Triangle trigonometry

Skills sheet · SL AA 3.2 · 3.3

KEY FACTS

SOH CAH TOA in a right-angled triangle D1

$\frac{a}{\sin A} = \frac{b}{\sin B}$; $c^2 = a^2 + b^2 - 2ab\cos C$ P1

Area $\frac{1}{2}ab\sin C$ P1

Bearings clockwise from north; elevation from the horizontal D2 P2

Sine rule: a side with its opposite angle W1.

Degrees mode.

A north line at every point W2.

WHAT UNLOCKS

- a side–angle pair → the sine rule.
- two sides and the angle between them → the cosine rule, or the area.
- three sides → the cosine rule for an angle.
- two bearings → the back bearing and the angle at the turn.

WORKED EXAMPLE ①

In a right-angled triangle, the side adjacent to $35°$ is 10. Find the opposite side x. with GDC

$\tan 35° = \frac{x}{10}$ M1

$x = 7.00$ A1

Method

A right angle

① Name the sides from the angle.
② Choose the ratio with both.
③ Solve, 3 s.f.

WORKED EXAMPLE ②

A triangle has sides 5, 7 and 8. Find the angle opposite 7. no GDC

$\cos\theta = \frac{5^2+8^2-7^2}{2\times5\times8}$ M1

$= \frac{1}{2}$, $\theta = 60°$ A1

Method

An angle from three sides

① The opposite side goes last, with the minus.
② Simplify the fraction.
③ Inverse cosine.

The side opposite the angle is subtracted.

FLUENCY

●○○ **1.** Hypotenuse 10, angle 30°: the opposite side no GDC

●○○ **2.** Area: sides 4 and 5, angle 30° between them no GDC

●○○ **3.** The back bearing of 070° no GDC

●○○ **4.** $a = 10$, $A = 30°$: the value of $\frac{a}{\sin A}$ no GDC

●○○ **5.** A tower 20 m high seen from 20 m away: elevation no GDC

●○○ **6.** Sides 3, 4, 5: the largest angle no GDC

REASONING

●●● **Question 1.** A triangle has sides 7, 9 and 12. [with GDC]

(a) Find its largest angle. [3]

●●● **Question 2.** From the top of an 80 m cliff, the angle of depression of a boat is 25°. [with GDC]

(a) Find the distance of the boat from the foot of the cliff. [2]

●●● **Question 3.** A triangle has sides 5 and 8 with an angle of 30° between them. [no GDC]

(a) Find its area. [2]

PROBLEMS

●●● **Question 4.** From a port P, a buoy B is 6 km away on a bearing of 040° and a lighthouse C is 10 km away on a bearing of 100°. [with GDC]

(a) Find BC. [3]

●●● **Question 5.** A triangle has sides 8 and 10, an obtuse angle θ between them, and area 30. [with GDC]

(a) Find θ. [3]

ANSWERS

1 5

2 5

3 250°

4 20

5 45°

6 90°

Q1 $\cos\theta = -\frac{1}{9},\ 96.4^\circ$

Q2 $\frac{80}{\tan 25^\circ} = 172$ m

Q3 10

Q4 $B\hat{P}C = 60^\circ,\ BC = \sqrt{76} = 8.72$ km

Q5 $\sin\theta = 0.75,\ \theta = 131.4^\circ$

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