Topic 15

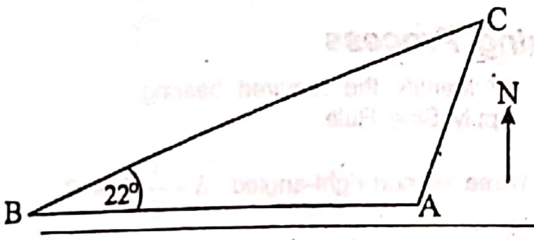
Bearings

1 *(J2004/P1/Q15)*

A, B and C are three ships. B is due West of A.

(a) Given that $A\hat{B}C = 22°$, write down the bearing of C from B. [1]

(b) By using your protractor, find the bearing of A from C. [2]



Thinking Process

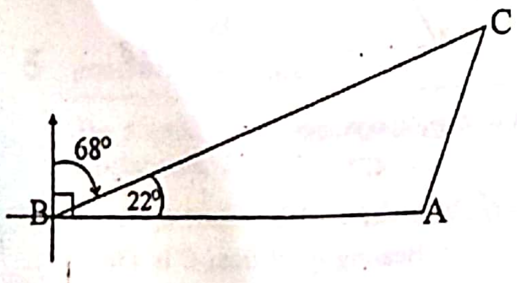
(a) Draw North at B. Remember line BA is horizontal.

(b) Draw North at C and measure the angle by using protractor.

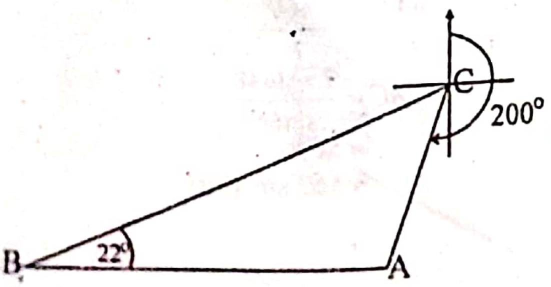
Solution

(a) $90 - 22 = 68$

$\therefore$ the bearing of C from $B = 068°$

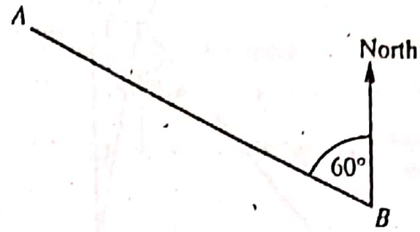


(b) Bearing of A from $C = 180 + 20 = 200°$



2 *(D2004/P1/Q9)*

The diagram shows the positions of A and B.



Find the bearing of

(a) A from B, [1]

(b) B from A. [1]

Thinking Process

(a) Bearing of A from $B = 360° - 60°$

(b) Bearing of B from $A = 180° - 60°$

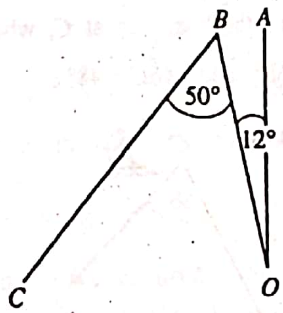
Solution

(a) Bearing of A from $B = 360° - 60°$
$= 300°$

(b) Bearing of B from $A = 180° - 60°$
$= 120°$

3 *(J2005/P1/Q4)*

A is due North of O.



(a) A ship sailed from O to B, where $A\hat{O}B = 12°$. Write down the bearing of B from O. [1]

(b) At B, the ship turned and sailed to C, where $O\hat{B}C = 50°$. Calculate the bearing of C from B. [1]

Thinking Process

(a) Identify the required angle.

(b) Identify the required angle.

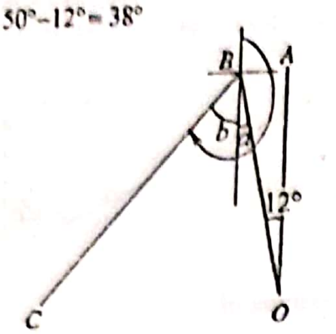
Solution

(a) $360° - 12° = 348°$

Bearing of B from $O = 348°$

(b) $a = 12°$ (alt. $\angle s$)

$b = 50° - 12° = 38°$



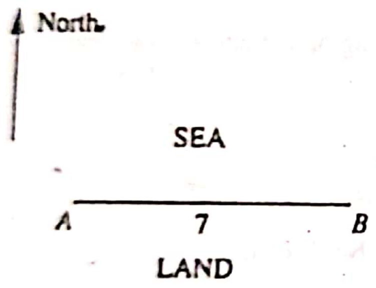
$\therefore$ Bearing of C from $B = 180° + 38° = 218°$

4 (J2006/P2/Q9)

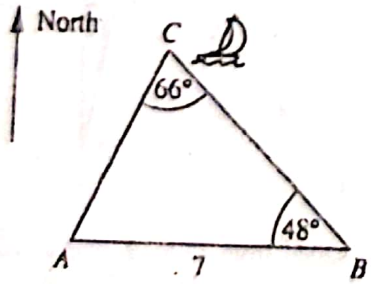
In the diagram, A and B are two points on a straight coastline.

B is due east of A and $AB = 7$ km.

The position of a boat at different times was noted.

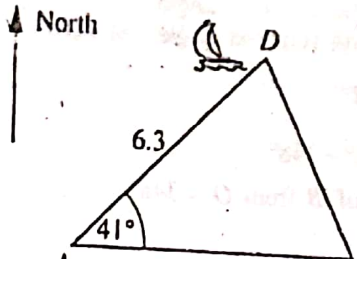


(a) At 8 a.m., the boat was at C, where $A\hat{C}B = 66°$ and $A\hat{B}C = 48°$.



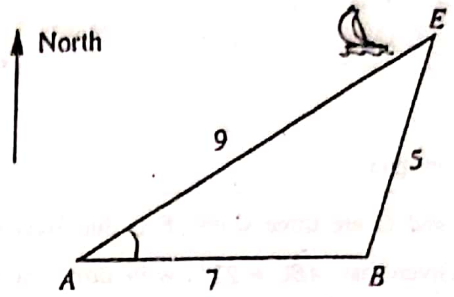
Calculate
(i) the bearing of B from C, [1]
(ii) the distance AC. [3]

(b) At 9 a.m., the boat was at D, where $AD = 6.3$ km and $D\hat{A}B = 41°$.



Calculate
(i) the area of triangle ADB, [2]
(ii) the shortest distance from the boat to the coastline. [2]

(c) At 11 a.m., the boat was at E, where $AE = 9$ km and $BE = 5$ km.



Calculate the bearing of E from A. [4]

Thinking Process

(a) (i) Identify the required bearing.
(ii) Apply Sine Rule.

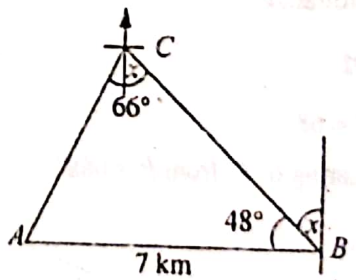
(b) (i) Area of non-right-angled $\Delta = \frac{1}{2}ab\sin C$.

(ii) Equate $\frac{1}{2}ab\sin C$ to $\frac{1}{2}b \times h$. Solve for h.

(c) Use Cosine Rule to solve for $\angle EAB$.

Solution

(a) (i)



$\angle x = 90° - 48°$
$= 42°$

$180° - 42° = 138°$

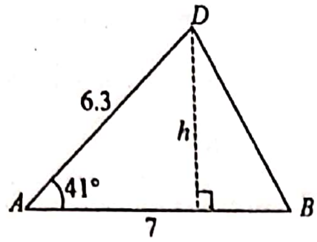
$\therefore$ Bearing of B from C is $138°$.

(ii) Using Sine Rule,

$$\frac{\sin 48°}{AC} = \frac{\sin 66°}{7}$$

$$\Rightarrow AC = \frac{7 \times \sin 48°}{\sin 66°}$$
$$\approx 5.694$$
$$\approx 5.69 \text{ km (3sf)}$$

(b)



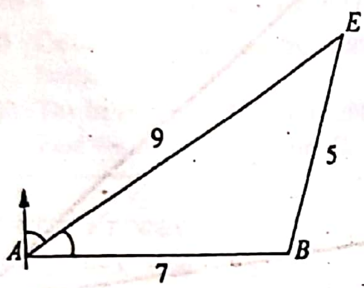
(i) Area of $\Delta ADB = \frac{1}{2} \times 7 \times 6.3 \times \sin 41°$
≈ 14.47
$\approx 14.5 \text{ km}^2$ (3sf)

(ii) Let the shortest distance be h.

$\frac{1}{2} \times 7 \times h = 14.47$

$\Rightarrow \quad h = \frac{14.47 \times 2}{7}$
≈ 4.13 km (3sf)

(c)



$\cos \angle EAB = \frac{9^2 + 7^2 - 5^2}{2(9)(7)}$

$\angle EAB = \cos^{-1}\left(\frac{105}{126}\right) \approx 33.6°$

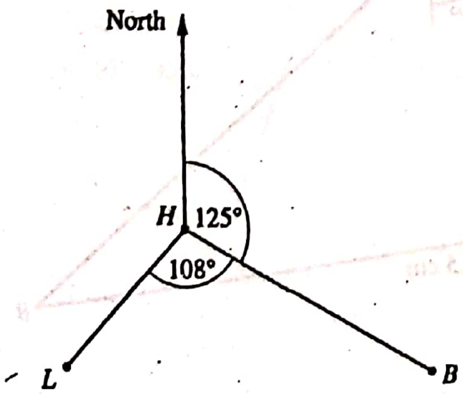
$90° - 33.6° = 56.4°$

$\therefore$ bearing of E from $A = 056.4°$

5 *(N2008/P1/Q18)*

The diagram shows the positions of a harbour, H, and a lighthouse, L.

A boat is anchored at B where $L\hat{H}B = 108°$.



(a) Given that the bearing of B from H is 125°, find the bearing of
(i) L from H, [1]
(ii) H from B. [1]

(b) At 730 a.m. the boat set sail in a straight line from B to H at an average speed of 25km/h. Given that BH = 70km, find the time at which the boat reaches the harbour. [2]

Thinking Process

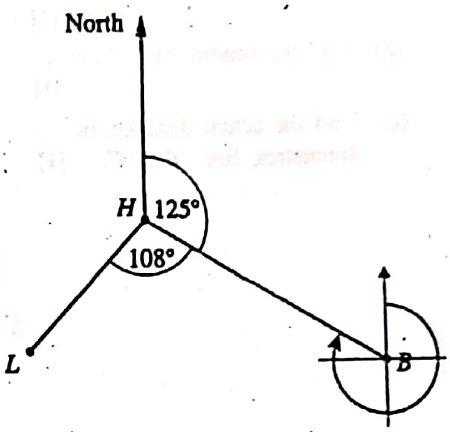
(a) (ii) Draw north at B and find the required bearing.

(b) Recall the formula: speed = $\frac{\text{distance}}{\text{time}}$.

Solution

(a) (i) Bearing of L from $H = 125° + 108°$
$= 233°$ **Ans.**

(ii)



Bearing of H from $B = 180° + 125°$
$= 305°$ **Ans.**

(b) Time $= \frac{\text{distance}}{\text{speed}} = \frac{70}{25} = 2.8$ hrs
$= 2\text{ h} + (0.8 \times 60)\text{ min} = 2\text{h } 48\text{ min.}$

$0730 + 2\text{h } 48 \text{ min} = 0978 = 1018$

$\therefore$ the boat reaches harbour at 10.18 a.m. **Ans.**

6 *(N2012/P1/Q8)*

A ship travelled from P to Q.
It unloaded its cargo at Q and then returned to P.
The bearing of Q from P is 075°.

(a) Find the bearing of P from Q. [1]

(b) The ship left P at 21 40 and returned to P at 05 33 the following day.
Find the length of time, in hours and minutes, between leaving P and returning to P. [1]

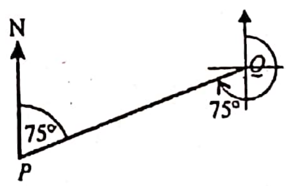
Thinking Process

(a) With given information, draw a line PQ. To find the bearing ∮ draw north at Q

(b) To find the length of time ∮ first subtract 2140 from 2400, then add 5 hours 33 minutes to it.

Solution

(a) Bearing of P from Q
$= 180° + 75°$
$= 255°$ **Ans.**



321

(b) $\begin{array}{r} 24\ 00 \\ -21\ 40 \\ \hline 02\ 20 \end{array}$

the ship took 2 hours 20 minutes untill midnight

$02\ 20 + 05\ 33 = 07\ 53$

$\therefore$ Length of time is 7 hours 53 minutes. **Ans.**

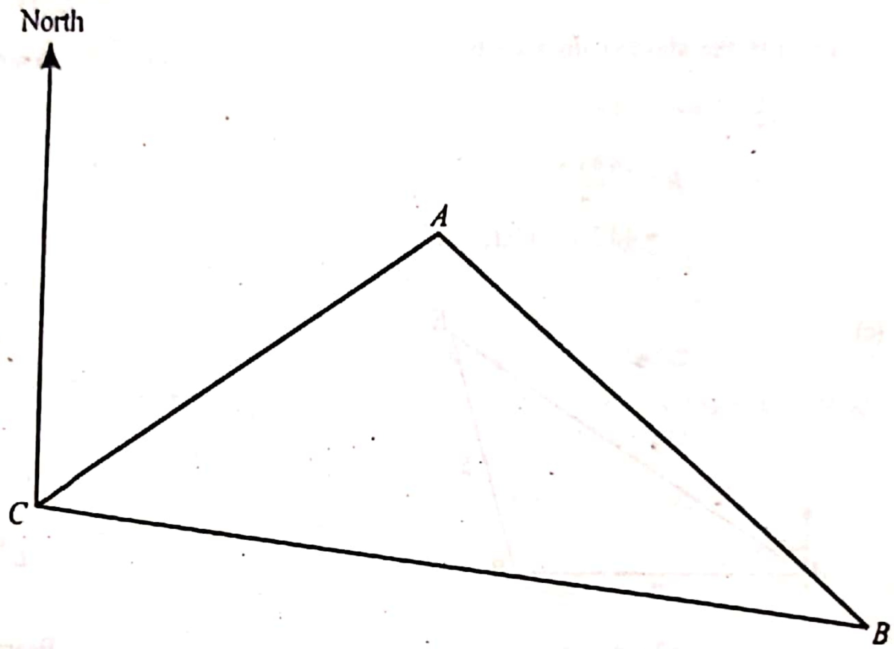
7 *(J2011/P1/Q16)*

The scale drawing shows three towns, A, B and C.
The scale of the drawing is 1 cm to 25 km.

(a) Measure the bearing of A from C. [1]

(b) Find the bearing of C from A. [1]

(c) Find the actual distance, in kilometres, from B to C. [1]



Thinking Process

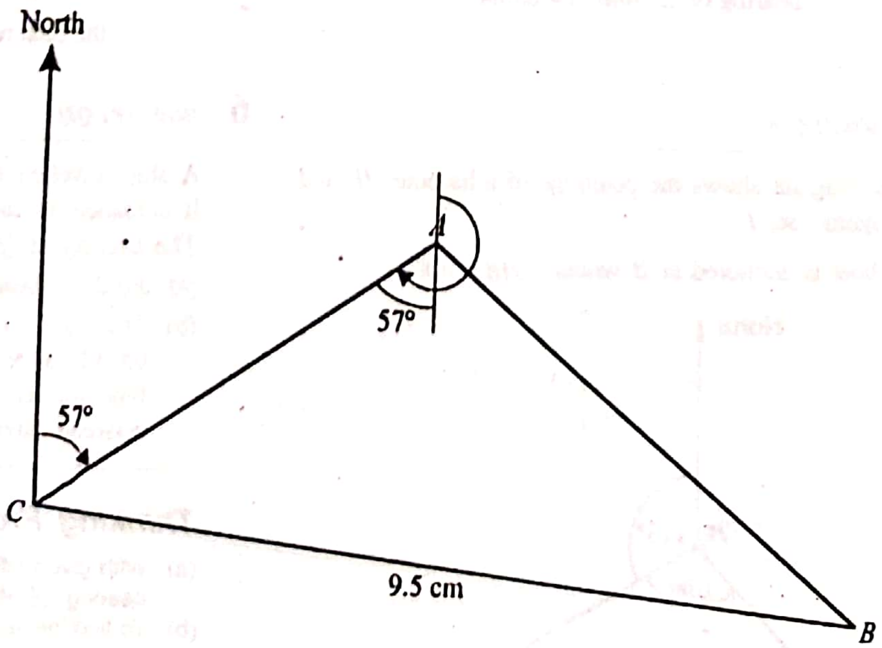
(a) Use a protractor to measure the bearing.
(b) Draw a north-line from A.
(c) Measure BC and multiply by 25.

Solution

(a) Bearing of A from C
$= 057°$ **Ans.**

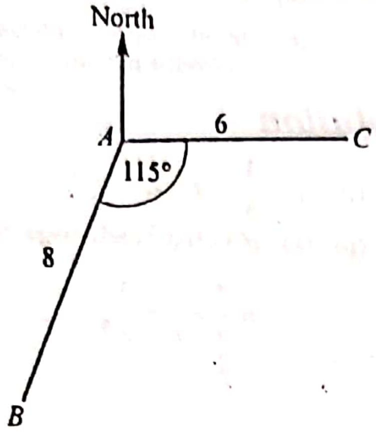
(b) Bearing of C from A
$= 180° + 57° = 237°$ **Ans.**

(c) $BC = 9.5$ cm
given scale: 1 cm = 25 km
$\therefore\ BC = 9.5 \times 25$
$= 237.5$ km **Ans.**



8 (N2013/P2/Q10 a)

(a)



Two boats sail from A. One boat sails to B, and the other boat sails to C.

$AB = 8$ km, $AC = 6$ km and $B\hat{A}C = 115°$.

(i) Calculate the distance, BC, between the boats. [4]

(ii) The bearing of B from A is 200°. Find the bearing of A from C. [2]

Thinking Process

(a) (i) Apply cosine rule.

(ii) To find the bearing draw north at C.

Solution

(a) (i) Using cosine rule,

$$BC^2 = (8)^2 + (6)^2 - 2(8)(6)\cos 115°$$
$$= 64 + 36 - (-40.5714)$$
$$= 64 + 36 + 40.5714$$
$$= 140.5714$$

$\therefore$ $BC = 11.856 \approx 11.9$ km (3sf) **Ans.**

(ii) $\angle a = 200° - 115°$
$= 85°$

$\therefore$ Bearing of A from C
$= 180° + 85°$
$= 265°$ **Ans.**