Warm Up

Prove the trig identity:

$$(\sin\theta+\cos\theta)^2 = 1+2\sin\theta\cos\theta$$

$(\sin\theta+\cos\theta)(\sin\theta+\cos\theta)$

$= \sin^2\theta + \sin\theta\cos\theta + \sin\theta\cos\theta + \cos^2\theta$

$= \sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta$

$= 1 + 2\sin\theta\cos\theta = RS$

Solving Trigonometry Problems in 3D

Lesson objectives

- I know how to draw a sketch of a 3-D word problem
- I know how to follow the multiple steps needed to solve problems using the primary trig ratios, the sine law, and/or the cosine law

1.1

Lesson objectives | Teachers' notes | Lesson notes

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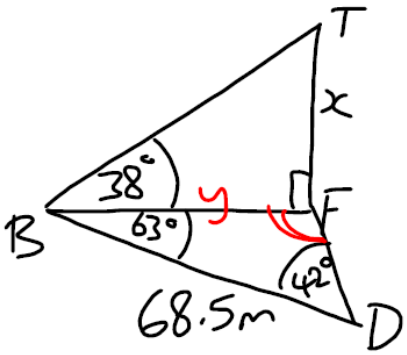
Example:
From a point B, Bunter uses a clinometer to determine that the angle of elevation to the top of the cliff is 38°. From point D, 68.5m away from Bunter, Smudger estimates the angle between the foot of the cliff, himself and Bunter to be 42°, while Bunter estimates the angle between the foot of the cliff, himself and Smudger to be 63°. How high is the cliff?



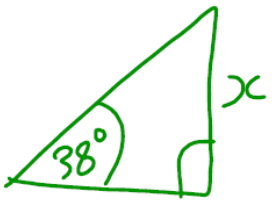
$\angle F = 180 - 63 - 42$
$= 75°$

Using the sine law

$\frac{y}{\sin 42} = \frac{68.5}{\sin 75}$

$y = \frac{68.5 \sin 42}{\sin 75}$

$y = 47.5m$



$\tan 38 = \frac{x}{47.5}$

$\Rightarrow x = 47.5 \tan 38$
$= 37.1m$

Bearings

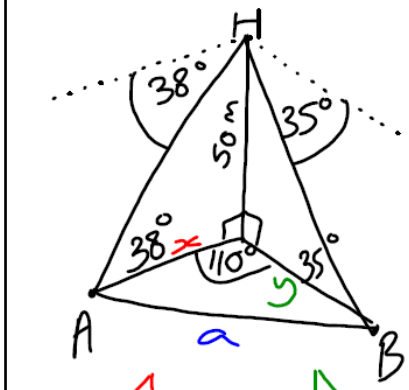
When we talk about BEARINGS we must follow these three rules:

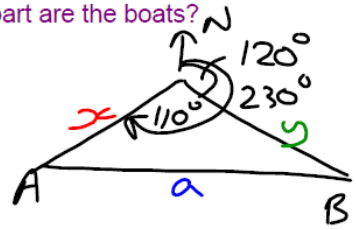
1. We always measure from North

2. We always measure clockwise

3. We always give the angle as a three-digit number

Example:
Bunter is on a 50m high bridge and sees two boats anchored below. From his position, boat A has a bearing of 230°, and boat B has a bearing of 120°. Bunter estimates the angles of depressions to be 38° for boat A and 35° for boat B. How far apart are the boats?





$a^2 = x^2 + y^2 - 2xy\cos A$

$a^2 = 64.0^2 + 71.4^2 - 2(64.0)(71.4)\cos 110$

$a^2 = 12319.75$

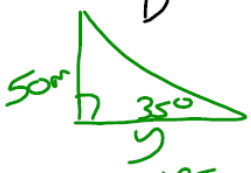
$a = \sqrt{ANS}$

$a = 111.0\text{m}$

$\tan 38 = \frac{50}{x}$

$x = \frac{50}{\tan 38}$

$x = 64.0\text{m}$



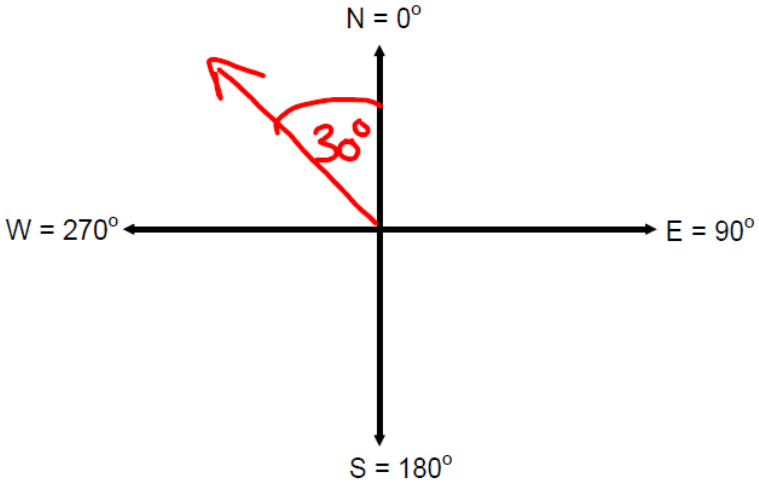
$\tan 35 = \frac{50}{y}$

$y = \frac{50}{\tan 35}$

$y = 71.4\text{m}$

Compass Direction

Compass direction is always structured the following way:



Compass direction is read from left to right to determine direction.

Example: N30°W

This means start due north then go 30° towards the west.

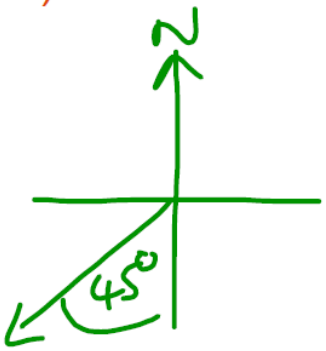
Bearing would be

$360 - 30 = 330°$

Example

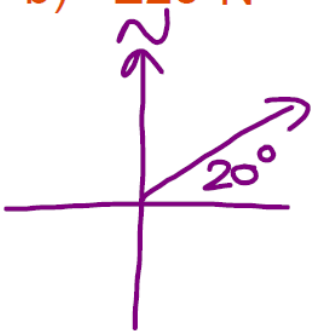
Draw the following angles:

a) S45°W



Bearing of
$180 + 45$
$= 225°$

b) E20°N



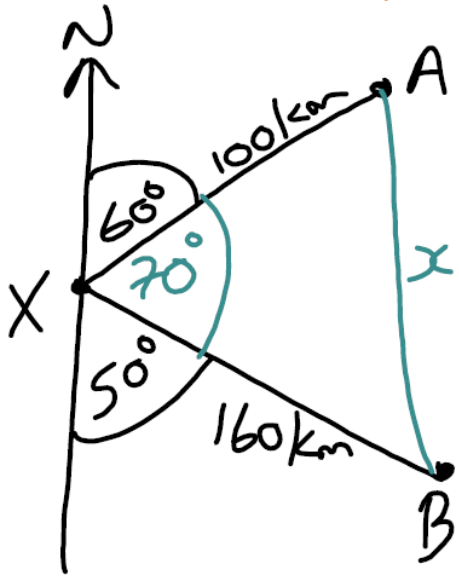
Bearing of
$90 - 20$
$= 070°$

c) N80°E

Bearing of
$080°$

Example

The radar screen in an air-traffic control tower shows that two airplanes are at the same altitude. According to the range finder, one airplane is 100km, in the direction N60°E. The other airplane is 160km away, in the direction S50°E. How far apart are the planes?



Using the cosine law

$x^2 = a^2 + b^2 - 2ab\cos X$

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

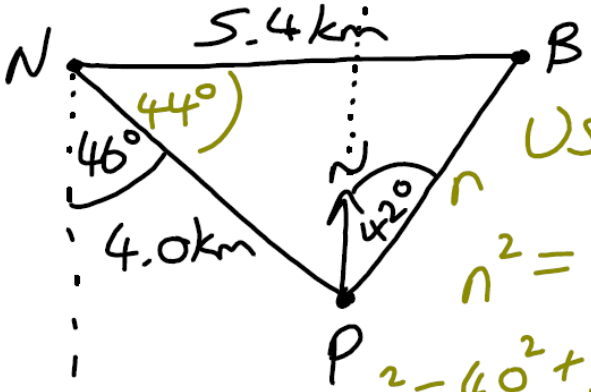
$x^2 = 24655.36$

$x = \sqrt{ANS}$

$x = 157\text{ km}$

Example

The Nautilus is sailing due east toward a buoy. At the same time, the Porpoise is approaching the buoy heading N42°E. If the Nautilus is 5.4km from the buoy and the Porpoise is 4.0km from the Nautilus, on a heading of S46°E, how far is the Porpoise from the buoy?



Using the cosine law

$n^2 = b^2 + p^2 - 2bp\cos N$

$n^2 = 4.0^2 + 5.4^2 - 2(4.0)(5.4)\cos 44°$

$n^2 = 14.08452063$

$n = \sqrt{ANS} = 3.75\text{ km}$