



- 1 In triangle ABC, AB = 8 cm, AC = 11 cm and angle BAC = 62° .
Work out the length of BC. Give your answer correct to 3 significant figures.

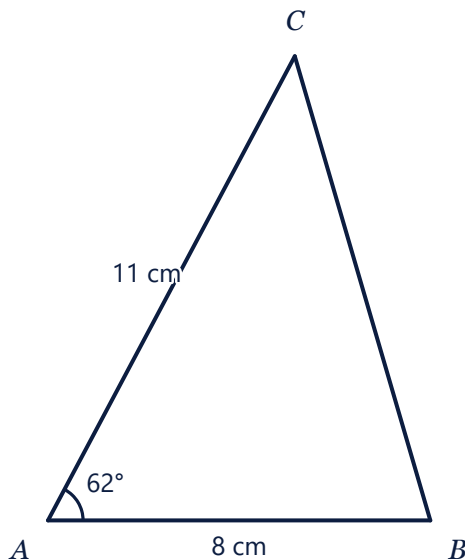


Diagram NOT accurately drawn

(4 marks)

We know two sides and the angle between them. The cosine rule finds the opposite side; unlike Pythagoras, it works even when the angle is not 90° . Use degree mode and keep the full value until the final rounding

Cosine rule

$$BC^2 = AB^2 + AC^2 - 2 \times AB \times AC \times \cos A$$

$$BC^2 = 8^2 + 11^2 - 2 \times 8 \times 11 \times \cos 62^\circ$$

$$BC^2 = 64 + 121 - 176 \times 0.46947... = 102.37..$$

$$BC = \sqrt{102.37...} = 10.117..$$

$$BC = 10.1 \text{ cm (3 sf)}$$

$$\boxed{10.1 \text{ cm}}$$

2

In triangle PQR, PQ = 9.4 cm, PR = 13.7 cm and angle QPR = 118° .
Calculate the length of QR. Give your answer correct to 3 significant figures.

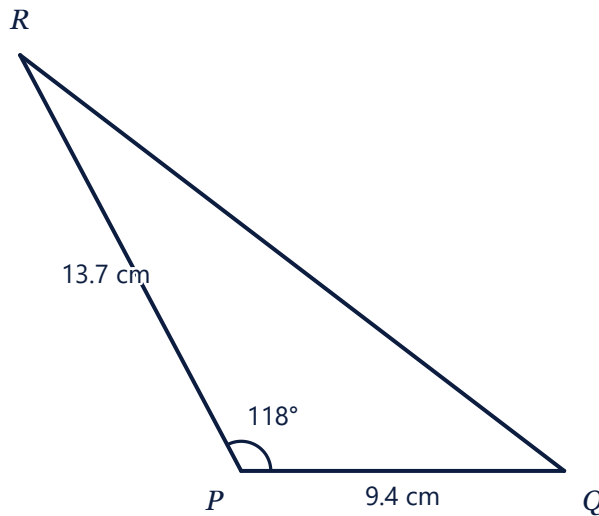


Diagram NOT accurately drawn

(4 marks)

Cosine rule

$$QR^2 = PQ^2 + PR^2 - 2 \times PQ \times PR \times \cos P$$

$$QR^2 = 9.4^2 + 13.7^2 - 2 \times 9.4 \times 13.7 \times \cos 118^\circ$$

$\cos 118^\circ$ is negative, so the last term adds on

$$QR^2 = 88.36 + 187.69 + 120.91... = 396.96..$$

$$QR = \sqrt{396.96...} = 19.924..$$

$$QR = 19.9 \text{ cm (3 s.f.)}$$

$$\boxed{19.9 \text{ cm}}$$

3

In triangle ABC, AB = 7 cm, BC = 9 cm and AC = 11 cm.

Find the size of the largest angle of the triangle. Give your answer correct to 1 decimal place.

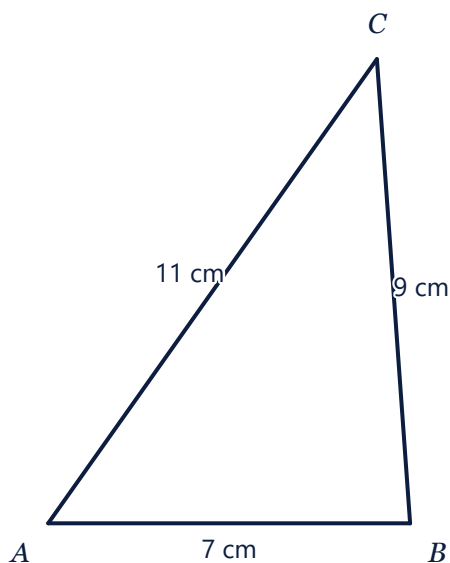


Diagram NOT accurately drawn

(4 marks)

The largest angle is opposite the longest side, AC = 11 cm, so it is angle ABC

Cosine rule

$$\cos B = \frac{AB^2 + BC^2 - AC^2}{2 \times AB \times BC}$$

$$\cos B = \frac{49 + 81 - 121}{2 \times 7 \times 9} = \frac{9}{126} = 0.07142\dots$$

$$B = \cos^{-1}(0.07142\dots) = 85.903\dots^\circ$$

The largest angle is 85.9° (1 dp)

85.9°

4

In triangle ABC, $AB = 3$ cm, $AC = 5$ cm and $BC = \sqrt{19}$ cm.

Find the size of angle BAC.

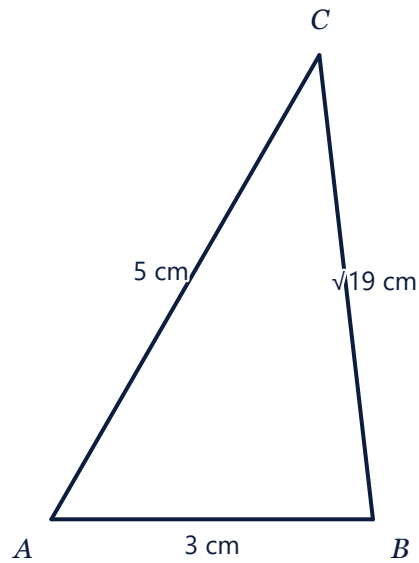


Diagram NOT accurately drawn

(4 marks)

Angle BAC is opposite BC, so use the cosine rule for the angle

$$\cos A = \frac{AB^2 + AC^2 - BC^2}{2 \times AB \times AC}$$

$$\cos A = \frac{9 + 25 - 19}{2 \times 3 \times 5} = \frac{15}{30} = \frac{1}{2}$$

$$\cos A = \frac{1}{2}, \text{ so angle BAC} = 60^\circ$$

$$\boxed{60^\circ}$$

5

Triangle ABC and triangle PQR are described below.

- a. For each of these, say whether the sine rule or the cosine rule should be used first. You do not need to calculate anything.
- (i) In triangle ABC, $AB = 6$ cm, $AC = 9$ cm and angle $BAC = 40^\circ$. Find BC .
 - (ii) In triangle ABC, angle $A = 35^\circ$, angle $B = 80^\circ$ and $BC = 7$ cm. Find AC .
 - (iii) In triangle ABC, $AB = 5$ cm, $BC = 7$ cm and $AC = 10$ cm. Find angle ABC .
- b. In triangle PQR, $PQ = 14$ cm, angle $QPR = 48^\circ$ and angle $PQR = 71^\circ$. Calculate the length of QR .
Give your answer correct to 3 significant figures.

(5 marks)

a)

(i) two sides + angle between: cosine rule

(ii) two angles + a side: sine rule

(iii) three sides, find an angle: cosine rule

b) Find the third angle first

$$\text{angle } R = 180^\circ - 48^\circ - 71^\circ$$

$$\text{angle } R = 61^\circ$$

Sine rule: QR is opposite 48° , PQ is opposite 61°

$$\frac{QR}{\sin 48^\circ} = \frac{14}{\sin 61^\circ}$$

$$QR = 14 \times \sin 48^\circ \div \sin 61^\circ$$

$$QR = 11.9 \text{ cm (3 s.f.)}$$

$$QR = 11.9 \text{ cm}$$

6

In triangle ABC, AB = 8 cm, BC = 12 cm and AC = 15 cm.

- Work out the size of angle ABC. Give your answer correct to 1 decimal place.
- Work out the area of the triangle. Give your answer correct to 3 significant figures.

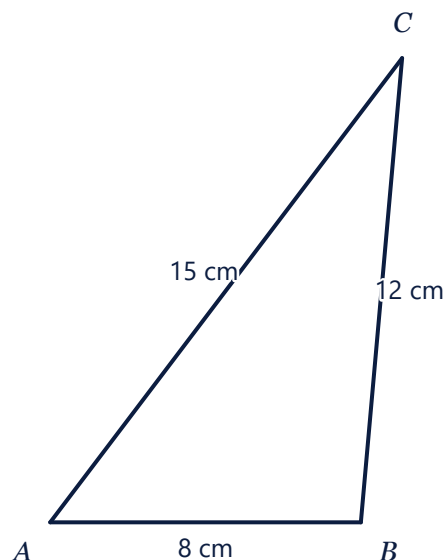


Diagram NOT accurately drawn

(5 marks)

a) Angle ABC is opposite AC. Cosine rule

$$\cos B = \frac{AB^2 + BC^2 - AC^2}{2 \times AB \times BC}$$

$$\cos B = \frac{64 + 144 - 225}{2 \times 8 \times 12} = -\frac{17}{192} = -0.08854..$$

$$B = \cos^{-1}(-0.08854...) = 95.079...^{\circ} = 95.1^{\circ} \text{ (1 dp)}$$

$$\text{b) Area} = \frac{1}{2} \times AB \times BC \times \sin B = \frac{1}{2} \times 8 \times 12 \times \sin 95.079...^{\circ}$$

$$\text{Area} = 48 \times 0.99607... = 47.811... = 47.8 \text{ cm}^2 \text{ (3 sf)}$$

7

In triangle ABC, AB = 9 cm, AC = 12 cm and angle BAC = 48° .

Work out the size of angle ABC. Give your answer correct to 1 decimal place.

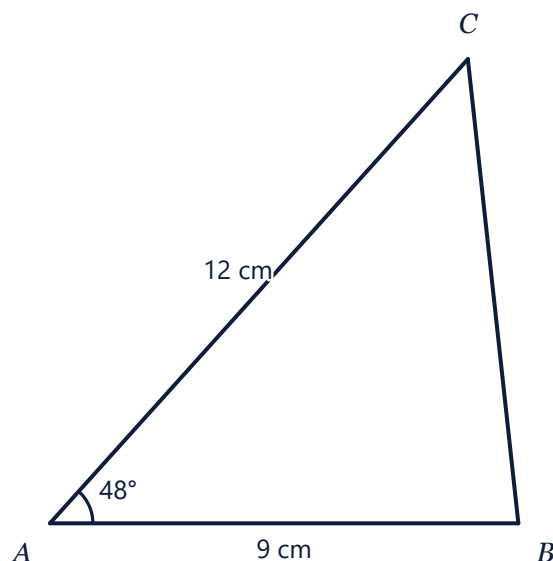


Diagram NOT accurately drawn

(5 marks)

First find BC with the cosine rule

$$BC^2 = 9^2 + 12^2 - 2 \times 9 \times 12 \times \cos 48^\circ$$

$$BC^2 = 225 - 216 \times 0.66913... = 80.467..., \text{ so } BC = 8.9703..$$

Angle ABC is opposite AC. Use the cosine rule for the angle so there is no acute/obtuse ambiguity:

$$\cos B = \frac{AB^2 + BC^2 - AC^2}{2 \times AB \times BC} = \frac{81 + 80.467... - 144}{2 \times 9 \times 8.9703...} = 0.10818..$$

$$B = \cos^{-1}(0.10818...) = 83.789...^\circ$$

$$\text{Angle ABC} = 83.8^\circ \text{ (1 dp)}$$

$$\boxed{83.8^\circ}$$

8

The diagram shows quadrilateral ABCD. The diagonal BD splits it into triangles ABD and BCD.

In triangle ABD, AB = 7 cm, AD = 10 cm and angle BAD = 65° .

In triangle BCD, angle DBC = 40° and angle BCD = 68° .

Work out the length of CD. Give your answer correct to 3 significant figures.

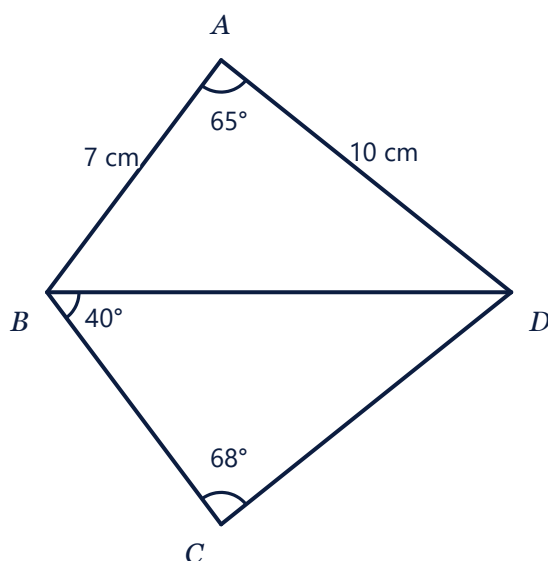


Diagram NOT accurately drawn

(5 marks)

Cosine rule in triangle ABD

$$BD^2 = 7^2 + 10^2 - 2 \times 7 \times 10 \times \cos 65^\circ$$

$$BD^2 = 149 - 140 \times 0.42261... = 89.833..., \text{ so } BD = 9.4780..$$

Sine rule in triangle BCD

$$\frac{CD}{\sin(\angle DBC)} = \frac{BD}{\sin(\angle BCD)}$$

$$CD = 9.4780... \times \sin 40^\circ \div \sin 68^\circ$$

$$CD = 9.4780... \times 0.64278... \div 0.92718... = 6.5708..$$

$$CD = 6.57 \text{ cm (3 s.f.)}$$

6.57 cm

9

Two ships leave a port at the same time.

Ship A sails 24 km on a bearing of 062° .

Ship B sails 31 km on a bearing of 148° .

Work out the distance between the two ships. Give your answer correct to 3 significant figures.

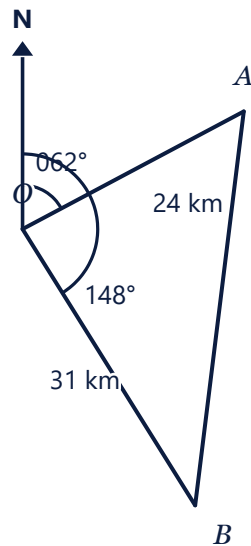


Diagram NOT accurately drawn

(5 marks)

The angle between the two courses at the port = $148^\circ - 62^\circ = 86^\circ$

Cosine rule

$$d^2 = 24^2 + 31^2 - 2 \times 24 \times 31 \times \cos 86^\circ$$

$$d^2 = 576 + 961 - 1488 \times 0.06975... = 1433.2..$$

$$d = \sqrt{1433.2...} = 37.857..$$

Distance = 37.9 km (3 sf)

37.9 km