



National
Qualifications
2017

X747/75/01

**Mathematics
Paper 1
(Non-Calculator)**

FRIDAY, 5 MAY

INSTRUCTIONS TO CANDIDATES

Candidates should enter their surname, forename(s), date of birth, Scottish candidate number and the name and Level of the subject at the top of their first answer sheet.

Total marks — 40

Attempt ALL questions.

You may NOT use a calculator.

Full credit will be given only to solutions which contain appropriate working.

State the units for your answer where appropriate.

Write your answers clearly on your answer sheet.

Questions marked with an asterisk differ in some respects from those in the printed paper.

Marks are shown in square brackets at the end of each question or part question.

An OW in the margin indicates a new question.

A separate formulae sheet is provided.

FORMULAE LIST

The roots of $ax^2 + bx + c = 0$ are $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

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

Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$ or $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle: $A = \frac{1}{2}ab \sin C$

Volume of a sphere: $V = \frac{4}{3}\pi r^3$

Volume of a cone: $V = \frac{1}{3}\pi r^2 h$

Volume of a pyramid: $V = \frac{1}{3}Ah$

Standard deviation: $s = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n - 1}}$

or $s = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n - 1}}$, where n is the sample size.

Total marks — 40
Attempt ALL questions

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

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 marks]

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

Give your answer in its simplest form. [2 marks]

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

* 5. A square-based pyramid is 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), at the front right of the base of the cube. The point C is the top vertex of the square-based pyramid, directly above the centre of the base. B is the point at the top left of the back of the cube.
Write down the coordinates of B and C. [2 marks]

* 6. Refer to the diagram for Question 6. It shows the straight line joining points A and B.
Find the equation of the line AB.
Give the equation in its simplest form. [3 marks]

- * 7. Refer to the diagram for Question 7.

In triangle DEF:

DE = 8 centimetres

EF = 12 centimetres

$$\sin E = \frac{2}{3}$$

Calculate the area of triangle DEF. [2 marks]

8. Solve, algebraically, the inequality

$$19 + x > 15 + 3(x - 2). \quad [3 \text{ marks}]$$

- * 9. Refer to the diagram for Question 9.

In the diagram:

ABE is a tangent to the circle centre O

Angle DBE is 58°

ACOD is a straight line

Calculate the size of angle CAB. [3 marks]

10. Change the subject of the formula $F = \frac{t^2 + 4b}{c}$ to b . [3 marks]

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

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 marks]

***13.** Refer to the graph for Question 13. The graph 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 marks]**

***14.** Refer to the graph for Question 14. The graph 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 mark]**

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

(b) Calculate the value of b . **[2 marks]**

***15.** Refer to the diagram for Question 15.

In the diagram:

TS is parallel to QR

TS = 5 centimetres

QR = 7 centimetres

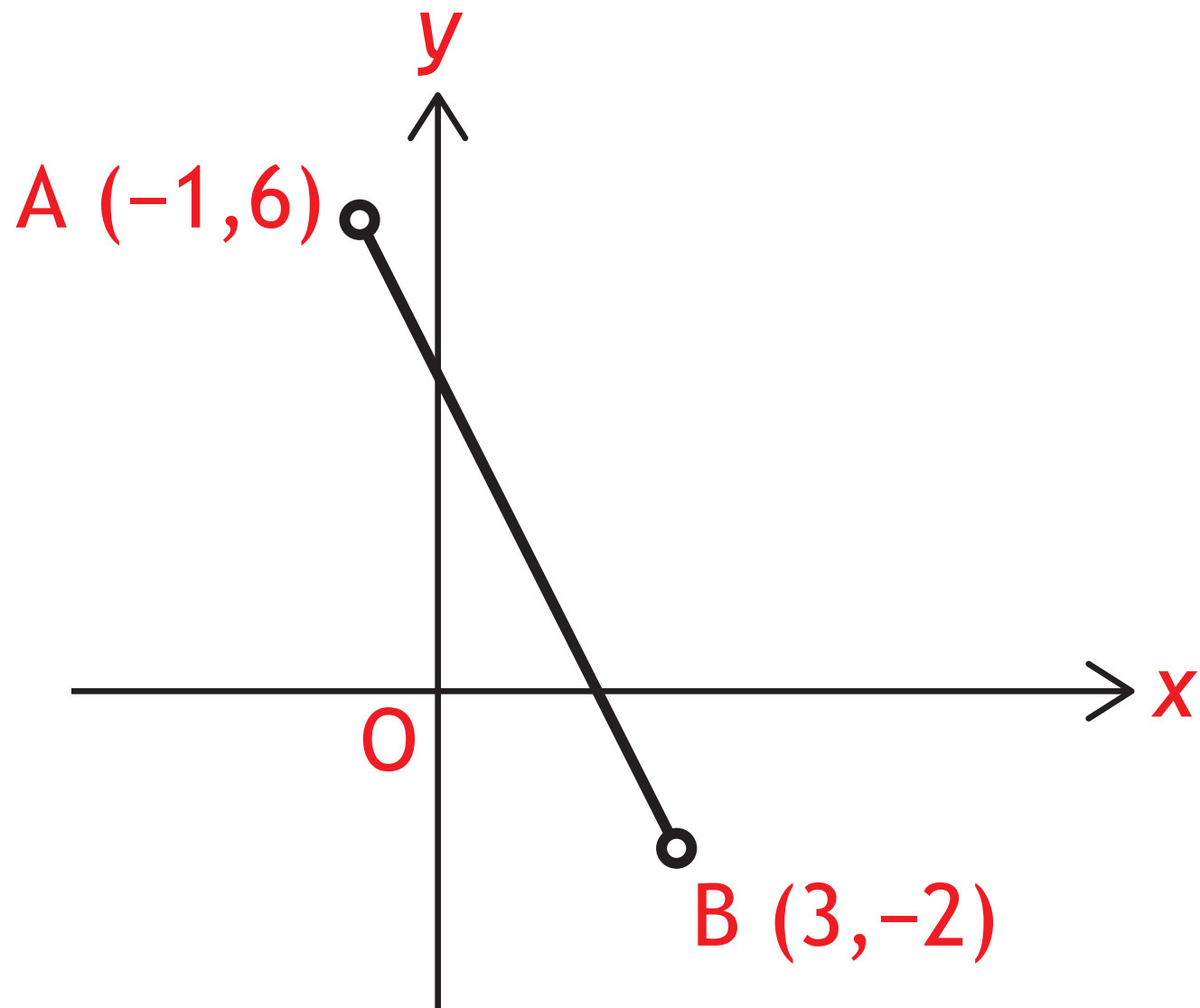
SR = 2.6 centimetres

PS is marked x cm

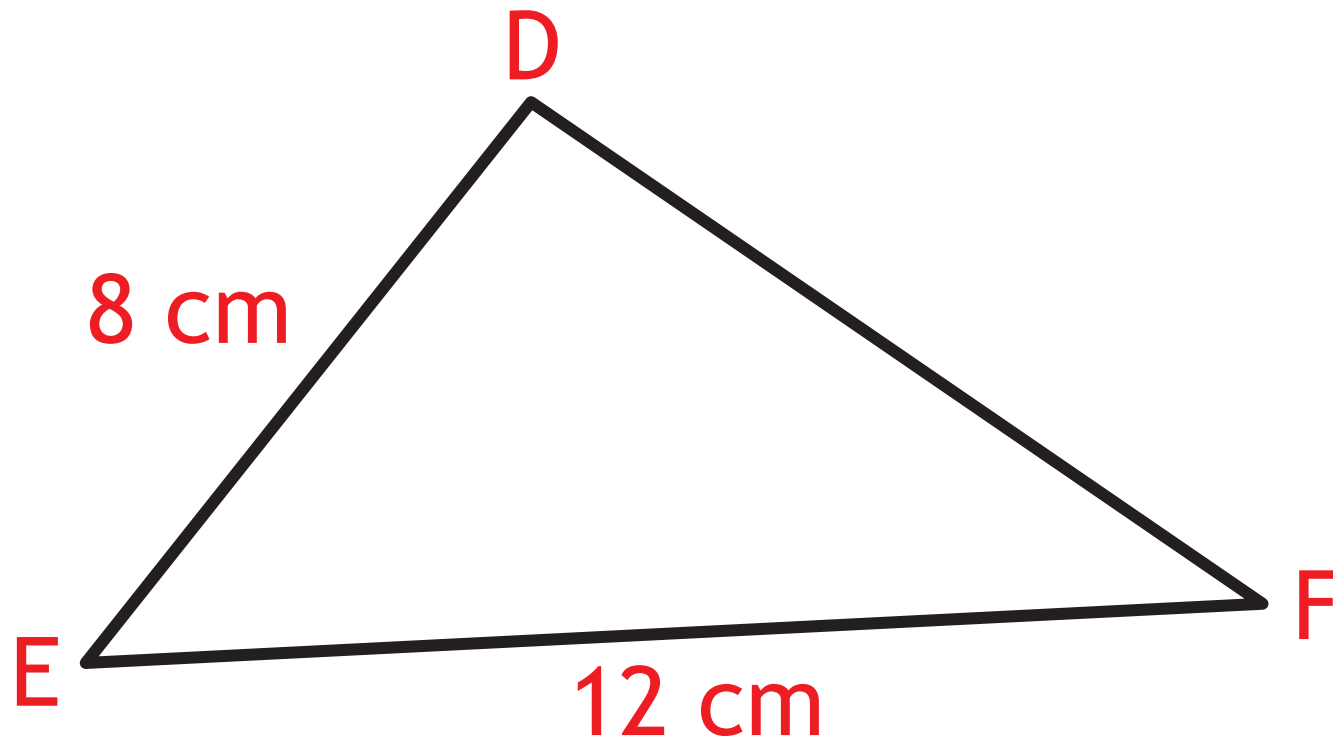
The length of PS is x centimetres.

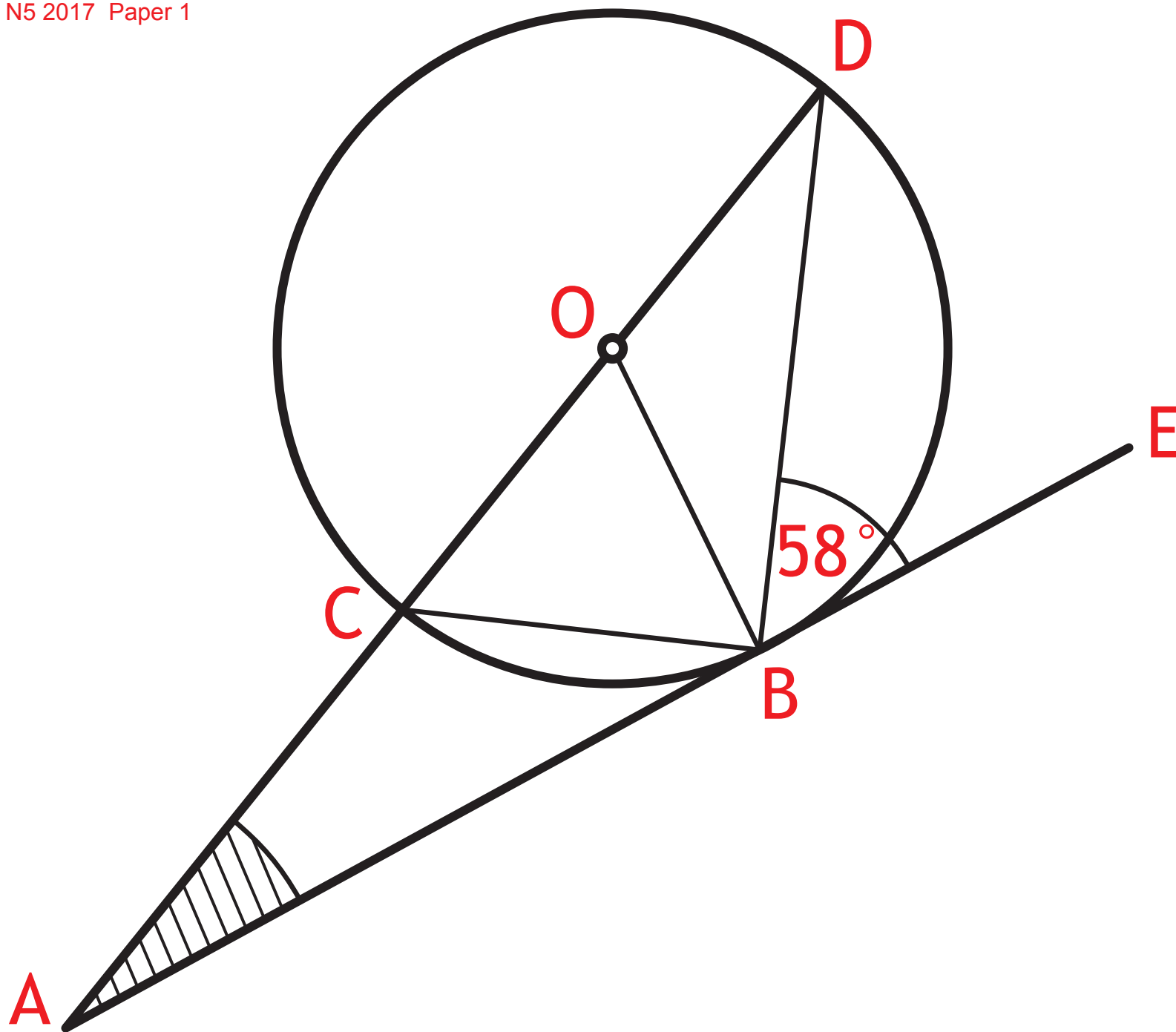
Calculate the value of x . **[3 marks]**

[END OF QUESTION PAPER]

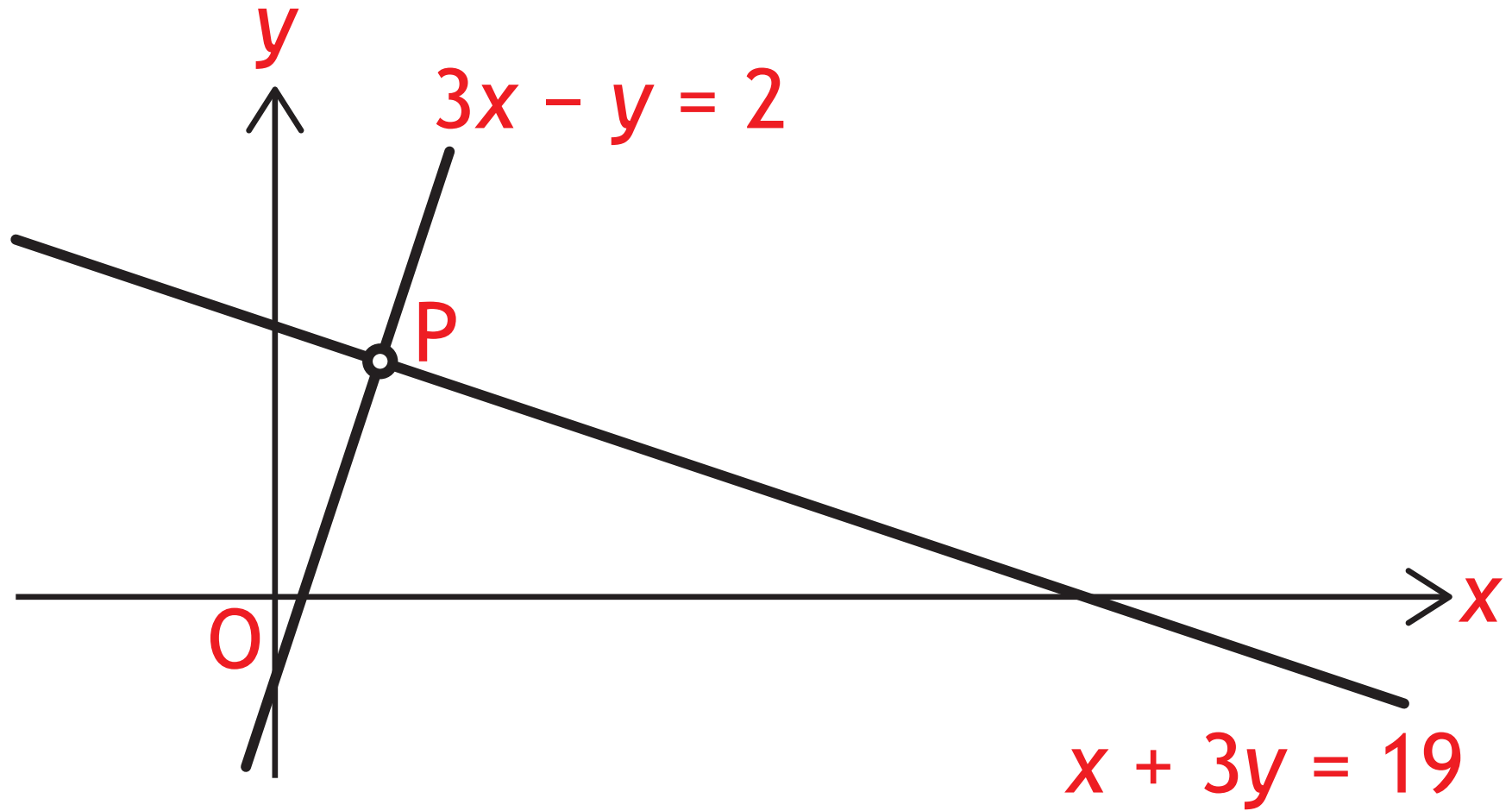


Q7

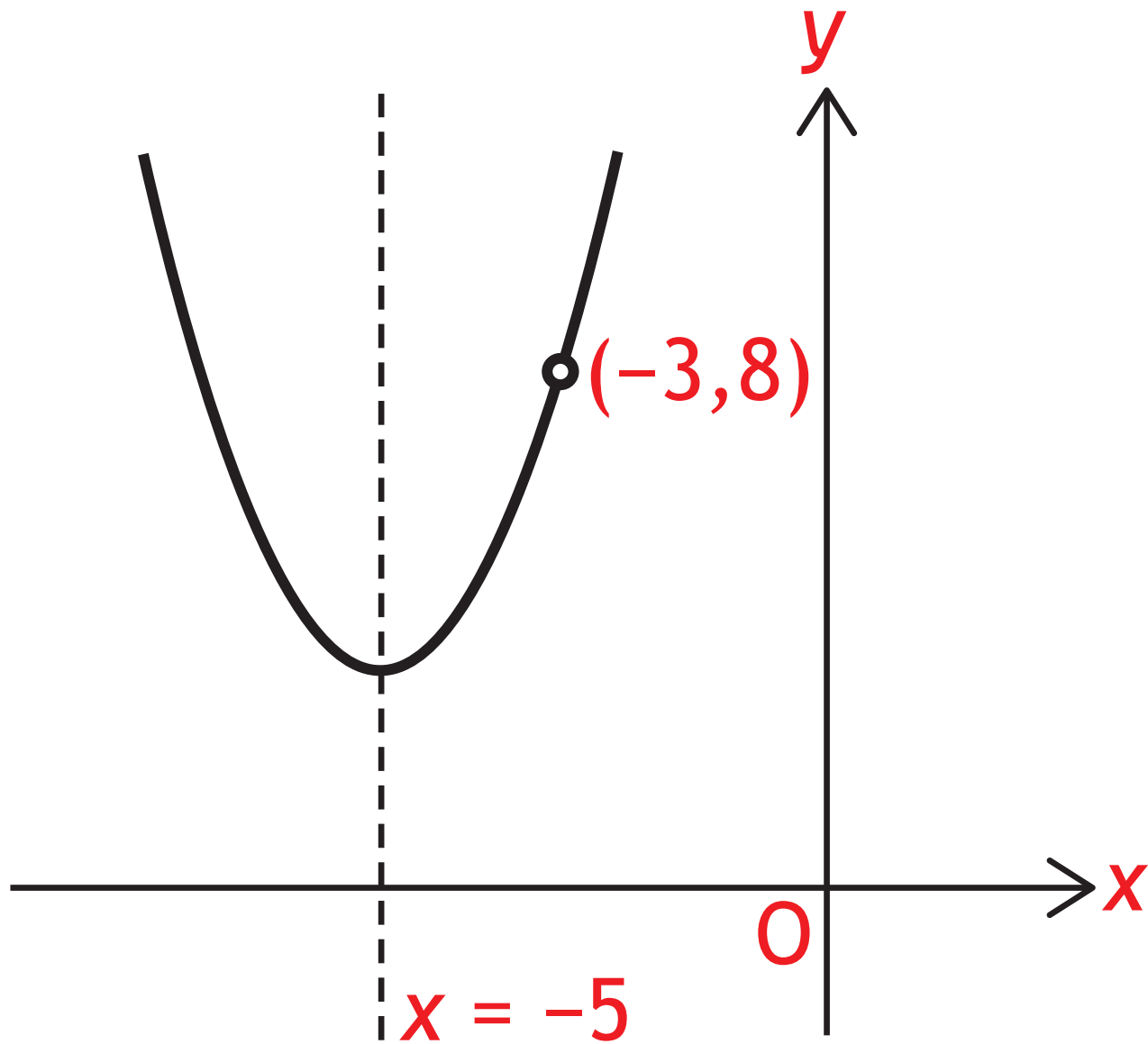




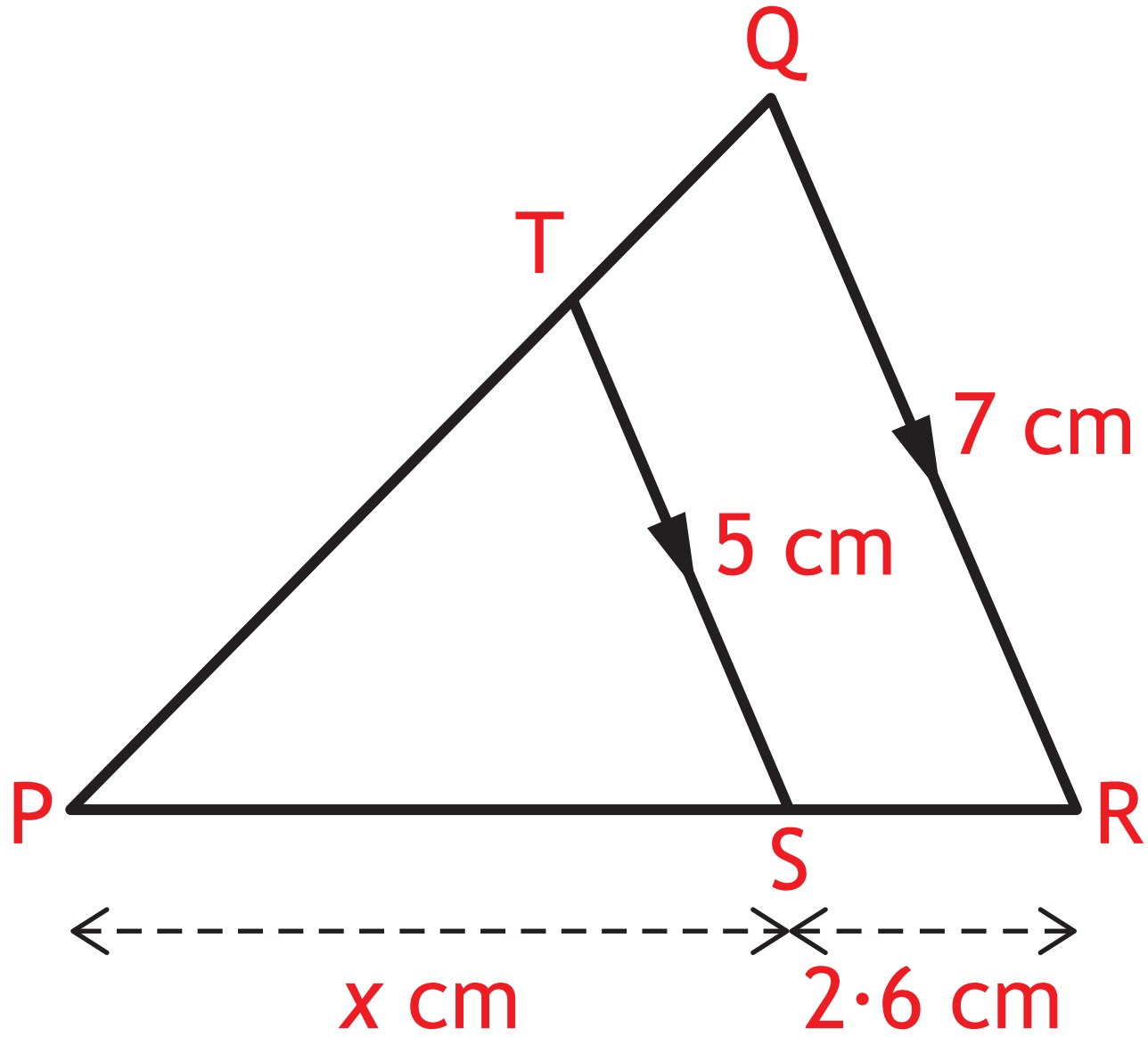
Q13



Q14



Q15





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**Mathematics
Paper 2**

FRIDAY, 5 MAY

INSTRUCTIONS TO CANDIDATES

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Total marks — 50

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Total marks — 50

Attempt ALL questions

1. Find $|\mathbf{v}|$, the magnitude of vector $\mathbf{v} = \begin{pmatrix} 18 \\ -14 \\ 3 \end{pmatrix}$. [2 marks]

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 marks]

* 3. Refer to the diagram for Question 3. It shows a piece of land in the shape of a triangle.

PQ = 250 metres

PR = 180 metres

angle QPR = 147°

The owner wishes to build a fence along the side QR. Calculate the length of the fence. [3 marks]

4. Solve the equation $2x^2 + 5x - 4 = 0$. Give your answers correct to one decimal place. [3 marks]

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 marks]

* 6. Refer to the diagram for Question 6. A spherical sweet is made by coating a caramel sphere evenly with chocolate. A cross-section of the sweet is shown.

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. [5 marks]

Give your answer correct to 3 significant figures.

- * 7. Refer to the diagrams for Question 7. Diagram 1 shows triangles A and B. In Diagram 2, the triangles are placed together to form a larger triangle. Is this larger triangle right-angled? **[3 marks]**
Justify your answer.
- * 8. Refer to the diagram for Question 8. \vec{RQ} and \vec{PQ} represent the vectors **c** and **d** respectively.
- (a) Express \vec{PR} in terms of **c** and **d**. **[1 mark]**
- * Refer to the diagram for Question 8 (b). The line QP is extended to T.
TP = PQ
V is the midpoint of PR
- (b) Express \vec{TV} in terms of **c** and **d**. Give your answer in simplest form. **[2 marks]**
9. (a) Factorise $4x^2 - 25$. **[1 mark]**
- (b) Hence simplify $\frac{4x^2 - 25}{2x^2 - x - 10}$. **[3 marks]**
- *10. Refer to the diagram for Question 10. In the diagram, 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. **[4 marks]**
11. A straight line has equation $3x - 5y - 10 = 0$. Find the gradient of this line. **[2 marks]**
12. Express $\frac{1}{\sqrt[3]{x}}$ in the form x^n . **[2 marks]**

- *13.** Refer to the diagram for Question 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 marks]**

- *14.** Refer to the diagram for Question 14. It 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 marks]**

- *15.** Refer to the diagram for Question 15. It shows a wind turbine that has three blades.

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

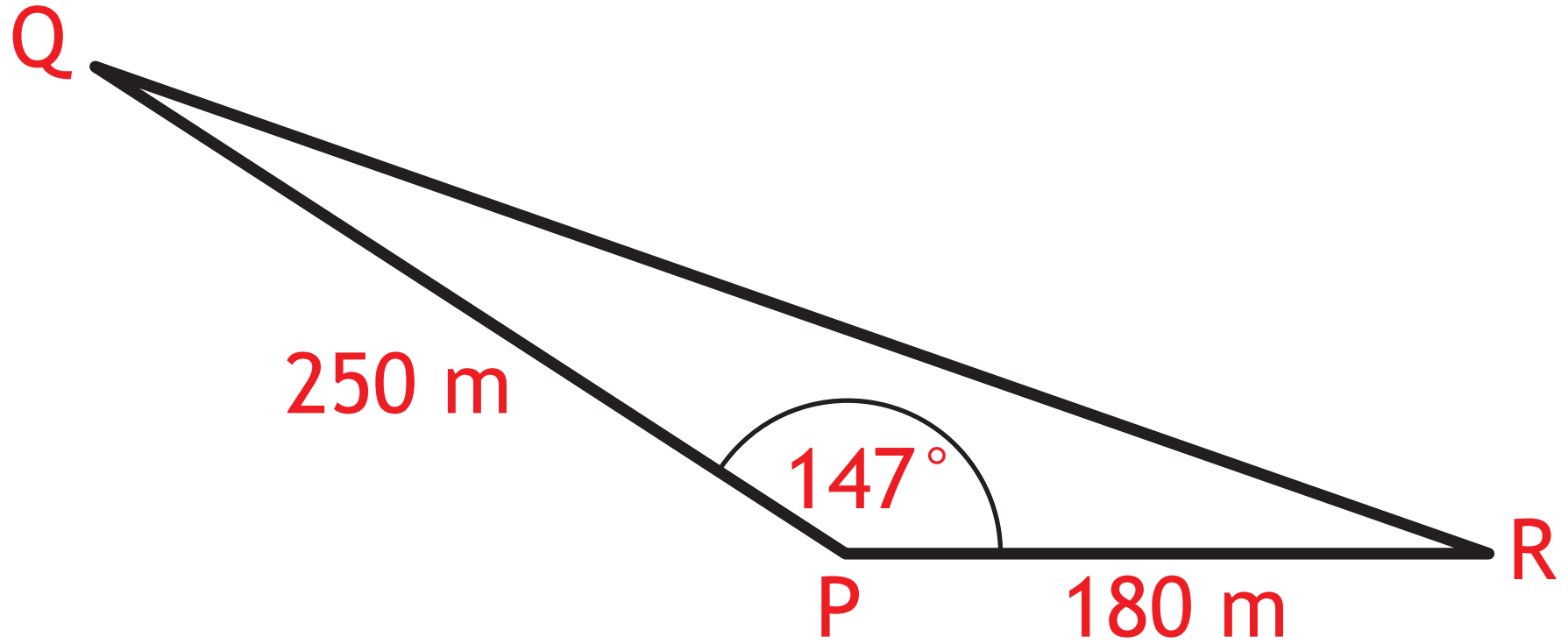
$$h = 40 + 23\cos x^\circ, \quad 0 \leq x < 360$$

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 mark]
- (b) Find the minimum height of the tip of blade A above the ground. **[1 mark]**
- (c) Calculate the values of x for which the tip of blade A is 61 metres above the ground.
[4 marks]

[END OF QUESTION PAPER]

Q3



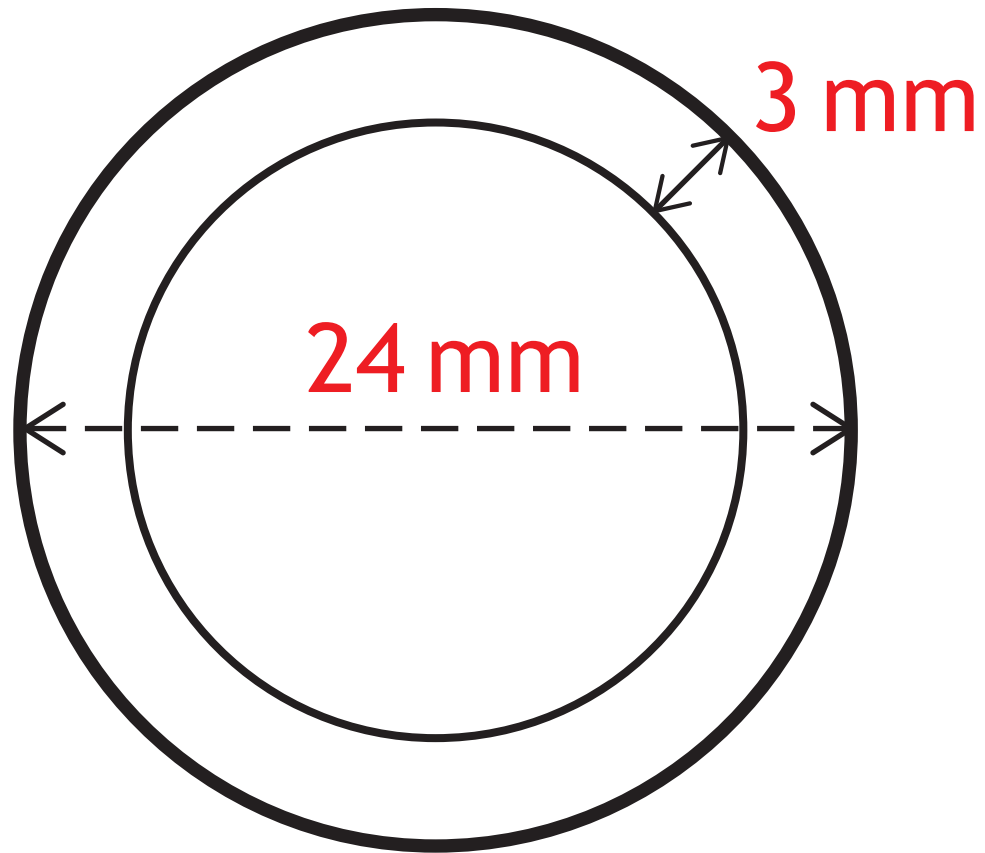


Diagram 1

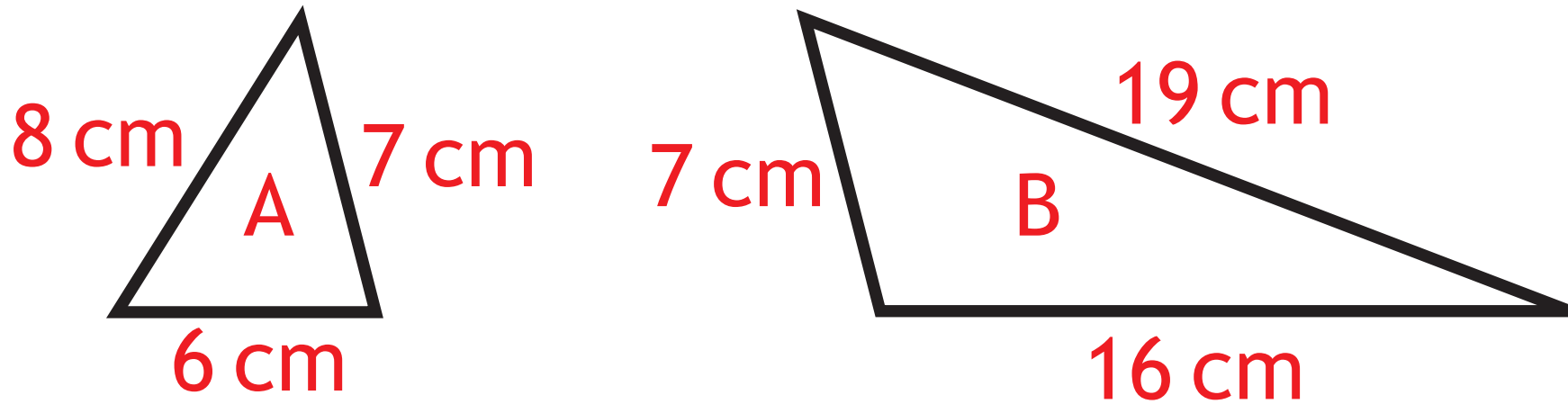
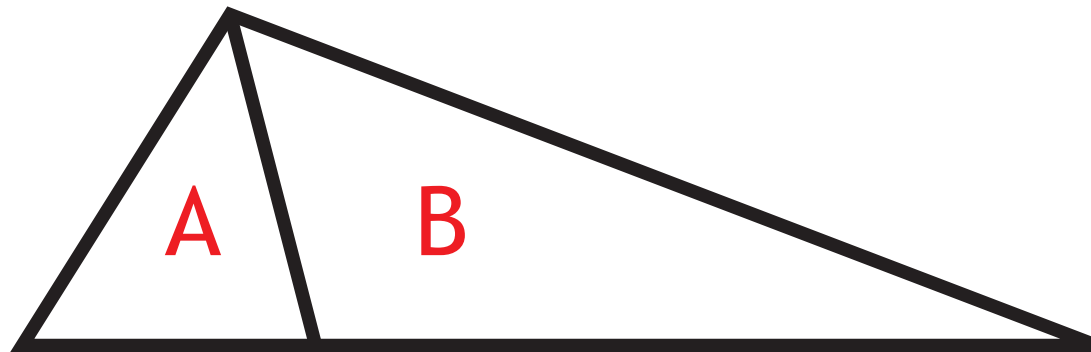
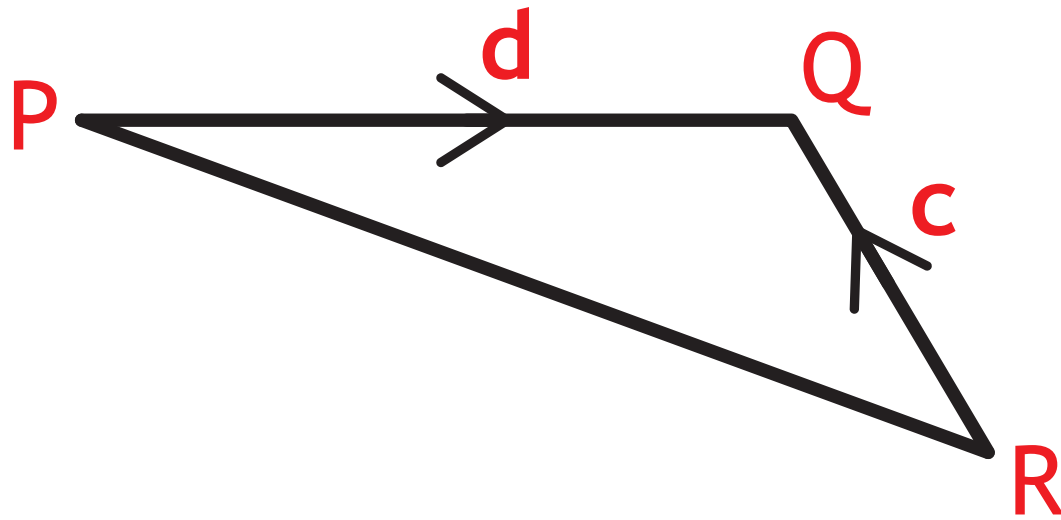


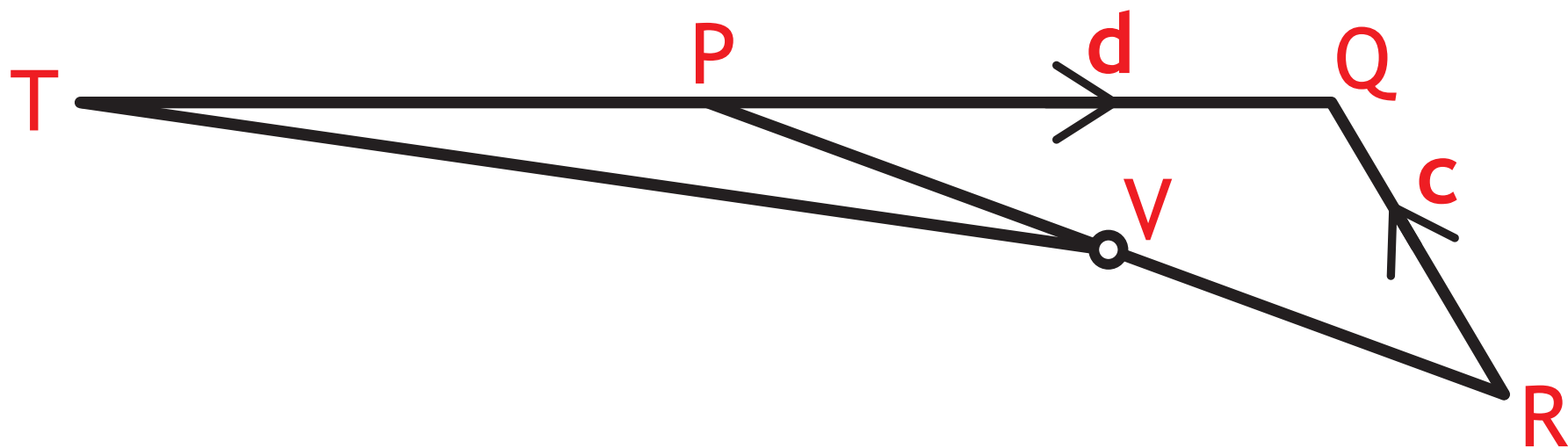
Diagram 2



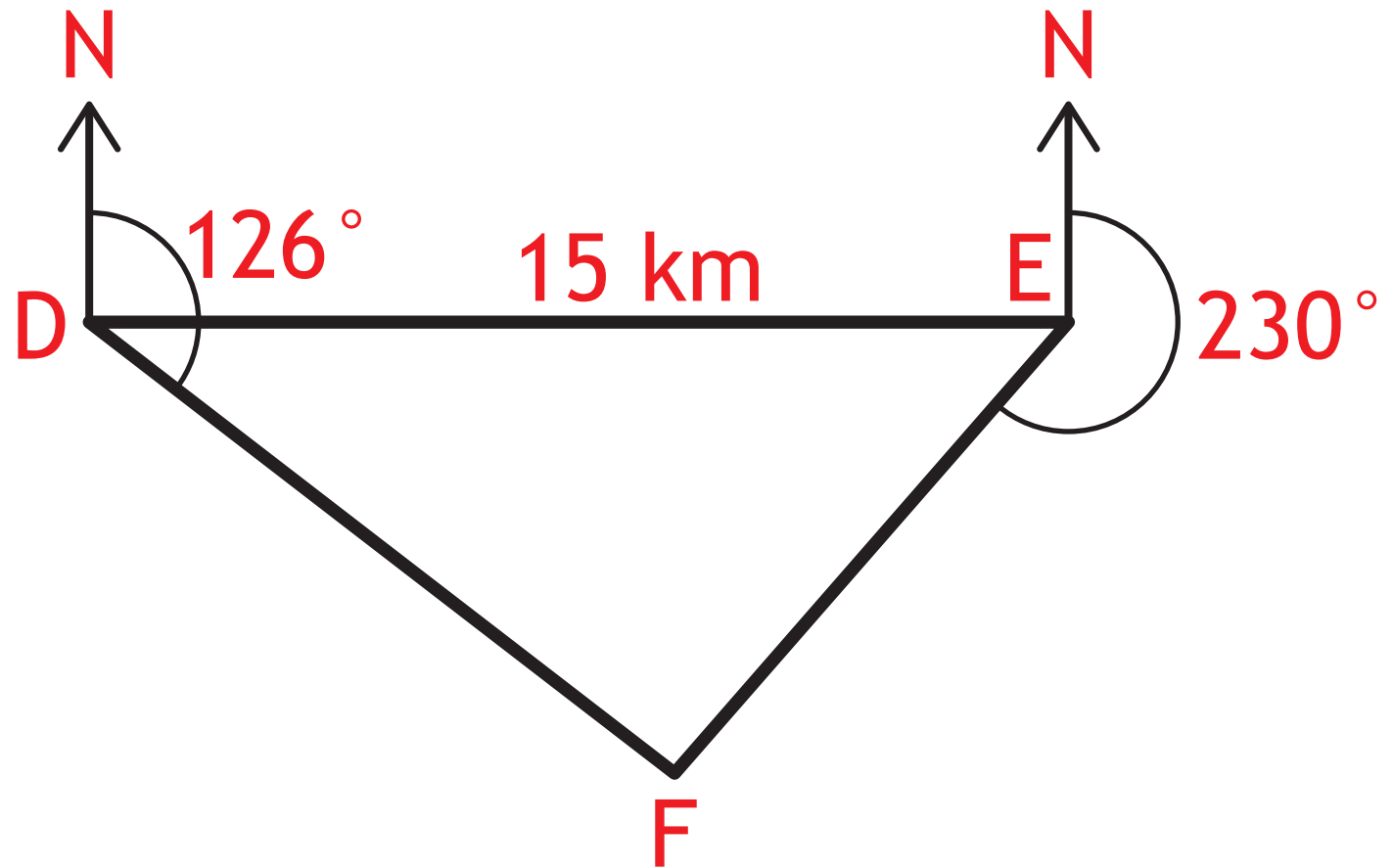
Q8a



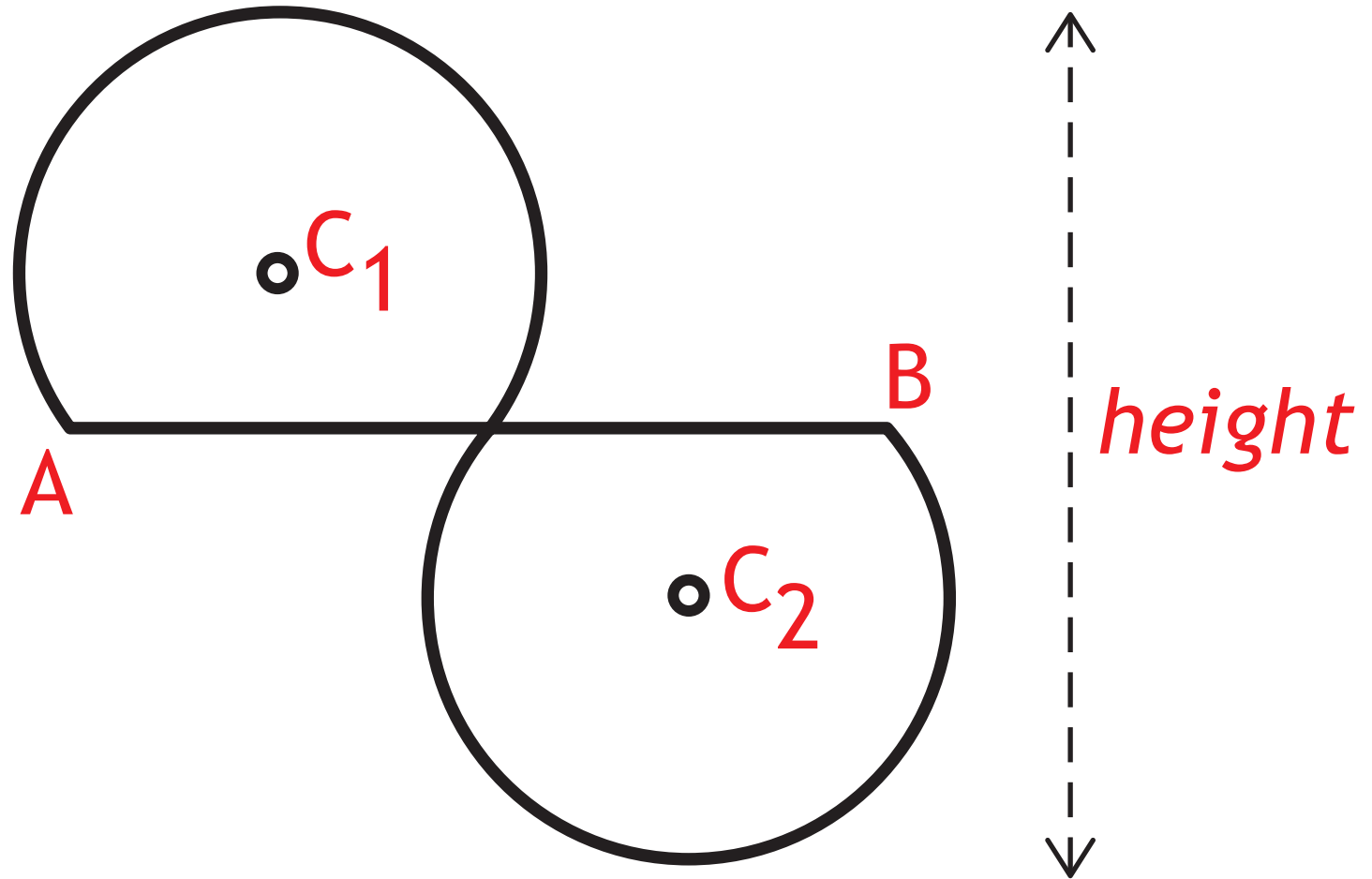
Q8b



Q10



Q13



Q14

