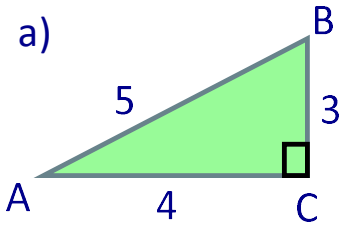
1.5 Solving Problems with Primary Trig Ratios

1) Solve for ∠A using two different ratios.

a)



Any ratio!

Sin

$\sin\theta = \frac{opp}{hyp}$

$\sin A = \frac{3}{5}$

$A = \sin^{-1}\left(\frac{3}{5}\right)$

$A \doteq 36.9°$

Cos

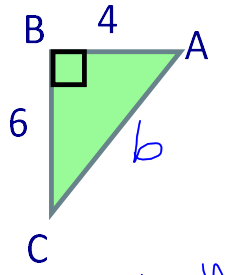
$\cos\theta = \frac{adj}{hyp}$

$\cos A = \frac{4}{5}$

$A = \cos^{-1}\left(\frac{4}{5}\right)$

$\doteq 36.9°$

b)



Let's find that unknown side first

$b^2 = 6^2 + 4^2$

$= 36 + 16$

$= 52$

$b = \sqrt{52}$

$\doteq 7.2$

tan

$\tan\theta = \frac{opp}{adj}$

$\tan A = \frac{6}{4}$

$A = \tan^{-1}\left(\frac{6}{4}\right)$

$\doteq 56°$

Sin

$\sin\theta = \frac{opp}{hyp}$

$\sin A = \frac{6}{7.2}$

$A = \sin^{-1}\left(\frac{6}{7.2}\right)$

$\doteq 56°$

To "Solve" a triangle means to determine all side lengths and all angle measures that aren't given in the question.

Tools I could use:

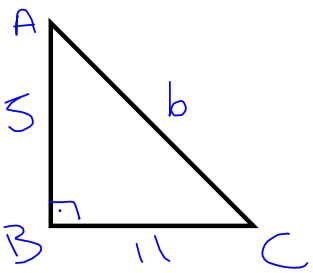
sum of angles in a triangle is 180 degrees

trigonometric ratios (angles & sides)

pythagorean theorem (sides)

2) Solve the following triangles.
Include a labelled diagram as part of your solution.

a) In ΔABC, ∠B=90°, c = 5cm and a = 11 cm.



$b^2 = 5^2 + 11^2$
$= 25 + 121$
$= 146$
$b \doteq 12.1$

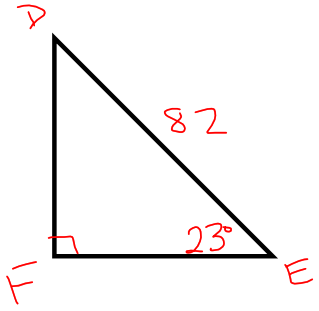
$\tan\theta = \frac{opp}{adj}$

$\tan C = \frac{5}{11}$

$C = 24.4°$

$A = 180 - 90 - 24.4$
$= 65.6°$

b) In ΔDEF, ∠F = 90°, ∠E=23° and f= 82 m.



∠D

$D = 180 - 90 - 23°$
$= 67°$

Side e

$\sin\theta = \frac{opp}{hyp}$

$\sin 23° = \frac{e}{82}$

$82 \cdot \sin 23° = e$

$e \doteq 32$

side d

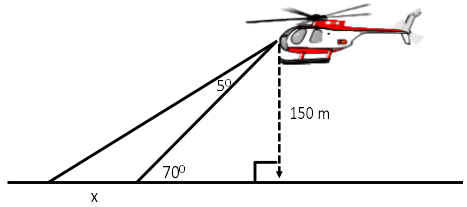
$82^2 = 32^2 + d^2$

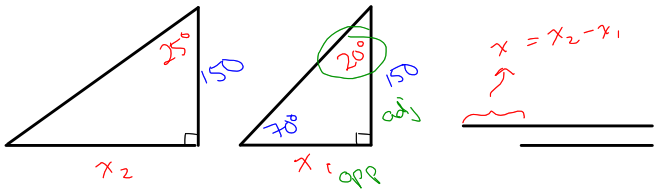
$82^2 - 32^2 = d^2$

$5700 = d^2$

$d = 75.5$

A searchlight is mounted at the front of a search and rescue helicopter. The pilot is flying the helicopter 150 m above the ground and the beam hits the ground at 70^0 from the horizontal. The beam spreads out at an angle of 5^0. **How wide is the beam when it hits the ground?**





$\tan\theta = \frac{opp}{adj}$

$\tan 20° = \frac{x_1}{150}$

$150 \cdot \tan 20° = x_1$

$x_1 \doteq 54.6$

$\tan\theta = \frac{opp}{adj}$

$\tan 25° = \frac{x_2}{150}$

$150 \cdot \tan 25° = x_2$

$x_2 \doteq 69.9$

$x = x_2 - x_1$

$= 69.9 - 54.6$

$= 15.3$

∴ The width of the beam is 15.3 m

A student is standing at the top of a hill that is 200 m high. **Using a** clinometer, she sights the base of the hill at an angle of depression **of 40^0** from the horizontal. If the slope of the hill is constant, how far will the walk be from the top of the hill to the base? Draw a diagram!

$\sin\theta = \frac{opp}{hyp}$

$\sin 40° = \frac{200}{x}$

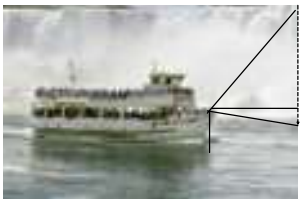
$x \cdot \sin 40° = 200$

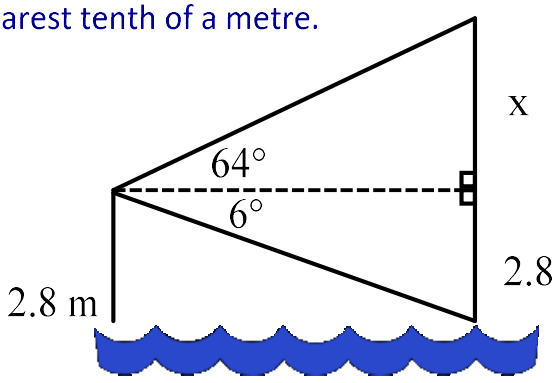
$x = \frac{200}{\sin 40°}$

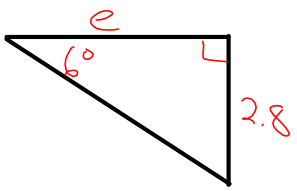
$\doteq 311.1$

∴ Her walk is approx. 311 m

From the bridge of a boat on the Niagara River, the angle of elevation of the top of the Horseshoe Falls is 64^0. The angle of depression of the bottom of the Falls is 6^0. If the bridge of the boat is 2.8 m above the water, calculate the height of the Horseshoe Falls, to the nearest tenth of a metre.





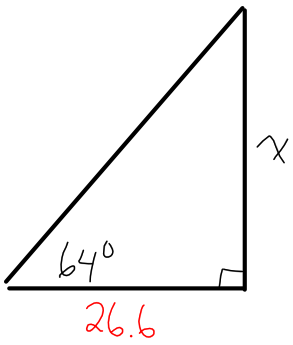


$\tan\theta = \frac{opp}{adj}$

$\tan 6^\circ = \frac{2.8}{e}$

$e = \frac{2.8}{\tan 6^\circ}$

$\div 26.6$



$\tan\theta = \frac{opp}{adj}$

$\tan 64^\circ = \frac{x}{26.6}$

$26.6(\tan 64^\circ) = x$

$x \div 55$

$h = 55 + 2.8$

$= 57.8$

∴ The height of the falls is approx. 57.8 m