

Total marks — 40
Attempt ALL questions

1. Given that $f(x) = x^2 + 3x$, evaluate $f(-5)$.

2

2. The number of calls received by the police was recorded over 10 days.
The results are shown below.

198 216 218 230 232 247 248 250 265 267

Find the semi-interquartile range of this data.

2

[Turn over



* X 7 4 7 7 5 0 1 0 3 *

3. Evaluate $1\frac{5}{6} \div \frac{3}{4}$.

Give your answer in its simplest form.

2

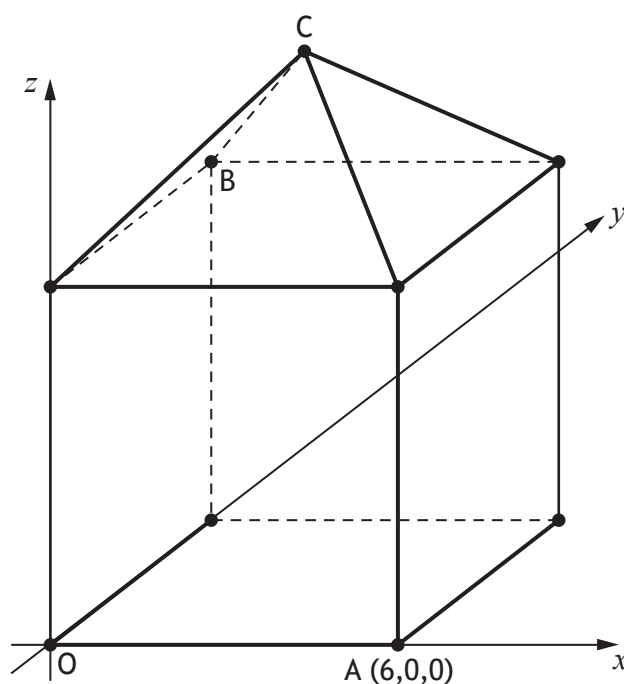
4. Expand and simplify $(2x + 3)(x^2 - 4x + 1)$.

3



* X 7 4 7 7 5 0 1 0 4 *

5. The diagram shows a square-based pyramid placed on top of a cube, relative to the coordinate axes.



The height of the pyramid is half of the height of the cube.

A is the point $(6, 0, 0)$.

The point C is directly above the centre of the base.

Write down the coordinates of B and C.

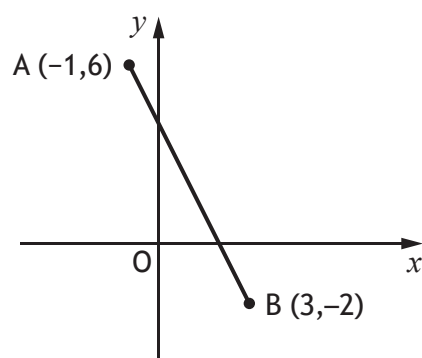
2

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* X 7 4 7 7 5 0 1 0 5 *

6. The diagram below shows the straight line joining points A and B.



Find the equation of the line AB.

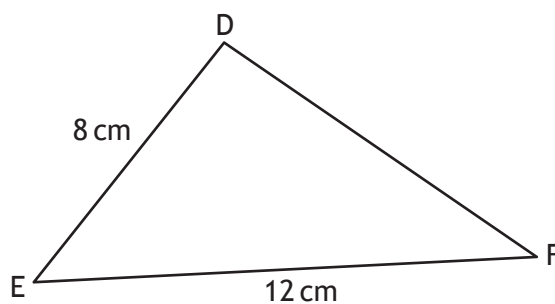
Give the equation in its simplest form.

3



7. In triangle DEF:

- $DE = 8$ centimetres
- $EF = 12$ centimetres
- $\sin E = \frac{2}{3}$



Calculate the area of triangle DEF.

2

[Turn over



* X 7 4 7 7 5 0 1 0 7 *

MARKS

DO NOT
WRITE IN
THIS
MARGIN

8. Solve, algebraically, the inequality

$$19 + x > 15 + 3(x - 2).$$

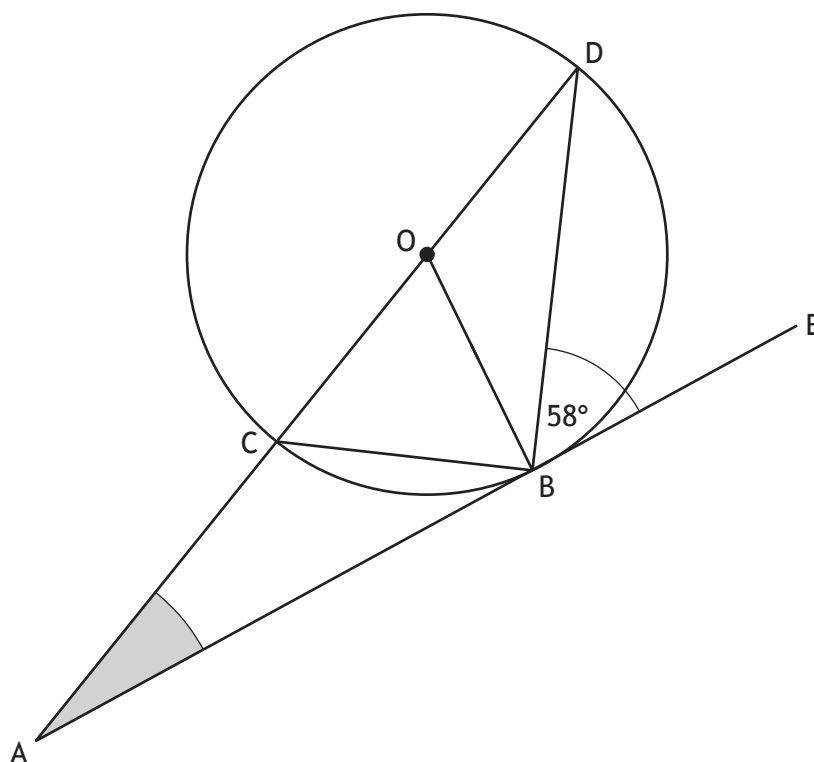
3



* X 7 4 7 7 5 0 1 0 8 *

9. In the diagram shown below:

- ABE is a tangent to the circle centre O
- Angle DBE is 58°



Calculate the size of angle CAB.

3

[Turn over



* X 7 4 7 7 5 0 1 0 9 *

10. Change the subject of the formula $F = \frac{t^2 + 4b}{c}$ to b .

3

11. Express $\frac{3}{a^2} - \frac{2}{a}$, $a \neq 0$, as a single fraction in its simplest form.

2



* X 7 4 7 7 5 0 1 1 0 *

12. Gym members are asked to fill out a questionnaire to rate the quality of service provided.

They are asked to give a rating on a scale of 1 to 6.

The ratings given by five members were as follows:

1 4 6 3 6

In its simplest form, the standard deviation of these ratings can be written as $\frac{a\sqrt{b}}{2}$.

Find the values of a and b .

4

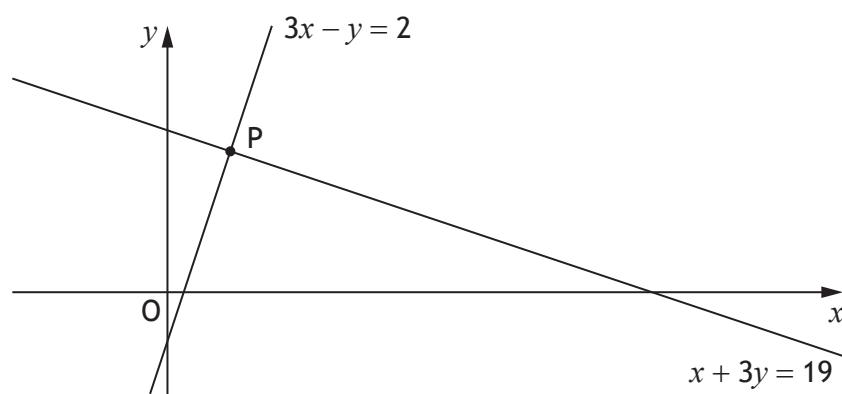
[Turn over



* X 7 4 7 7 5 0 1 1 1 *

13. The graph below shows two straight lines with the equations:

- $3x - y = 2$
- $x + 3y = 19$



The lines intersect at the point P.

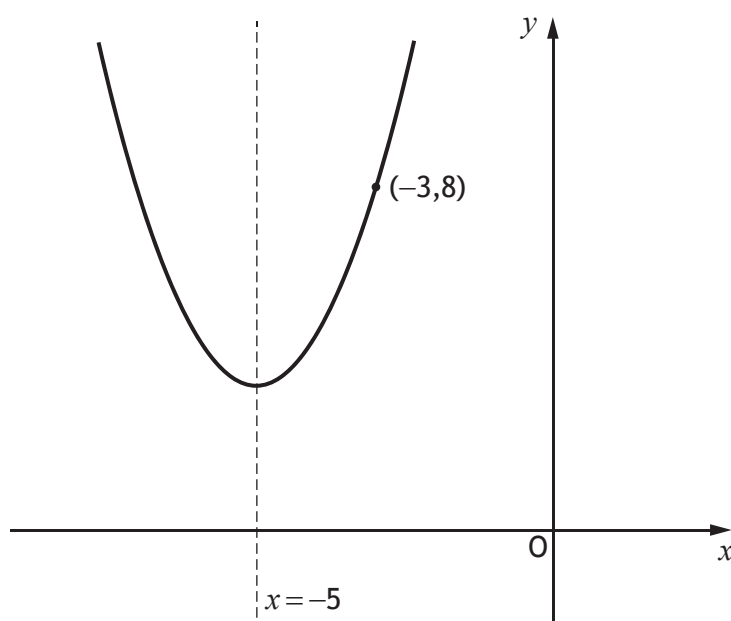
Find, **algebraically**, the coordinates of P.

3



* X 7 4 7 7 5 0 1 1 2 *

14. The graph below shows a parabola with equation of the form $y = (x + a)^2 + b$.



The equation of the axis of symmetry of the parabola is $x = -5$.

- (a) State the value of a .

1

The point $(-3, 8)$ lies on the parabola.

- (b) Calculate the value of b .

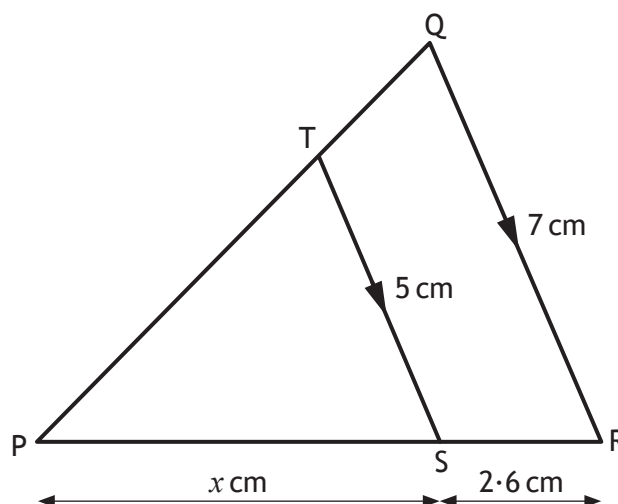
2

[Turn over for next question]



15. In the diagram below:

- TS is parallel to QR
- $TS = 5$ centimetres
- $QR = 7$ centimetres
- $SR = 2.6$ centimetres



The length of PS is x centimetres.

Calculate the value of x .

3

[END OF QUESTION PAPER]



* X 7 4 7 7 5 0 1 1 4 *

Total marks — 50
Attempt ALL questions

1. Find $|\mathbf{v}|$, the magnitude of vector $\mathbf{v} = \begin{pmatrix} 18 \\ -14 \\ 3 \end{pmatrix}$.

2

2. A necklace is valued at £1200.
Its value is expected to increase by 4.5% per year over the next 3 years.
Calculate the expected value of the necklace after this time.
Give your answer to the nearest pound.

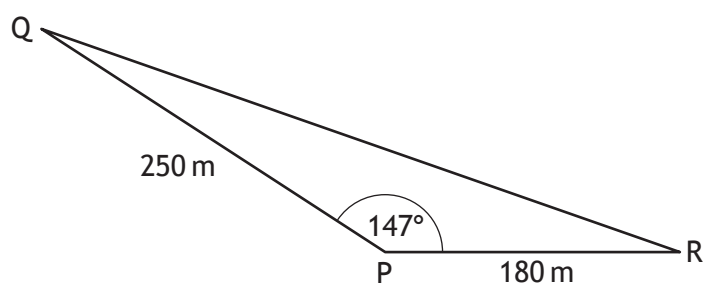
3

[Turn over



* X 7 4 7 7 5 0 2 0 3 *

3. A piece of land is in the shape of a triangle as shown.



- $PQ = 250$ metres
- $PR = 180$ metres
- $\text{angle } QPR = 147^\circ$

The owner wishes to build a fence along the side QR.
Calculate the length of the fence.

3



* X 7 4 7 7 5 0 2 0 4 *

4. Solve the equation $2x^2 + 5x - 4 = 0$.

Give your answers correct to one decimal place.

3

5. A theatre group sold 4830 tickets for their show.

This was 15% more than they sold last year.

How many tickets did they sell last year?

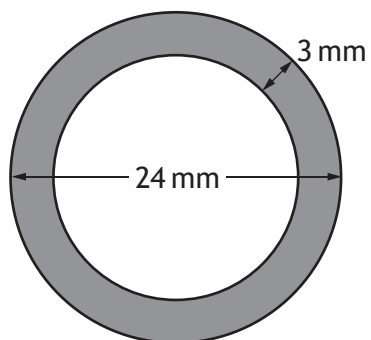
3

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* X 7 4 7 7 5 0 2 0 5 *

6. A spherical sweet is made by coating a caramel sphere evenly with chocolate. A cross-section of the sweet is shown below.



The diameter of the sweet is 24 millimetres and the thickness of the chocolate coating is 3 millimetres.

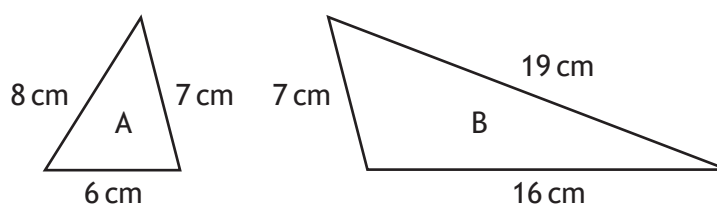
Calculate the volume of the chocolate coating.

Give your answer correct to 3 significant figures.

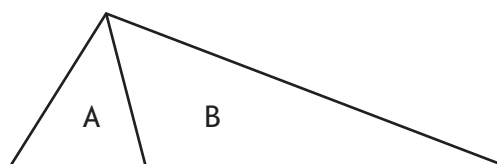
5



7. Triangles A and B are shown below.



The triangles are placed together to form the larger triangle shown below.



Is this larger triangle right-angled?

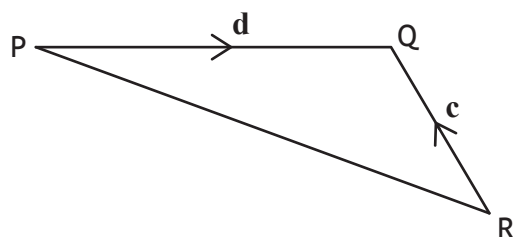
Justify your answer.

3

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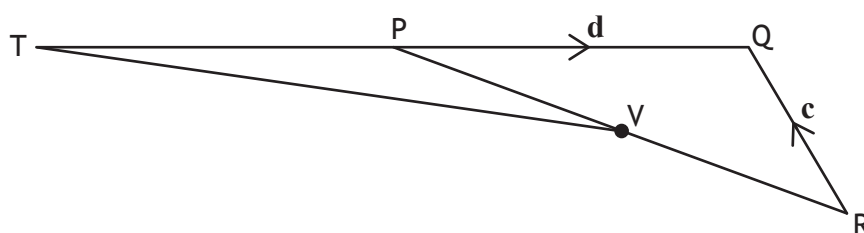
8. In the diagram below, \vec{RQ} and \vec{PQ} represent the vectors \mathbf{c} and \mathbf{d} respectively.



- (a) Express \vec{PR} in terms of \mathbf{c} and \mathbf{d} .

1

The line QP is extended to T.



- $TP = PQ$
- V is the midpoint of PR

- (b) Express \vec{TV} in terms of \mathbf{c} and \mathbf{d} .
Give your answer in simplest form.

2



MARKS

DO NOT
WRITE IN
THIS
MARGIN

9. (a) Factorise $4x^2 - 25$.

1

(b) Hence simplify $\frac{4x^2 - 25}{2x^2 - x - 10}$.

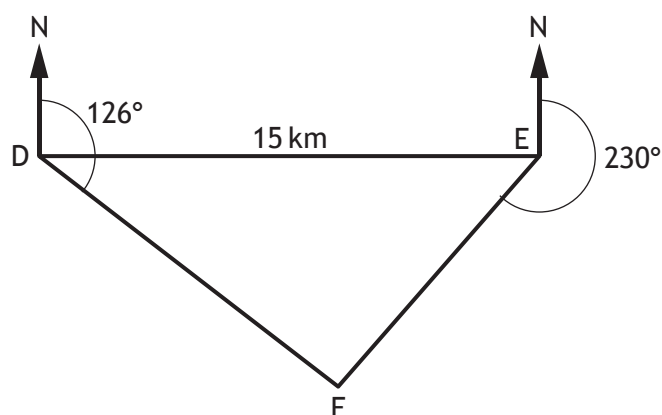
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* X 7 4 7 7 5 0 2 0 9 *

10. In the diagram below D, E and F represent the positions of Dunbridge, Earlsford and Fairtown respectively.



Dunbridge is 15 kilometres west of Earlsford.

From Dunbridge, the bearing of Fairtown is 126° .

From Earlsford the bearing of Fairtown is 230° .

Calculate the distance between Dunbridge and Fairtown.

Do not use a scale drawing.

4

MARKS

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THIS
MARGIN

11. A straight line has equation $3x - 5y - 10 = 0$.
Find the gradient of this line.

2

12. Express $\frac{1}{\sqrt[3]{x}}$ in the form x^n .

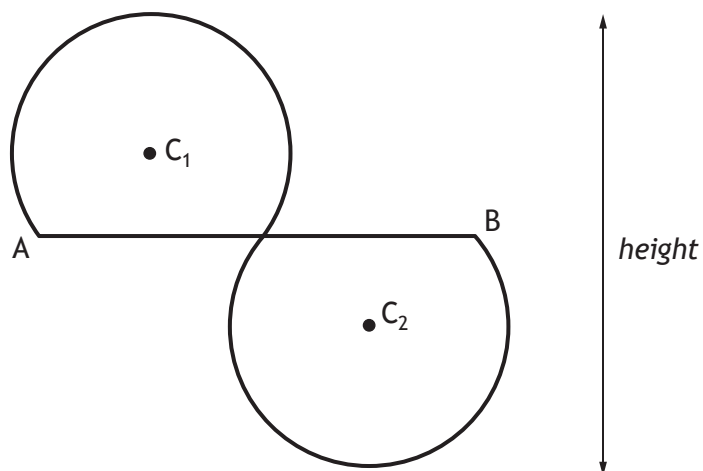
2

[Turn over



* X 7 4 7 7 5 0 2 1 1 *

13. Two identical shapes are used to form a logo.
Each shape is part of a circle.



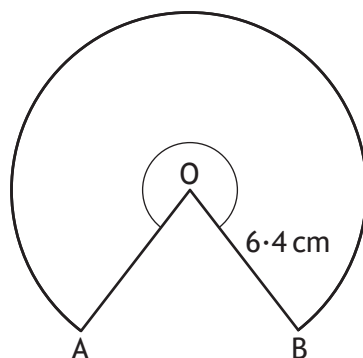
- The circles have centres C_1 and C_2 .
- The radius of each circle is 14 centimetres.
- The logo has half-turn symmetry about the mid-point of AB .
- AB is 48 centimetres long.

Calculate the height of the logo.

4



14. The diagram below shows part of a circle, centre O.



The radius of the circle is 6.4 centimetres.

Major arc AB has length 31.5 centimetres.

Calculate the size of the reflex angle AOB.

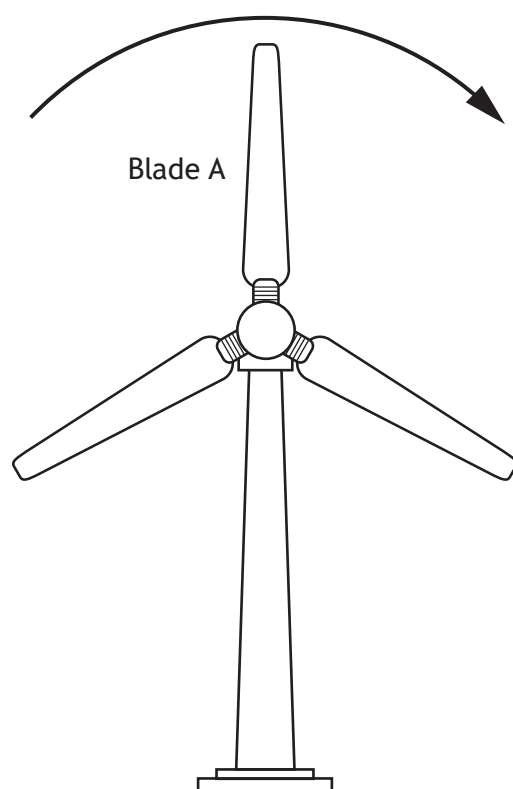
3

[Turn over]



* X 7 4 7 7 5 0 2 1 3 *

15. A wind turbine has three blades as shown below.



The height, h metres, of the tip of blade A above the ground in each rotation is given by

$$h = 40 + 23 \cos x^\circ, \quad 0 \leq x < 360$$

where x is the angle blade A has turned clockwise from its vertical position.

- (a) Calculate the height of the tip of blade A after it has turned through an angle of 60° .

1



* X 7 4 7 7 5 0 2 1 4 *

15. (continued)

(b) Find the minimum height of the tip of blade A above the ground.

1

(c) Calculate the values of x for which the tip of blade A is 61 metres above the ground.

4

[END OF QUESTION PAPER]



* X 7 4 7 7 5 0 2 1 5 *