Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTER NUMBER						CANDIDATE NUMBER				

3292264135

MATHEMATICS (US) **0444/41**

Paper 4 (Extended) **May/June 2018**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Center number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If work is needed for any question it must be shown in the space provided.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant digits.
Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

The number of points is given in parentheses [ ] at the end of each question or part question.
The total of the points for this paper is 130.

Write your calculator model in the box below.

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. $\quad A = 2\pi rh$

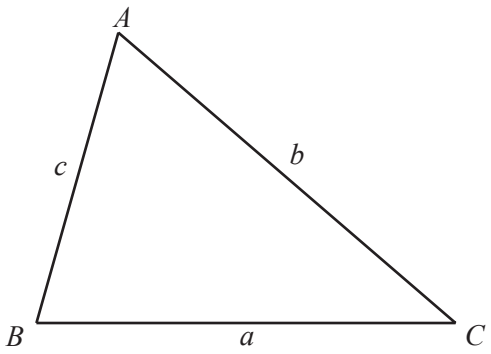
Lateral surface area, A, of cone of radius r, sloping edge l. $\quad A = \pi rl$

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 Adele, Barbara, and Collette share \$680 in the ratio 9 : 7 : 4.

(a) Show that Adele receives \$306.

[1]

(b) Calculate the amount that Barbara and Collette each receives.

Barbara \$ .....

Collette \$ ..... [3]

(c) Adele changes her \$306 into euros (€) when the exchange rate is €1 = \$1.125 .

Calculate the number of euros she receives.

€ ..... [2]

(d) Barbara spends a total of \$17.56 on 5 kg of apples and 3 kg of bananas.
Apples cost \$2.69 per kilogram.

Calculate the cost per kilogram of bananas.

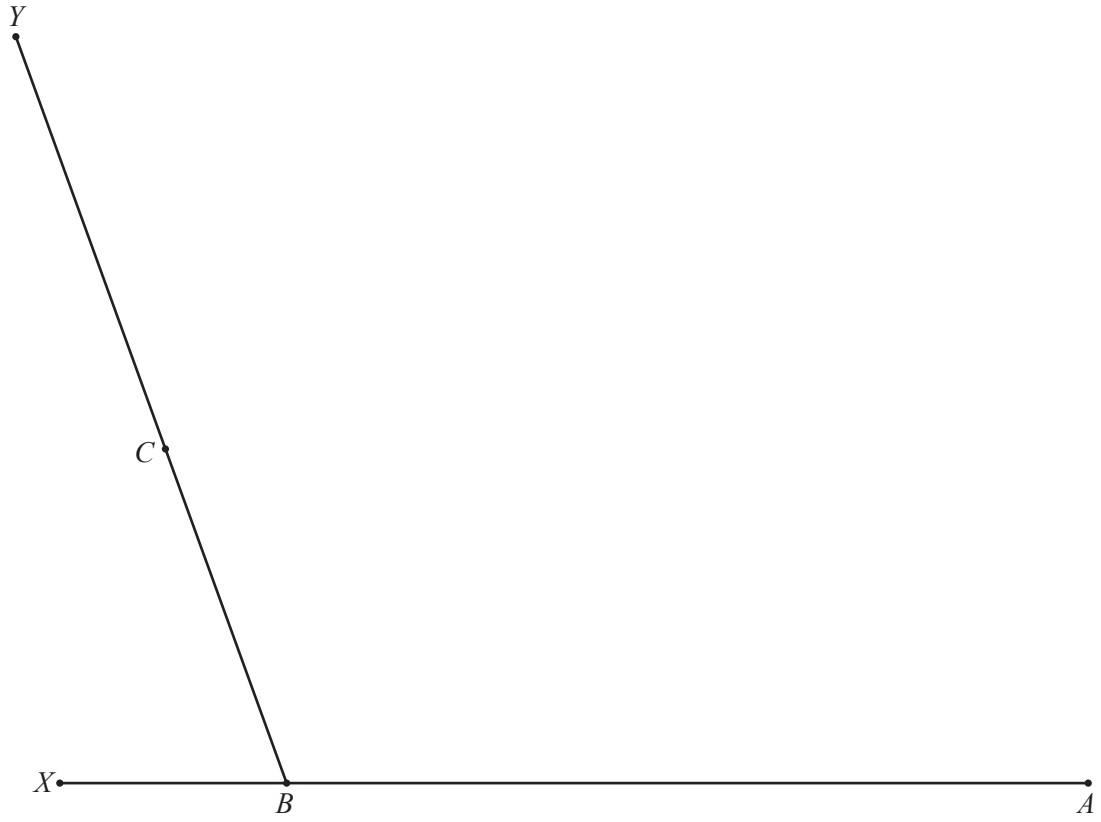
\$ ..... [3]

(e) Collette spends half of her share on clothes and $\frac{1}{5}$ of her share on books.

Calculate the amount she has left.

\$ ..... [3]

2 The diagram shows two straight lines, *XBA* and *YCB*.



(a) By copying angle *XBC* at *A*, using compass and straight edge only, draw a line through *A* parallel to *BC*. [2]

(b) Using compass and straight edge only, construct a line through *C* that is perpendicular to *YCB*. [2]

(c) The lines constructed in **part (a)** and **part (b)** meet at *D*.

Complete the quadrilateral *ABCD*. [1]

(d) Using compass and straight edge only, construct the bisector of angle *ABC*. [2]

(e) The angle bisector in **part (d)** meets *CD* at *P*.

Measure angle *BPD*.

Angle *BPD* = ... [1]

3 **(a)** The price of a house decreased from \$82 500 to \$77 500.

Calculate the percentage decrease.

..... % [3]

(b) Roland invests \$12 000 in an account that pays compound interest at a rate of 2.2% per year.

Calculate the value of his investment at the end of 6 years.
Give your answer correct to the nearest dollar.

\$ ..... [3]

4 **(a)** Factor.

(i) $2mn + m^2 - 6n - 3m$

..... [2]

(ii) $4y^2 - 81$

..... [1]

(iii) $t^2 - 6t + 8$

..... [2]

(b) Solve for x.

$$k = \frac{2m - x}{x}$$

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

(c) Solve the system of linear equations.
You must show all your working.

$$\tfrac{1}{2}x - 3y = 9$$
$$5x + y = 28$$

$x =$ .....

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

(d) $\dfrac{3}{m+4} - \dfrac{4}{m} = 6$

(i) Show that this equation can be written as $6m^2 + 25m + 16 = 0$.

[3]

(ii) Solve the equation $6m^2 + 25m + 16 = 0$.
Show all your working and give your answers correct to 2 decimal places.

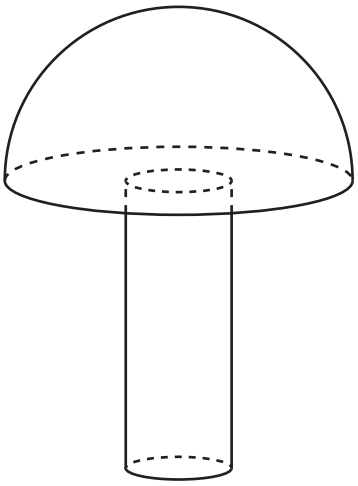
$m =$ ..... or $m =$ ..... [4]

5 A solid hemisphere has volume 230 cm^3.

(a) Calculate the radius of the hemisphere.

..... cm [3]

(b) A solid cylinder with radius 1.6 cm is attached to the hemisphere to make a toy.



NOT TO SCALE

The total volume of the toy is 300 cm^3.

(i) Calculate the height of the cylinder.

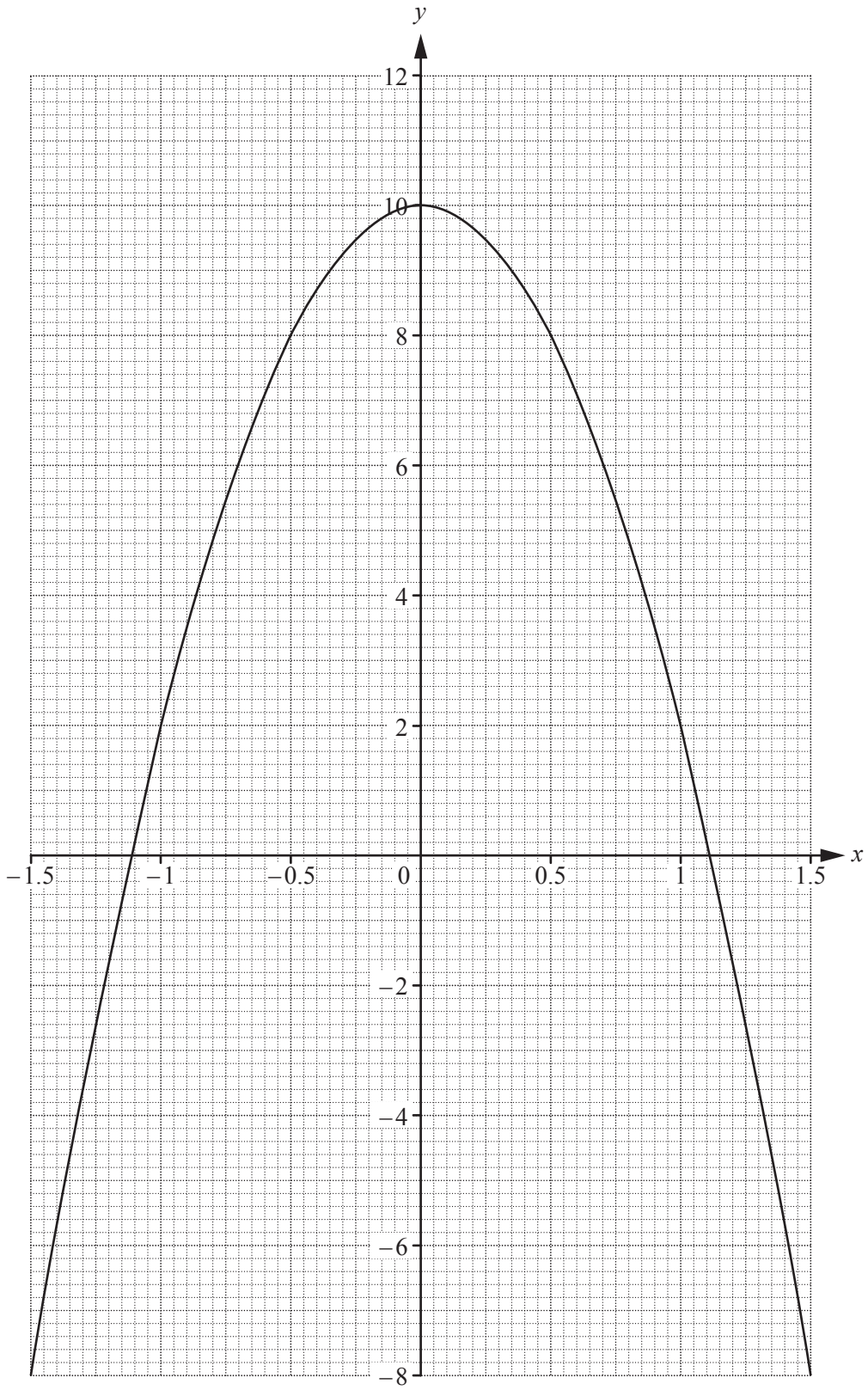
..... cm [3]

(ii) A mathematically similar toy has volume 19 200 cm^3.

Calculate the radius of the cylinder for this toy.

..... cm [3]

6 The graph of $y = 10 - 8x^2$ for $-1.5 \leqslant x \leqslant 1.5$ is drawn on the grid.



(a) Write down the equation of the line of symmetry of the graph.

..... [1]

(b) On the grid on the opposite page, draw the tangent to the curve at the point where $x = 0.5$.
Find the slope of this tangent.

..... [3]

(c) The table shows some values for $y = x^3 + 3x + 4$.

x	-1.5	-1	-0.5	0	0.5	1	1.5
y	-3.9				5.6	8	11.9

(i) Complete the table. [3]

(ii) On the grid on the opposite page, draw the graph of $y = x^3 + 3x + 4$ for $-1.5 \leqslant x \leqslant 1.5$. [4]

(d) Show that the values of x where the two curves intersect are the solutions to the equation $x^3 + 8x^2 + 3x - 6 = 0$.

[1]

(e) By drawing a suitable straight line, solve the equation $x^3 + 5x + 2 = 0$ for $-1.5 \leqslant x \leqslant 1.5$.

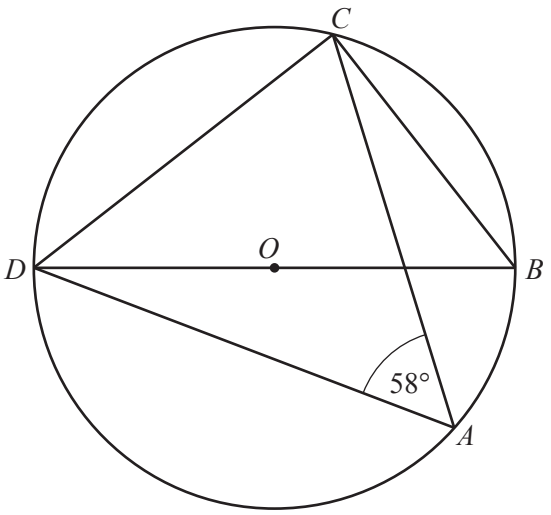
$x =$ ..... [3]

7 **(a)** The exterior angle of a regular polygon is $x°$ and the interior angle is $8x°$.

Calculate the number of sides of the polygon.

..... [3]

(b)



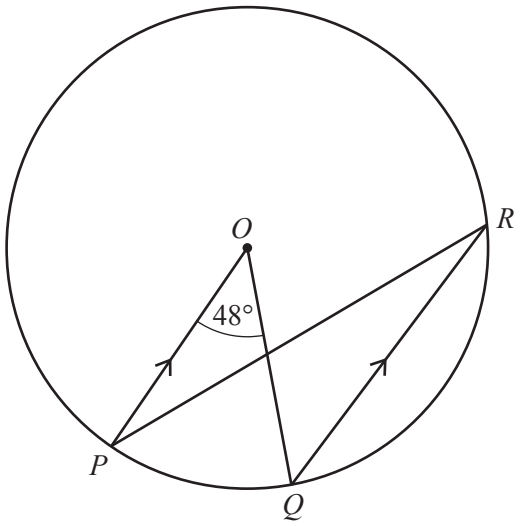
NOT TO SCALE

A, B, C, and D are points on the circumference of the circle, center O.
DOB is a straight line and angle $DAC = 58°$.

Find angle CDB.

Angle CDB = ... [3]

(c)



NOT TO SCALE

P, Q, and R are points on the circumference of the circle, center O.
PO is parallel to QR and angle $POQ = 48°$.

(i) Find angle OPR.

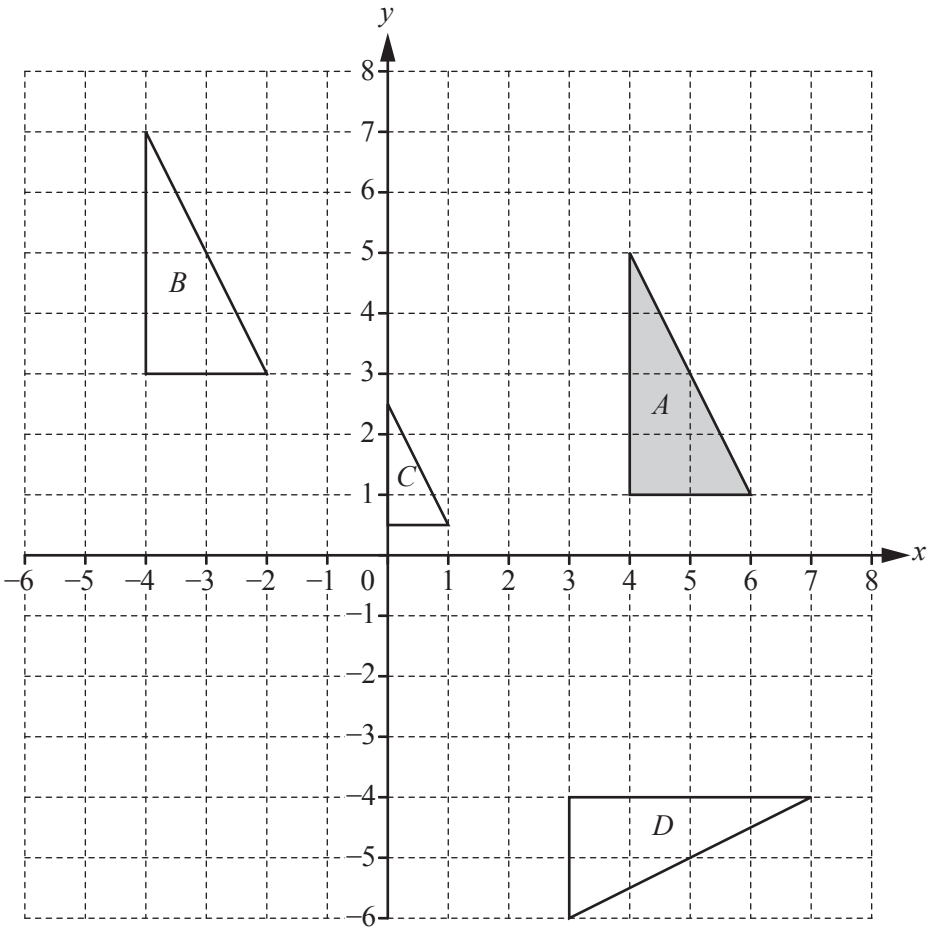
Angle OPR = ... [2]

(ii) The radius of the circle is 5.4 cm.

Calculate the length of the **major** arc PQ.

..... cm [3]

8



(a) Describe fully the **single** transformation that maps

(i) triangle A onto triangle B,

.....

..... [2]

(ii) triangle A onto triangle C,

.....

..... [3]

(iii) triangle A onto triangle D.

.....

..... [3]

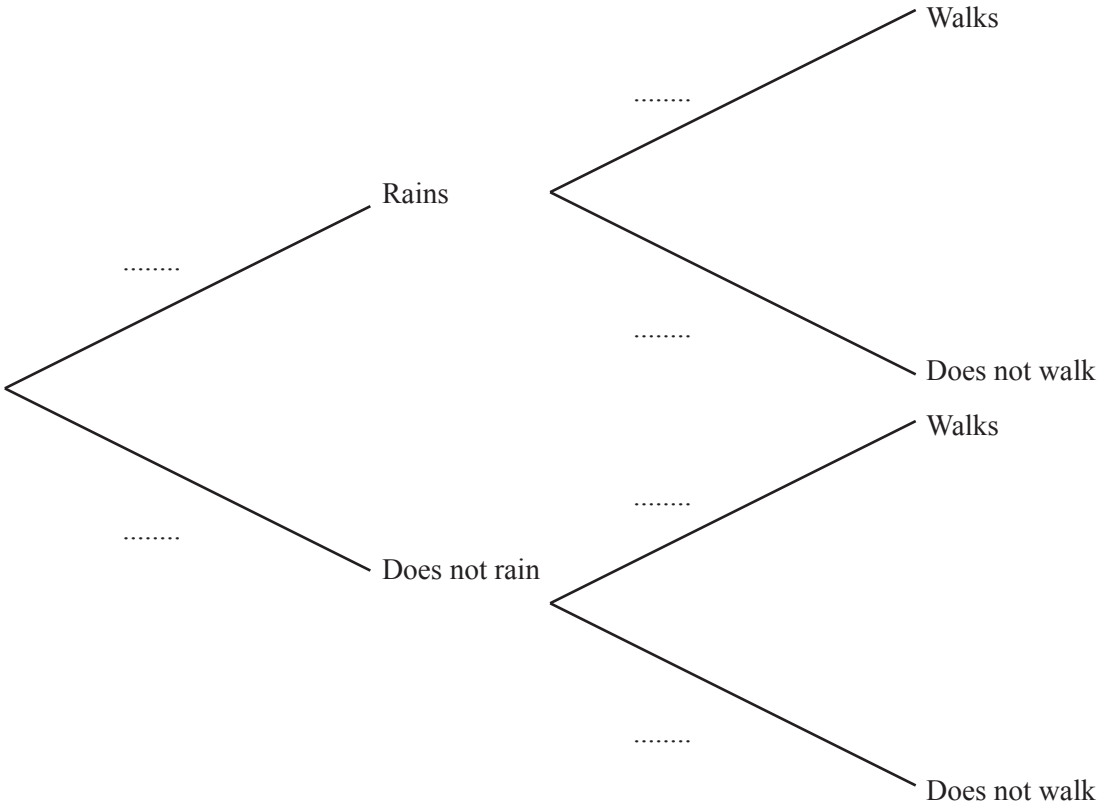
(b) On the grid, draw the image of triangle A after an enlargement by scale factor 2, center $(7, 3)$. [2]

9 The probability that it will rain tomorrow is $\frac{5}{8}$.

If it rains, the probability that Rafael walks to school is $\frac{1}{6}$.

If it does not rain, the probability that Rafael walks to school is $\frac{7}{10}$.

(a) Complete the tree diagram.



[3]

(b) Calculate the probability that it will rain tomorrow and Rafael walks to school.

..... [2]

(c) Calculate the probability that Rafael does not walk to school.

..... [3]

10 **(a)** $\overrightarrow{OA} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ $\overrightarrow{AB} = \begin{pmatrix} 8 \\ -7 \end{pmatrix}$ $\overrightarrow{AC} = \begin{pmatrix} -3 \\ 6 \end{pmatrix}$

Find

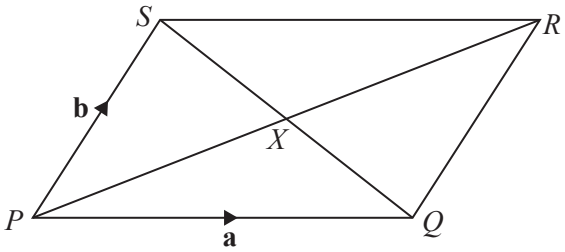
(i) $\left|\overrightarrow{OB}\right|$,

$\left|\overrightarrow{OB}\right|$ = ... [3]

(ii) $\overrightarrow{BC}$.

$\overrightarrow{BC}$ = $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(b)



NOT TO SCALE

$PQRS$ is a parallelogram with diagonals PR and SQ intersecting at X.
$\overrightarrow{PQ} = \mathbf{a}$ and $\overrightarrow{PS} = \mathbf{b}$.

Find $\overrightarrow{QX}$ in terms of **a** and **b**.
Give your answer in its simplest form.

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

11 $f(x) = 5 - 2x$ $g(x) = x^2 + 8$ $h(x) = 2^x$

(a) For the domain $\{-3, 0, 3\}$, find the range of $h(x)$.

{..... } [2]

(b) Find $g(g(1))$.

..... [2]

(c) Find x when $h(x) = 32$.

$x =$ ..... [1]

(d) Find $g(2x)$.

..... [1]

(e) Find x when $f(x) = h(3)$.

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

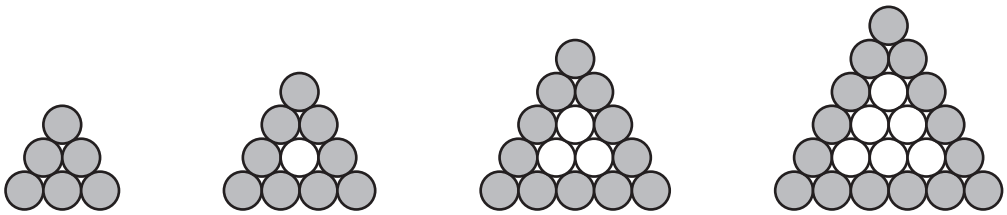
(f) Find $f^{-1}(x)$.

$f^{-1}(x) =$ ..... [2]

(g) Find $g(f(x))$ in the form $ax^2 + bx + c$.

..... [3]

12 Marco is making patterns with gray and white circular mats.



Pattern 1 Pattern 2 Pattern 3 Pattern 4

The patterns form a sequence.
Marco makes a table to show some information about the patterns.

Pattern number	1	2	3	4	5
Number of gray mats	6	9	12	15	
Total number of mats	6	10	15	21	

(a) Complete the table for Pattern 5. [2]

(b) Find an expression, in terms of n, for the number of gray mats in Pattern n.

..... [2]

(c) Marco makes a pattern with 24 gray mats.

Find the total number of mats in this pattern.

..... [2]

(d) Marco needs a total of 6 mats to make the first pattern.
He needs a total of 16 mats to make the first two patterns.
He needs a total of $\frac{1}{6}n^3 + an^2 + bn$ mats to make the first n patterns.

Find the value of a and the value of b.

$a =$ .....

$b =$ ..... [6]

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