

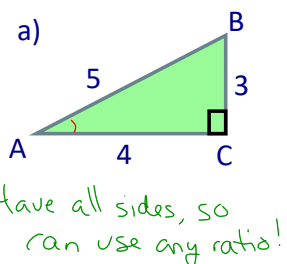
1.5 Solving Problems with Primary Trig Ratios

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:

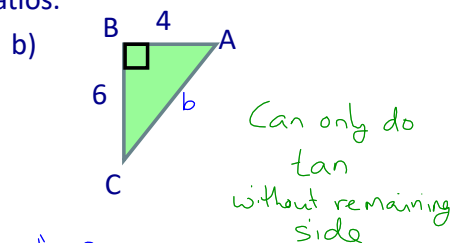
- angle Sum of angles in a triangle is 180 degrees
- angle/side Primary Trig Ratios (SOH CAH TOA)
- side Pythagorean Theorem $hyp^2 = a^2 + b^2$

1) Solve for A using two different ratios.



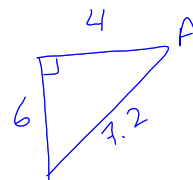
Sin
 $\sin \theta = \frac{O}{H}$
 $\sin A = \frac{3}{5}$
 $A = \sin^{-1}\left(\frac{3}{5}\right)$
 $\approx 36.9^\circ$

cos
 $\cos \theta = \frac{A}{H}$
 $\cos A = \frac{4}{5}$
 $A = \cos^{-1}\left(\frac{4}{5}\right)$
 $\approx 36.9^\circ$



Let's find unknown side first!

$hyp^2 = x^2 + y^2$
 $b^2 = 4^2 + 6^2$
 $b^2 = 16 + 36$
 $b^2 = 52$
 $b = \sqrt{52}$
 ≈ 7.2



Sin
 $\sin \theta = \frac{O}{H}$
 $\sin A = \frac{6}{7.2}$
 $A \approx 56.4$

cos
 $\cos \theta = \frac{A}{H}$
 $\cos A = \frac{4}{7.2}$
 $A \approx 56.3$

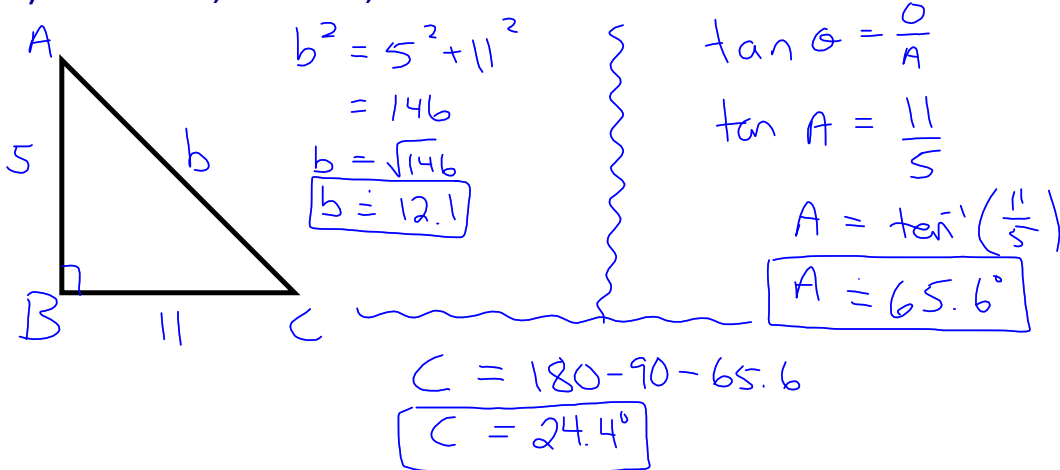
tan
 $\tan \theta = \frac{O}{A}$
 $\tan A = \frac{6}{4}$
 $A \approx 56.3^\circ$

→ All unknowns (sides & angles)

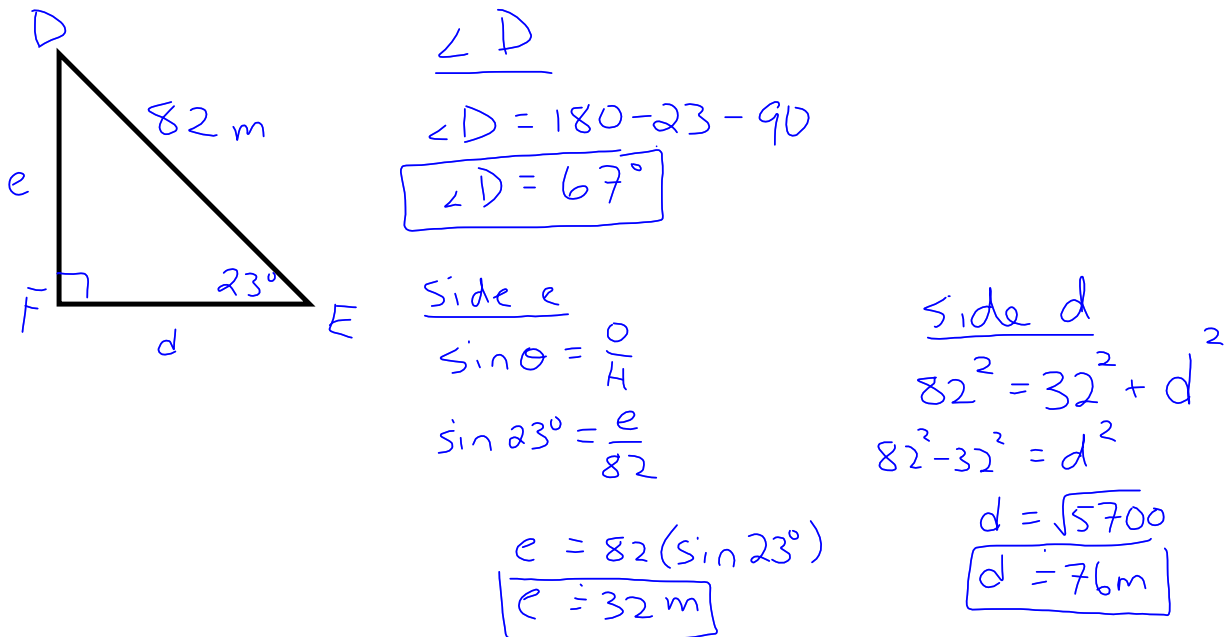
2) Solve the following triangles.

Include a labelled diagram as part of your solution.

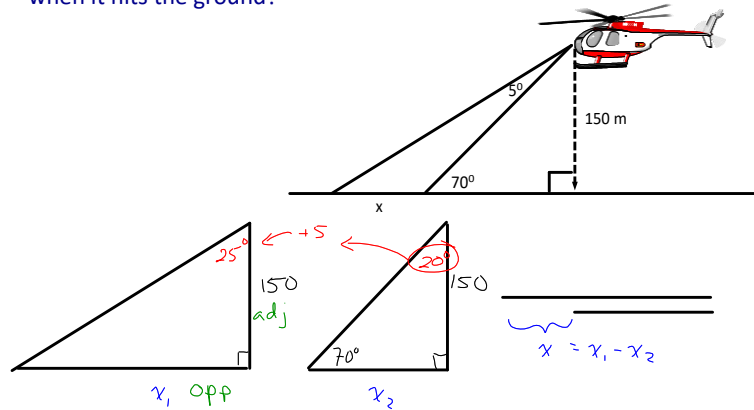
a) In $\triangle ABC$, $\angle B = 90^\circ$, $c = 5$ cm and $a = 11$ cm.



b) In $\triangle DEF$, $\angle F = 90^\circ$, $\angle E = 23^\circ$ and $f = 82$ m.



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° from the horizontal. The beam spreads out at an angle of 5° . How wide is the beam when it hits the ground?



$$\frac{x_1}{\tan 25^\circ} = \frac{150}{\tan 70^\circ}$$

$$150(\tan 25^\circ) = x_1$$

$$x_1 = 70$$

$$\frac{150}{\tan 70^\circ} = x_2$$

$$\tan 70^\circ = \frac{150}{x_2}$$

$$x_2(\tan 70^\circ) = 150$$

$$x_2 = \frac{150}{\tan 70^\circ}$$

$$= 55$$

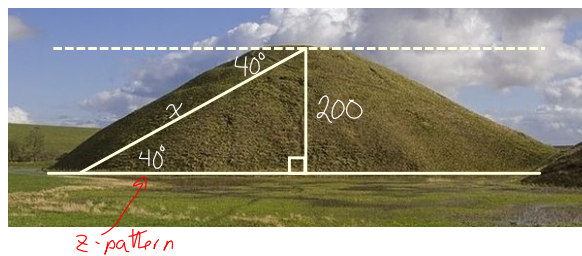
$$\frac{x}{x} = x_1 - x_2$$

$$= 70 - 55$$

$$= 15$$

∴ The beam is 15m wide

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° 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!



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

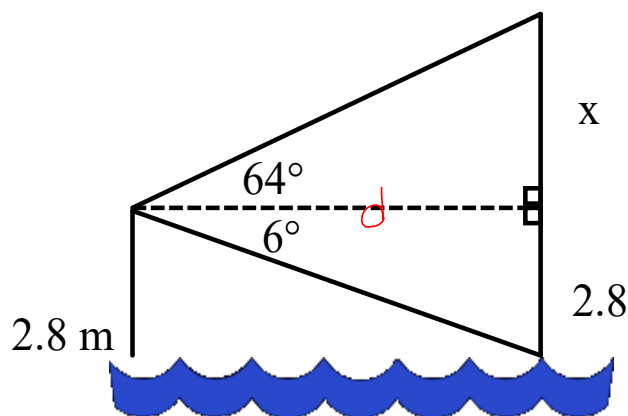
$$\sin 40^\circ = \frac{200}{x}$$

$$x = \frac{200}{\sin 40^\circ}$$

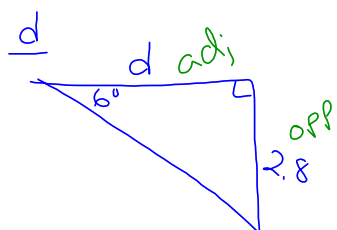
$$= 311$$

∴ The walk is approx. 311m

From the bridge of a boat on the Niagara River, the angle of elevation of the top of the Horseshoe Falls is 64° . The angle of depression of the bottom of the Falls is 6° . 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.



- Solve for d
- Use d to solve for x

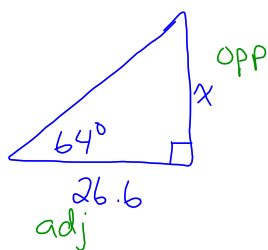


$$\tan \theta = \frac{O}{A}$$

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

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

$$= 26.6$$



$$\tan \theta = \frac{O}{A}$$

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

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

$$x = 54.5$$

$$h = 54.5 + 2.8$$

$$= 57.3$$

\therefore The height is
57.3m

Practice:

Set 1: p. 374 #13 p.380 #1,5,11,14

Set 2: p. 374 #13, p.380 #5,6,14,20,23*