants.

Height (h cm)	$10 < h \leqslant 15$	$15 < h \leqslant 25$	$25 < h \leqslant 40$	$40 < h \leqslant 60$	$60 < h \leqslant 70$
Frequency	8	18	28	33	13

(a) Complete the histogram to show this information.
The first two blocks have been drawn for you.

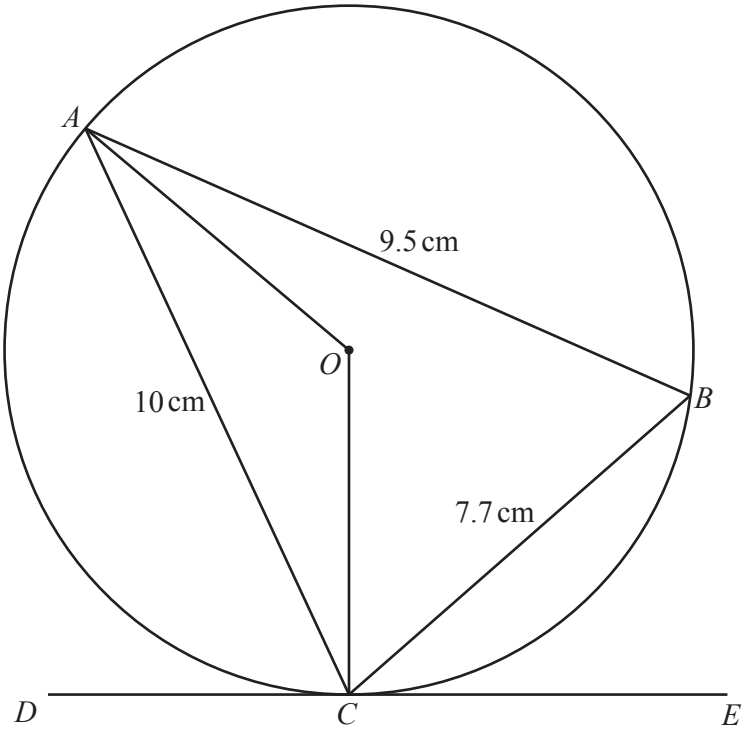


[3]

(b) Calculate an estimate of the mean height.

..... cm [4]

8



NOT TO SCALE

A, B and C are points on the circle, center O.
DE is a tangent to the circle at C.
$AC = 10\,\text{cm}$, $AB = 9.5\,\text{cm}$, and $BC = 7.7\,\text{cm}$.

(a) Show that angle $ABC = 70.2°$, correct to 1 decimal place.

[4]

(b) Find

(i) angle AOC

Angle $AOC =$ ..... [1]

(ii) angle ACO

Angle $ACO =$ ..... [1]

(iii) angle ACD.

Angle $ACD =$ ..... [1]

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(c) Calculate the radius, OC, of the circle.

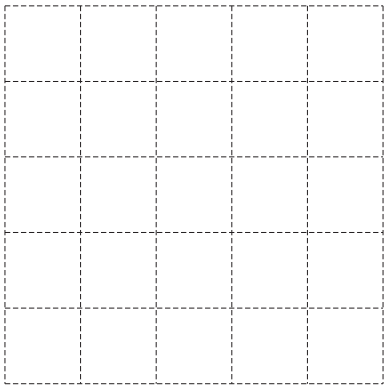
$OC =$ ..... cm [3]

(d) Calculate the area of triangle ABC as a percentage of the area of the circle.

..... % [4]

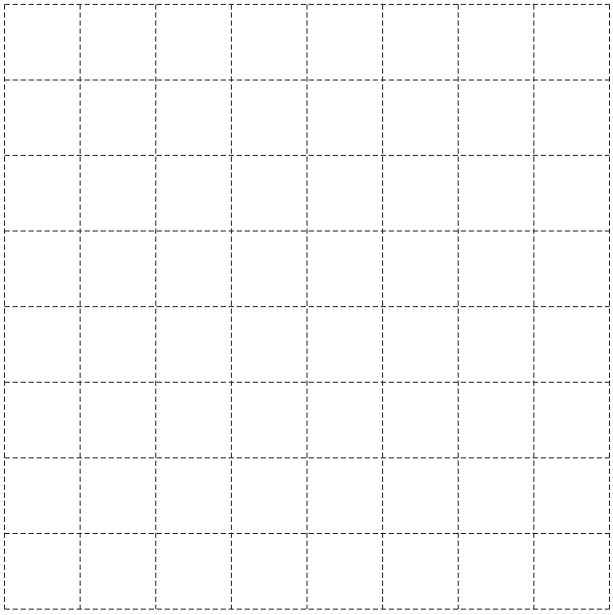
9 **(a)** $\mathbf{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$

(i) On the grid, draw and label vector $2\mathbf{a}$.



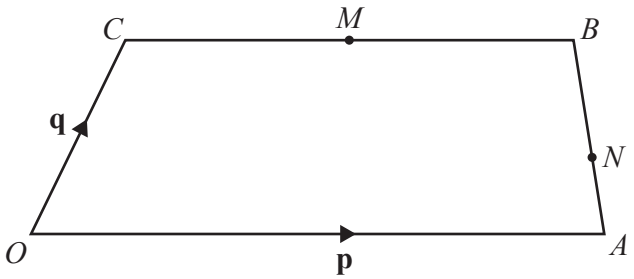
[1]

(ii) On the grid, draw and label vector $(\mathbf{a} - \mathbf{b})$.



[2]

(b)



NOT TO SCALE

$OABC$ is a trapezoid with OA parallel to CB.
M is the midpoint of CB and N is the point on AB such that $AN : NB = 1 : 2$.
O is the origin, $\overrightarrow{OA} = \mathbf{p}$, $\overrightarrow{OC} = \mathbf{q}$ and $\overrightarrow{CB} = \frac{3}{4}\mathbf{p}$.

(i) Find, in terms of **p** and/or **q**, in its simplest form

(a) $\overrightarrow{OB}$

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

(b) $\overrightarrow{AB}$

$\overrightarrow{AB} =$ ..... [2]

(c) $\overrightarrow{MN}$.

$\overrightarrow{MN} =$ ..... [3]

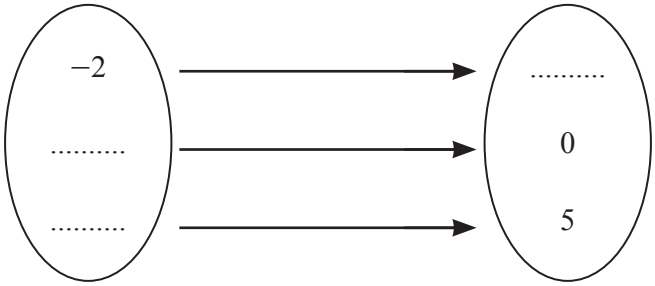
(ii) OA and MN are extended to meet at G.

Find the position vector of G in terms of **p**.

..... [2]

10 (a) $f(x) = 7 - 5x$

Complete the mapping diagram.



[3]

(b) $T(x) = 50 + 30x$

A plumber charges $T(x)$ dollars for x hours of work.

(i) Find the charge for 4 hours of work.

$ ..... [1]

(ii) Find the number of hours of work when the charge is $305.

..... hours [2]

(iii) $C(x) = 20 + 50x$

Another plumber charges $C(x)$ dollars for x hours of work.

Find the number of hours of work when the charges of the two plumbers are the same.

..... hours [2]

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(c) $\mathrm{j}(x) = a\sin bx$

The amplitude of $\mathrm{j}(x)$ is 5 and the period of $\mathrm{j}(x)$ is 60°.

Find the value of a and the value of b.

$a =$ .....

$b =$ ..... [2]

(d) (i) $\sin x^\circ = 0.2$, for $0 \leqslant x \leqslant 360$

Find the values of x.

..... [2]

(ii) Complete the statement.

$\sin x = \cos$ (.....) [1]

(e) $\mathrm{g}(x) = 5^x - 2x$

Find the value of x when $\mathrm{g}^{-1}(x) = 3$.

$x =$ ..... [2]

(f) Describe fully the **single** transformation that maps the graph of $y = \mathrm{h}(x)$ onto the graph of $y = 3\mathrm{h}(x)$.

.....

..... [3]

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