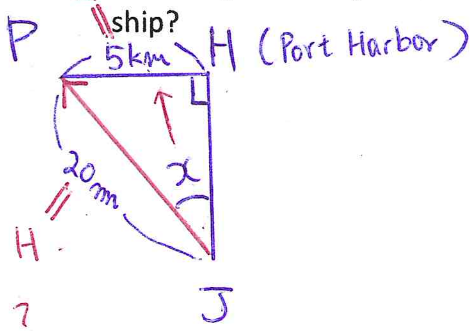
April 16 Park

Example 2

Captain Jack is navigating his ship to Port Harbour, which is directly north of the ship's location. To compensate for an easterly current, he aims for a point on shore that is 5 km west of Port Harbour. Assuming that the point on shore is 20 km from his position now, at what bearing must Jack head his ship?



SOH → $\sin x = \frac{O}{H}$

$\sin x = \frac{5}{20}$

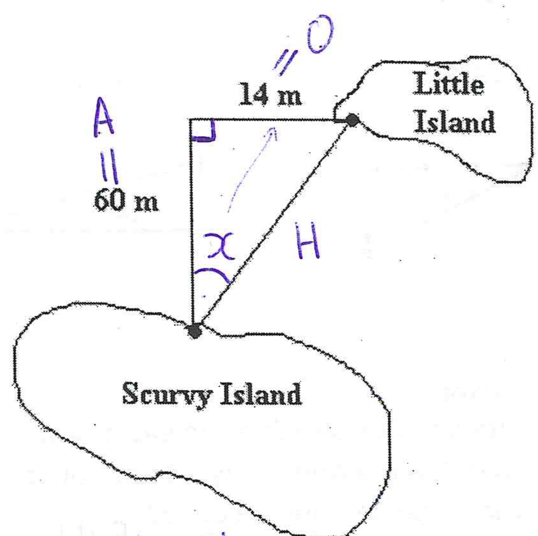
$x = \sin^{-1}\left(\frac{5}{20}\right)$

$x = 14.5°$

∴ Captain Jack must head N W

Practice Questions:

1. Captain Jack would like to sail from Scurvy Island to Little Island, as shown in the picture. What bearing must Jack head his ship? (Use compass points)



N x° E

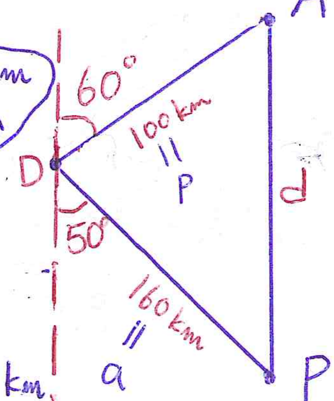
TOA → $\tan x = \frac{O}{A} = \frac{14}{60}$

$\tan x = \frac{14}{60}$

$x = \tan^{-1}\left(\frac{14}{60}\right) = 13.1°$

∴ Jack must head N 13° E.

2. The radar screen of an airport control tower shows that two planes are at the same altitude. According to the range finder, one plane is 100 km away, in the direction N60°E. The other is 160 km away, at a direction of S50°E. How far apart are the planes?



$\angle ADP = 180° - 60° - 50° = 70°$

∴ Planes are 157 km apart from each other.

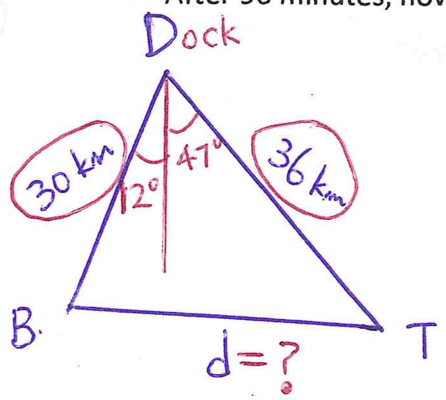
$d^2 = a^2 + p^2 - 2(a)(p)\cos D$

$d^2 = 160^2 + 100^2 - 2(160)(100)\cos 70°$

$d^2 = 25600 + 10{,}000 - 32000 \cos 70°$

$d^2 = 24655 \rightarrow \sqrt{d^2} = \sqrt{24655} \rightarrow d = 157$ km

3. On the North side of a lake is a dock. Two boats leave the dock at the same time. One boat travels S12°W and travels at 20 km/h and the other boat travels S47°E and travels at 24 km/h. After 90 minutes, how far apart are the boats to the nearest kilometre?



d = speed x time

90 minutes

$Bd = 20\text{km/h} \times 1.5 \text{ hours} = 30 \text{ km}$

$Td = 24\text{km/h} \times 1.5 \text{ hours} = 36 \text{ km}$

$d^2 = 30^2 + 36^2 - 2(30)(36)\cos 59°$

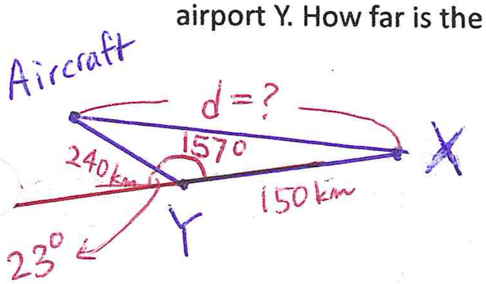
$d^2 = 900 + 1296 - 1112.482$

$\sqrt{d^2} = \sqrt{1083.52}$

$d = 33 \text{ km}$

∴ The boats are 33 km apart from each other.

4. Airport X is 150 km east of airport Y. An aircraft is 240 km from airport Y, and W23°N from airport Y. How far is the aircraft from airport X, to the nearest kilometre?



$\angle Y = 180° - 23° = 157°$

* Cosine Law

$d^2 = 150^2 + 240^2 - 2(150)(240)\cos 157°$

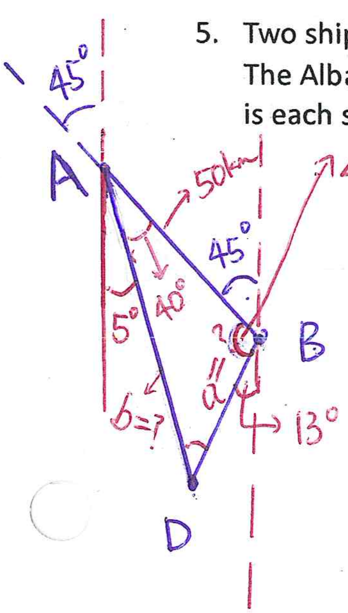
$d^2 = 22500 + 57600 + 66276.35$

$\sqrt{d^2} = \sqrt{146376.35}$

$d = 382.59 = 383 \text{ km}$

∴ The aircraft is 383 km away from airport X.

5. Two ships, the Albacore and the Bonito, are 50 km apart. The Albacore is N45°W of the Bonito. The Albacore sights a distress flare at S5°E. The Bonito sights the same flare at S13°W. How far is each ship from the distress flare?



$\angle B = 180° - 45° - 13° = 122°$ ∴ $\angle B = 122°$

$\angle A = 45 - 5 = 40°$ $\angle D = 180 - 40 - 122° = 18°$

$\frac{50}{\sin 18°} = \frac{b}{\sin 122°}$

$\sin 18° \times b = 50 \times \sin 122°$

$b = \frac{50 \times \sin 122°}{\sin 18°}$

∴ $b = 137.2 \text{ km}$

$\frac{50}{\sin 18} = \frac{a}{\sin 40°}$

$a \cdot \sin 18° = 50 \times \sin 40$

$a = \frac{50 \times \sin 40°}{\sin 18°}$

∴ $a = 104 \text{ km}$