Dr Oliver Mathematics
Mathematics: National Qualifications N5
2017 Paper 2: Calculator
1 hour 20 minutes

The total number of marks available is 50.
You must write down all the stages in your working.

1. Find $|\mathbf{v}|$, the magnitude of vector (2)

$$\mathbf{v} = \begin{pmatrix} 18 \\ -14 \\ 3 \end{pmatrix}.$$

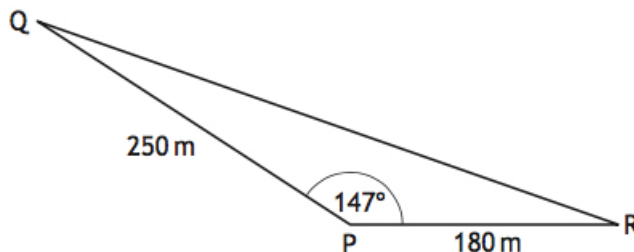2. A necklace is valued at £1 200. (3)
   Its value is expected to increase by 4.5% per year over the next 3 years.
   Calculate the expected value of the necklace after this time.
   Give your answer to the nearest pound.

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

   - $PQ = 250$ metres,

   - $PR = 180$ metres, and

   - angle $QPR = 147°$.

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

4. Solve the equation (3)

$$2x^2 + 5x - 4 = 0.$$

   Give your answers correct to one decimal place.

5. A theatre group sold 4 830 tickets for their show. (3)
   This was 15% more than they sold last year.
   How many tickets did they sell last year?

6. A spherical sweet is made by coating a caramel sphere evenly with chocolate. (5)
   A cross-section of the sweet is shown below.
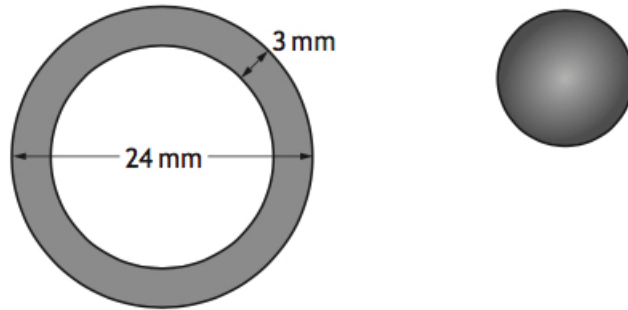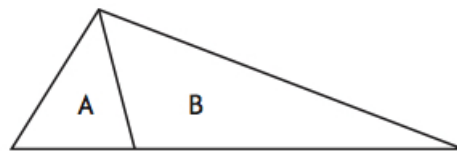

   The diameter of the sweet is 24 millimetres and the thickness of the chocolate coating
   is 3 millimetres.
   Calculate the volume of the chocolate coating.
   Give your answer correct to 3 significant figures.

7. Triangles A and B are shown below. (3)
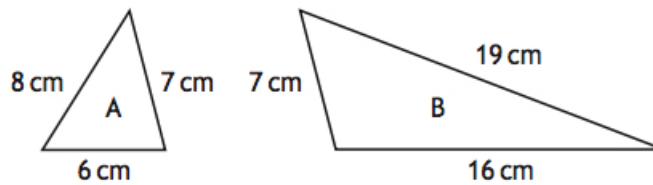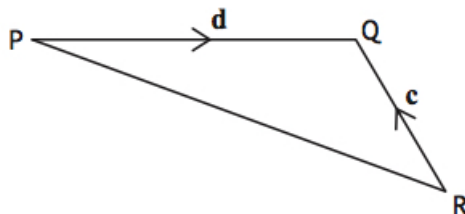

   The triangles are placed together to form the larger triangle shown below.

   Is this larger triangle right-angled?
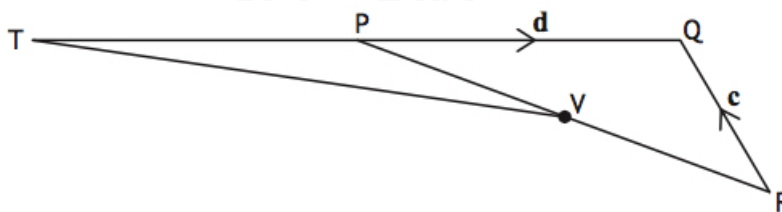   **Justify your answer**.

8. In the diagram below, $\overrightarrow{RQ}$ and $\overrightarrow{PQ}$ represent the vectors **c** and **d** respectively.

(a) Express $\overrightarrow{PR}$ in terms of **c** and **d**. (1)

The line QP is extended to T.

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

(b) Express $\overrightarrow{TV}$ in terms of **c** and **d**. (2)
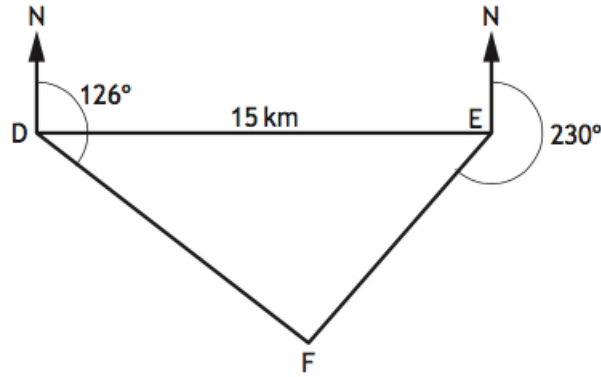Give your answer in simplest form.

9. (a) Factorise (1)
$$4x^2 - 25.$$

(b) Hence simplify (3)
$$\frac{4x^2 - 25}{2x^2 - x - 10}.$$

10. In the diagram below D, E, and F represent the positions of Dunbridge, Earlsford, and Fairtown respectively. (4)

Dunbridge is 15 kilometres west of Earlsford.
From Dunbridge, the bearing of Fairtown is 126°.
From Earlsford, the bearing of Fairtown is 230°.

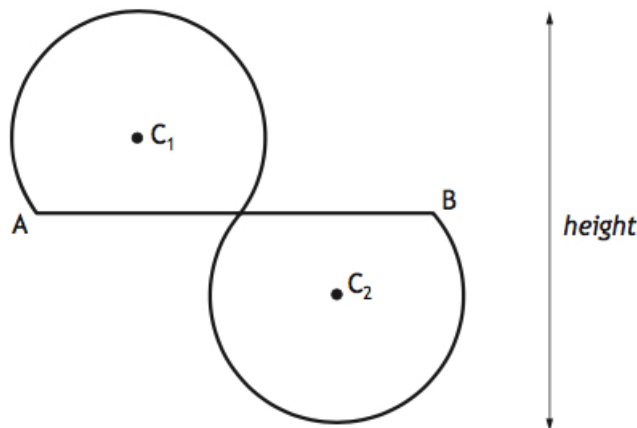Calculate the distance between Dunbridge and Fairtown.
Do not use a scale drawing.

11. A straight line has equation   (2)
$$3x - 5y - 10 = 0.$$

Find the gradient of this line.

12. Express   (2)
$$\frac{1}{\sqrt[3]{x}}$$

in the form x^n.

13. Two identical shapes are used to form a logo.   (4)
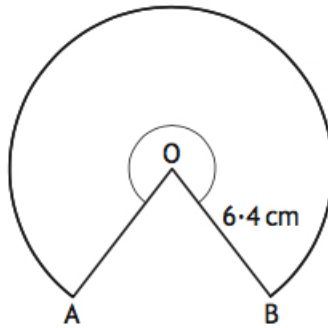Each shape is part of a circle.

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- 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.

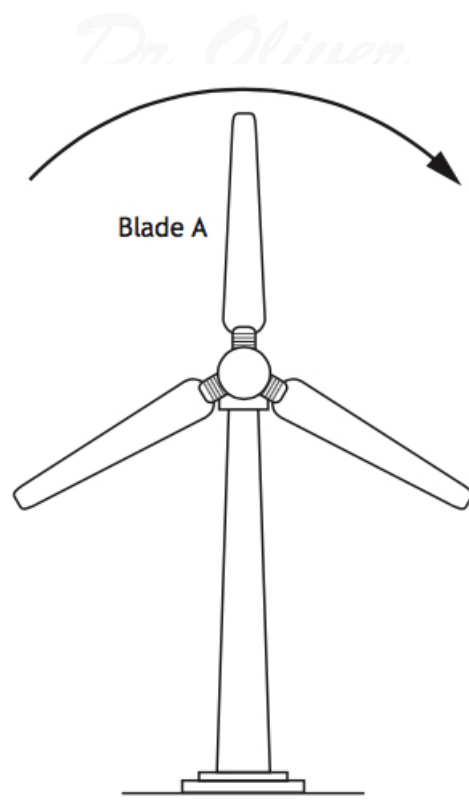- AB is 48 centimetres long.

Calculate the height of the logo.

14. The diagram below shows part of a circle, centre O. (3)

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.

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

Blade A

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

$$h = 40 + 23 \cos x°, \ 0 \leqslant x < 360,$$

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)

(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)