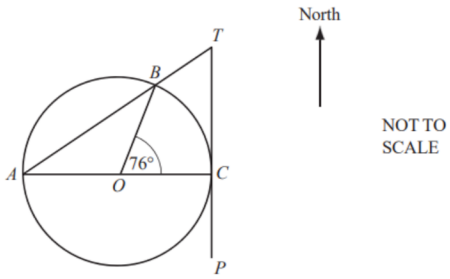
EXAM PAPERS PRACTICE

Bearings

Model Answers

Question 1



AOC is a diameter of the circle, centre O.
AT is a straight line that cuts the circle at B.
PT is the tangent to the circle at C.
Angle COB = 76°.

(a) Calculate angle ATC.

Answer:

PT is a tangent on the circle at C. Therefore, PT is perpendicular on AC, the diameter of the circle.
In the triangle OAB, both OB and OA are radius in the circle of centre C.
OA = OB, making the triangle OAB isosceles.
In the isosceles triangle OAB, the angles OAB and OBA are congruent.
AC is the diameter of the circle, therefore the angle AOB is 180° minus the angle COB.

Angle AOB = 180° - 76° = 104°

The sum of all 3 angles in a triangle is 180°.
Angle OBA x 2 + angle AOB = 180°
Angle OBA x 2 = 76°
Angle OBA = 38°

In the triangle ATC, the sum of all 3 angles is 180°.
Angle TCA + angle TAC + angle ATC = 180°
Angle ATC = 180° - 90° - 38°

Angle ATC = 52°

(b) T is due north of C.

Calculate the bearing of B from C.

Answer:

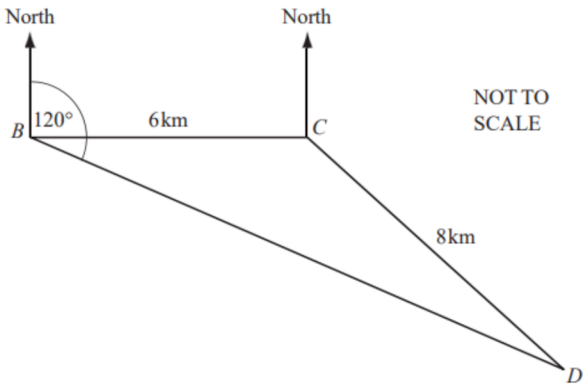
The bearing is calculated towards right, therefore the bearing of B form C will be 360°
minus the angle TCB.
In the angle OCB, OC = OB since both are the radius in the circle of centre O.
The angle OCB is isosceles, therefore the angles OCB and OBC are congruent.

2 x angle OCB = 180° - 76°
Angle OCB = 52°
Angle BCT = 90° - 52° (since the angle TCA is 90°)
Angle BCT = 38°
The bearing of B from C is: 360° - angle BCT
Bearing of B from C = 360° - 38°

Bearing of B from C = 322°

Question 2

A helicopter flies from its base B to deliver supplies to two oil rigs at C and D.
C is 6km due east of B and the distance from C to D is 8km.
D is on a bearing of 120° from B.



Find the bearing of D from C.

Answer:

To find the bearing of D from C we'll need to find the size of the angle BCD, and then take that angle, and 90°, away from 360°. This is going to require us to use the 'Sine Rule' to find out the angles inside the triangle.
The 'Sine Rule' can be used to find either the length of a side of a triangle, or an angle in a triangle – it goes like this:

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

Angle DCB = $120° - 90° = 30°$

So, applying the Sine rule:

$$\frac{8}{\sin 30} = \frac{6}{sinD}$$

$$\sin D \left(\frac{8}{\sin 30}\right) = 6$$

$$\sin D = \frac{6}{\left(\frac{8}{\sin 30}\right)}$$

$$D = \sin^{-1}\left(\frac{6}{\left(\frac{8}{\sin 30}\right)}\right)$$

$$D = 22.0°$$

All angles within a triangle add up to 180°, so

$$BCD = 180 - 30 - 22$$

$$BCD = 128°$$

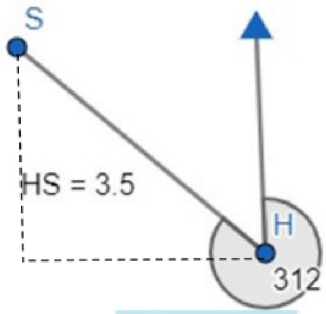
Bearing from C to D = 360 - 90 - 128 = 142°

Question 3

From a harbour, H, the bearing of a ship, S, is 312°. The ship is 3.5 km from the harbour.

(a) Draw a sketch to show this information.
Label H, S, the length 3.5 km and the angle 312°.

Answer:



The bearing is measured clockwise from the line pointing in the north clockwise.

(b) Calculate how far north the ship is of the harbour.

Answer:

In the right-angled triangle formed, the side representing how far north S is from H can be worked out using the sin of the opposite angle.

Opposite angle = 90° - 48° = 42°
HS = 3.5 km

$$\sin 42° = \frac{\text{how far north}}{3.5 \text{ km}}$$

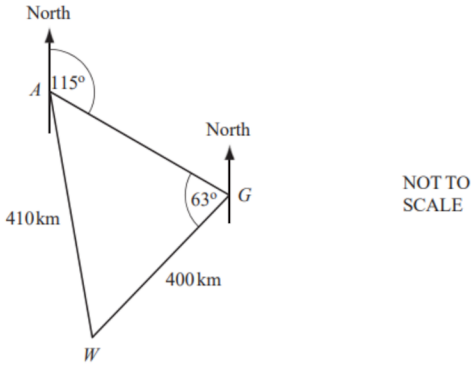
The ship is 2.34 km North form H.

Question 4

A plane flies from Auckland (A) to Gisborne (G) on a bearing of 115 o

.

The plane then flies on to Wellington (W). Angle AGW = 63 o



(a) Calculate the bearing of Wellington from Gisborne.

Answer:

The bearing of W from G goes form the North line, anticlockwise, all the way around to the line connecting W and G.

The bearing of W from G is marked in red on the figure above.
The 2 arrows pointing towards North are parallel, therefore the bearing from G to A summed up with the bearing from A to G will give 180°.
The bearing from G to A is:
180° - 115° = 65

This angle, the bearing from G to W and the angle AGW are angles around a single point,
G. Therefore, their sum will be equal to 360°
The bearing from G to W is:
360° - 65° - 63°
= 232°

(b) The distance from Wellington to Gisborne is 400 kilometres.
The distance from Auckland to Wellington is 410 kilometres.

Calculate the bearing of Wellington from Auckland.

Answer:

The bearing of W from A is marked in green in the figure above.
The bearing of W from A is the sum of the angle GAW with the bearing from A to G, 115°.

In the triangle GAW, we can apply the sine rule to work out the size of the angle GAW

The sine rule is:

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

In our case, angle GAW = A, angle AGW = B, GW = a and AW = b

$$\frac{\sin GAW}{400\text{ km}} = \frac{\sin 63^\circ}{410\text{ km}}$$

$$\sin GAW = 0.869$$

$$\text{angle } GAW = 60.4^\circ$$

The bearing from W to A is:
60.4° + 115°
= 175.4°