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0580/41

May/June 2018

2 hours 30 minutes

Additional Materials:	Electronic calculator	Geometrical instruments
	Tracing paper (optional)	

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

For π , use either your calculator value or 3.142.

The total of the marks for this paper is 130.

This document consists of **19** printed pages and **1** blank page.

- 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.

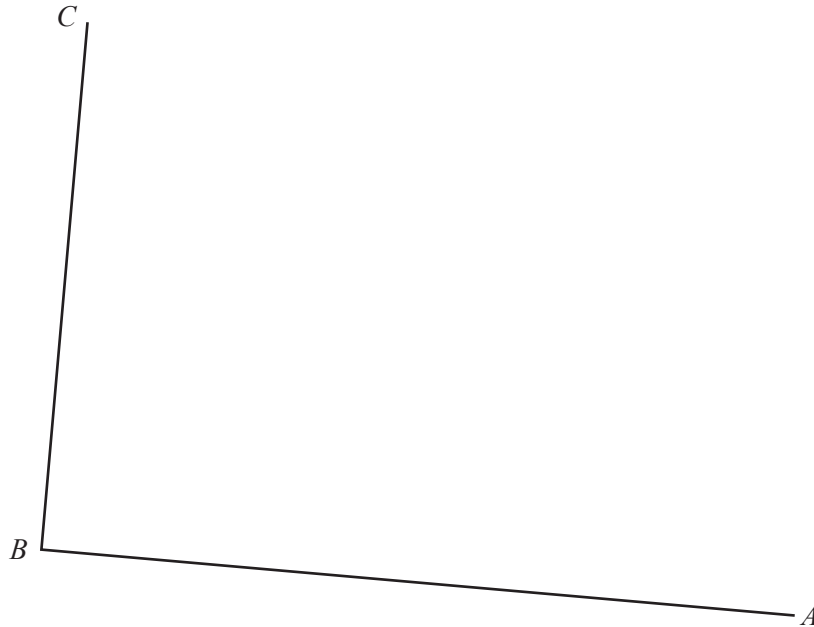
\$ [3]

(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 scale drawing shows two boundaries, AB and BC , of a field $ABCD$.
The scale of the drawing is 1 cm represents 8 m.



Scale: 1 cm to 8 m

- (a) The boundaries CD and AD of the field are each 72 m long.
- (i) Work out the length of CD and AD on the scale drawing.
- cm [1]
- (ii) **Using a ruler and compasses only**, complete accurately the scale drawing of the field. [2]
- (b) A tree in the field is
- equidistant from A and B
- and
- equidistant from AB and BC .

On the scale drawing, construct two lines to find the position of the tree.
Use a straight edge and compasses only and leave in your construction arcs. [4]

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

Calculate the percentage decrease.

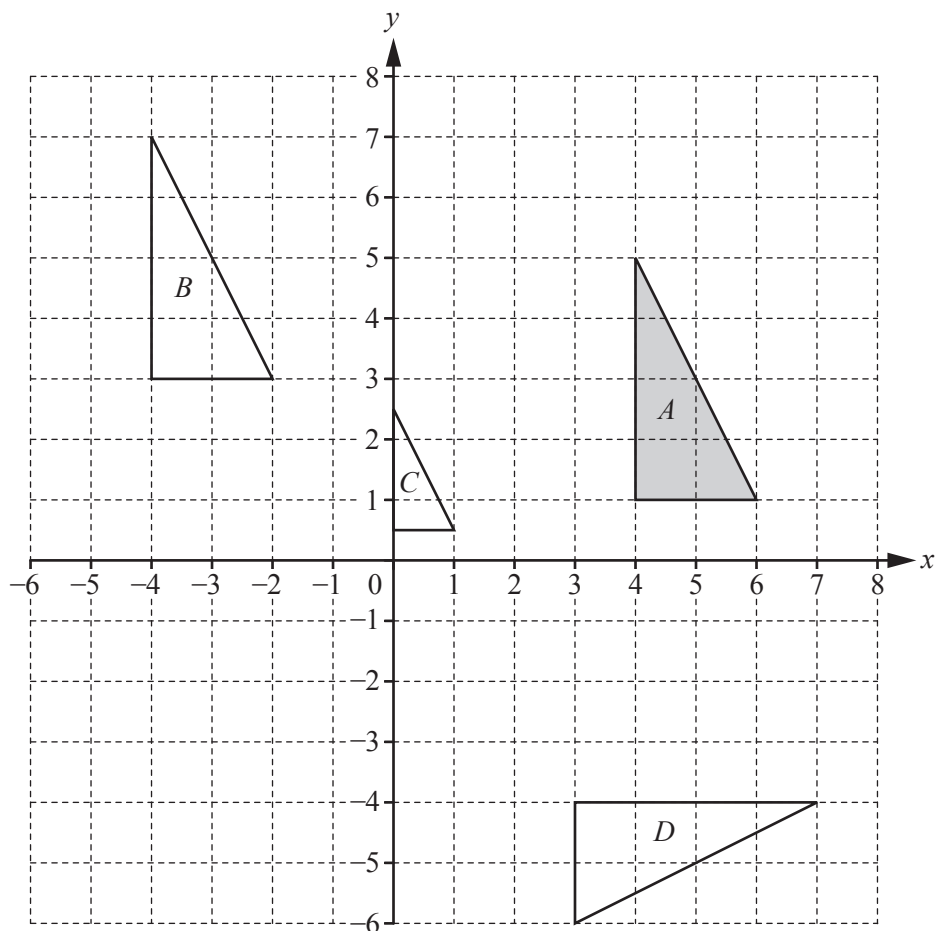
..... % [3]

- (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]



(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, centre $(7, 3)$. [2]

5 (a) Factorise.

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

..... [2]

(ii) $4y^2 - 81$

..... [1]

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

..... [2]

(b) Rearrange the formula to make x the subject.

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

$x =$ [4]

- (c) Solve the simultaneous equations.
You must show all your working.

$$\begin{aligned}\frac{1}{2}x - 3y &= 9 \\ 5x + y &= 28\end{aligned}$$

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots [3]$$

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

- (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.

$$m = \dots\dots\dots \text{ or } m = \dots\dots\dots [4]$$

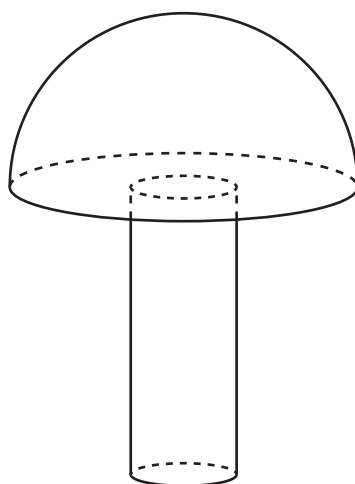
- 6 A solid hemisphere has volume 230 cm^3 .

(a) Calculate the radius of the hemisphere.

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

..... cm [3]

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



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

(i) Calculate the height of the cylinder.

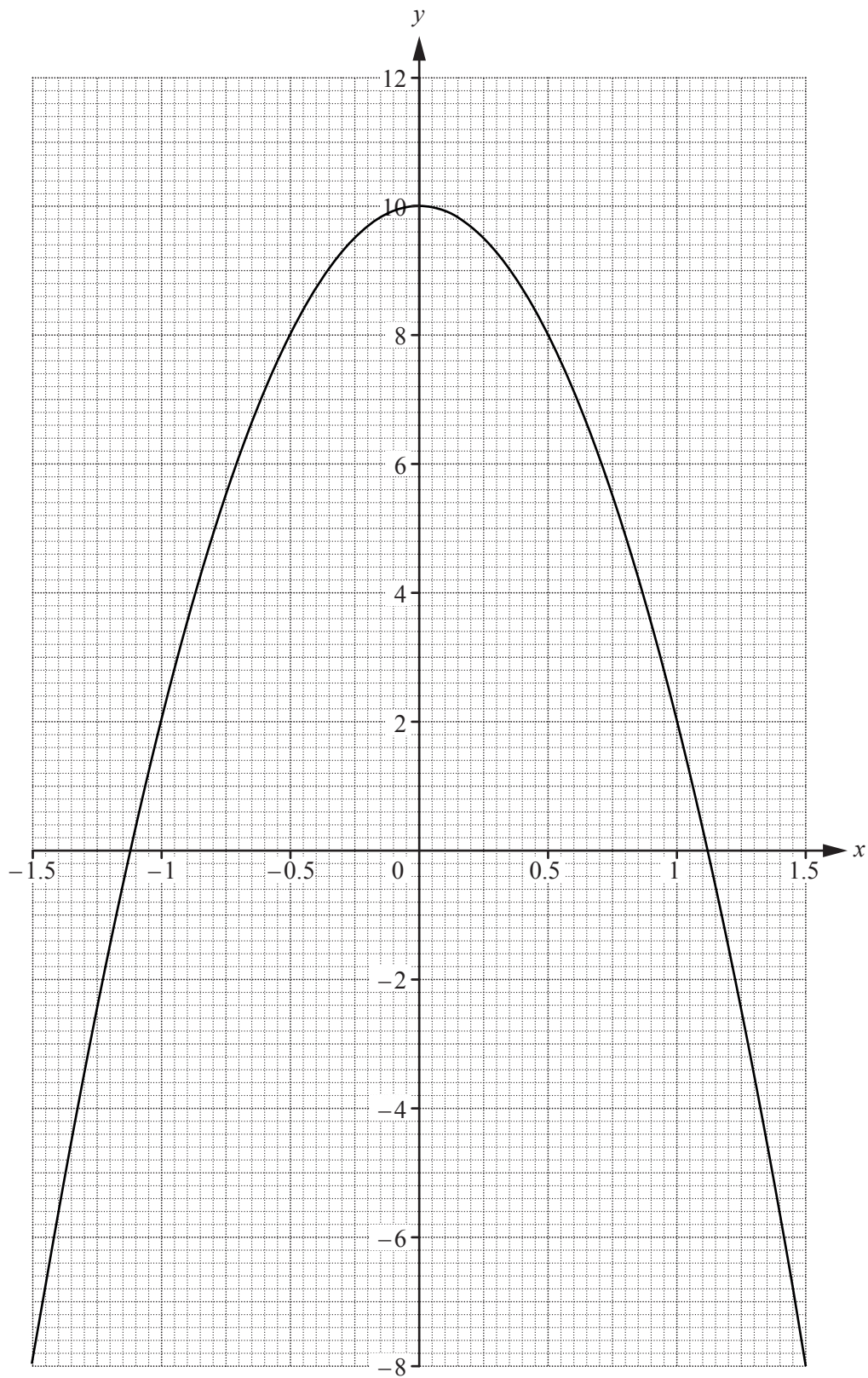
..... cm [3]

- (ii) A mathematically similar toy has volume $19\,200\text{ cm}^3$.

Calculate the radius of the cylinder for this toy.

..... cm [3]

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



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

..... [1]

- (b) On the grid opposite, draw the tangent to the curve at the point where $x = 0.5$.
Find the gradient 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 opposite, draw the graph of $y = x^3 + 3x + 4$ for $-1.5 \leq x \leq 1.5$. [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 $-1.5 \leq x \leq 1.5$.

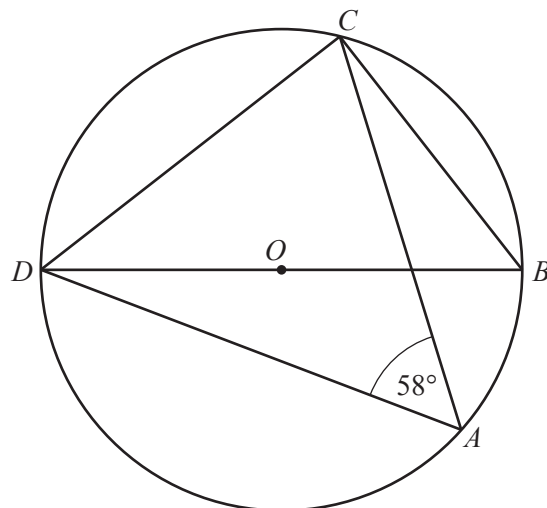
$x =$ [3]

- 8 (a) The exterior angle of a regular polygon is x° and the interior angle is $8x^\circ$.

Calculate the number of sides of the polygon.

..... [3]

(b)



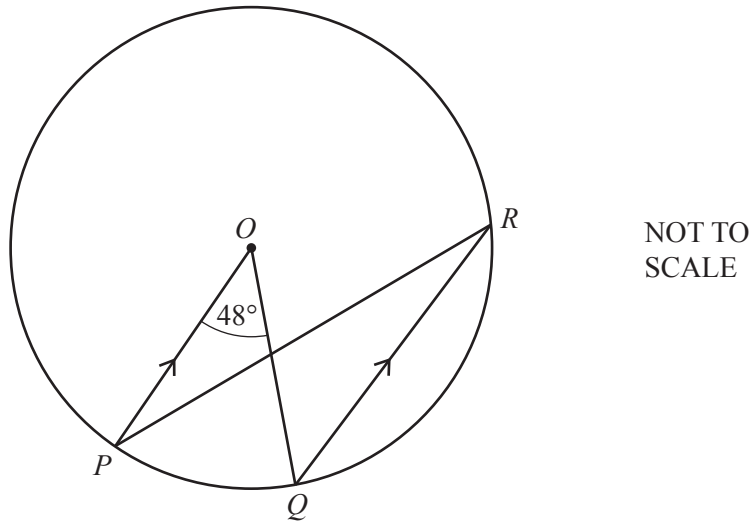
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A , B , C and D are points on the circumference of the circle, centre O .
 DOB is a straight line and angle $DAC = 58^\circ$.

Find angle CDB .

Angle $CDB =$ [3]

(c)



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

(i) Find angle OPR .

Angle $OPR = \dots\dots\dots$ [2]

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

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

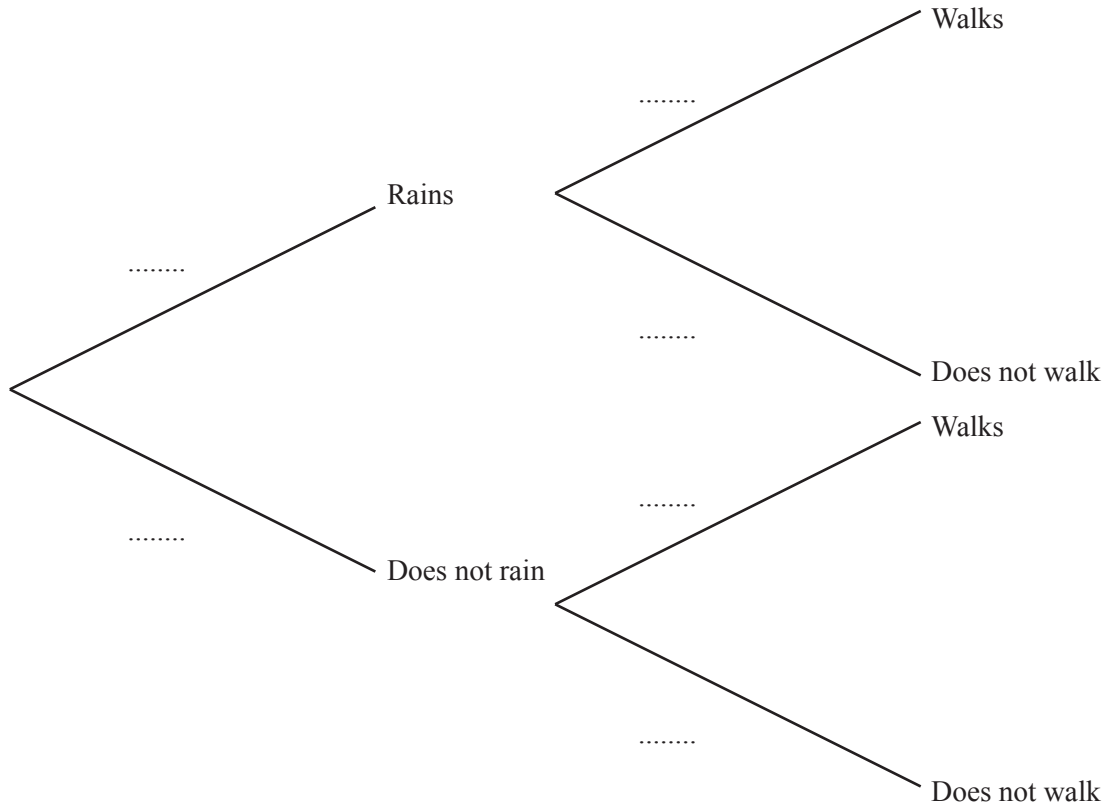
$\dots\dots\dots$ cm [3]

- 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) In 2017, the membership fee for a sports club was \$79.50 .
This was an increase of 6% on the fee in 2016.

Calculate the fee in 2016.

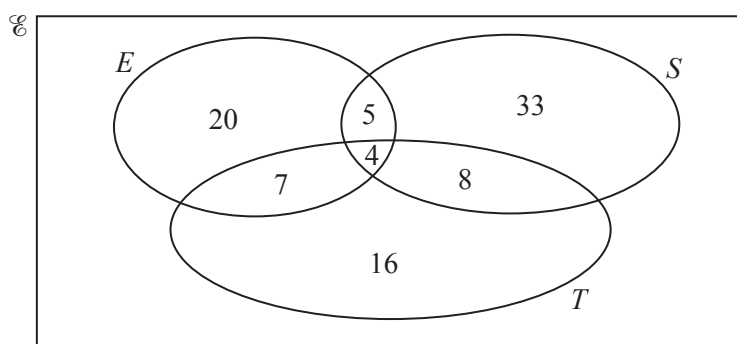
\$ [3]

- (b) On one day, the number of members using the exercise machines was 40, correct to the nearest 10.
Each member used a machine for 30 minutes, correct to the nearest 5 minutes.

Calculate the lower bound for the number of minutes the exercise machines were used on this day.

..... min [2]

- (c) On another day, the number of members using the exercise machines (E), the swimming pool (S) and the tennis courts (T) is shown on the Venn diagram.



- (i) Find the number of members using only the tennis courts.

..... [1]

- (ii) Find the number of members using the swimming pool.

..... [1]

- (iii) A member using the swimming pool is chosen at random.

Find the probability that this member also uses the tennis courts and the exercise machines.

..... [2]

- (iv) Find $n(T \cap (E \cup S))$.

..... [1]

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

Find

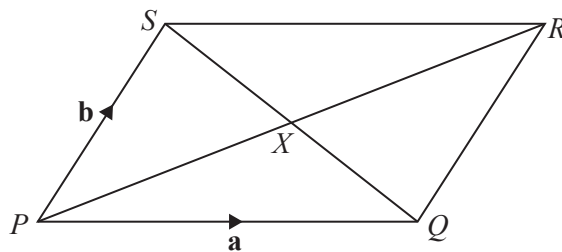
(i) $|\vec{OB}|$,

$|\vec{OB}| = \dots\dots\dots [3]$

(ii) $\vec{BC}$.

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

(b)



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$PQRS$ is a parallelogram with diagonals PR and SQ intersecting at X .

$\vec{PQ} = \mathbf{a}$ and $\vec{PS} = \mathbf{b}$.

Find $\vec{QX}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.

Give your answer in its simplest form.

$\vec{QX} = \dots\dots\dots [2]$

(c) $\mathbf{M} = \begin{pmatrix} 2 & 5 \\ 1 & 8 \end{pmatrix}$

Calculate

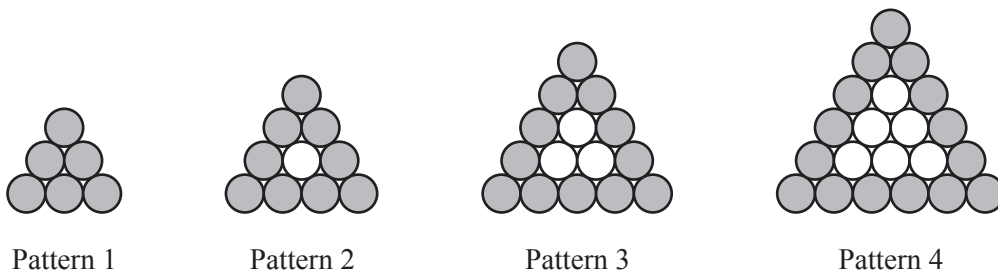
(i) $\mathbf{M}^2$,

(ii) $\mathbf{M}^{-1}$.

$$\mathbf{M}^2 = \begin{pmatrix} & \\ & \end{pmatrix} \quad [2]$$

$$\mathbf{M}^{-1} = \begin{pmatrix} & \\ & \end{pmatrix} \quad [2]$$

- 12 Marco is making patterns with grey and white circular mats.



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 grey 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 grey mats in Pattern n .

..... [2]

- (c) Marco makes a pattern with 24 grey 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 .

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots [6]$$

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