

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.

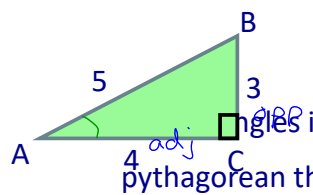
Tools I could use:

sum of angles in a triangle is 180 degrees

trigonometric ratios (angles & sides) (SOH CAH TOA)

pythagorean theorem (sides) $hyp^2 = a^2 + b^2$

1) Solve for A using two different ratios.



angles in a triangle is 180°
 pythagorean theorem (sides)
 trigonometric ratios (angles & sides)

$$\tan A = \frac{opp}{adj} = \frac{3}{4}$$

$$A = \tan^{-1}\left(\frac{3}{4}\right)$$

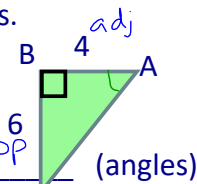
$$\approx 37^\circ$$

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

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

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

$$\approx 37^\circ$$



angles in a triangle is 180°
 pythagorean theorem (sides)
 trigonometric ratios (angles & sides)

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

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

$$\approx 56^\circ$$

Don't have hypotenuse!
 Use pythagorean theorem
 to find!

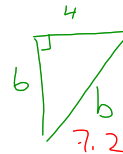
$$hyp^2 = a^2 + b^2$$

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

$$b^2 = 36 + 16$$

$$\sqrt{b^2} = \sqrt{52}$$

$$b \approx 7.2$$



$$\cos A = \frac{adj}{hyp} = \frac{4}{7.2}$$

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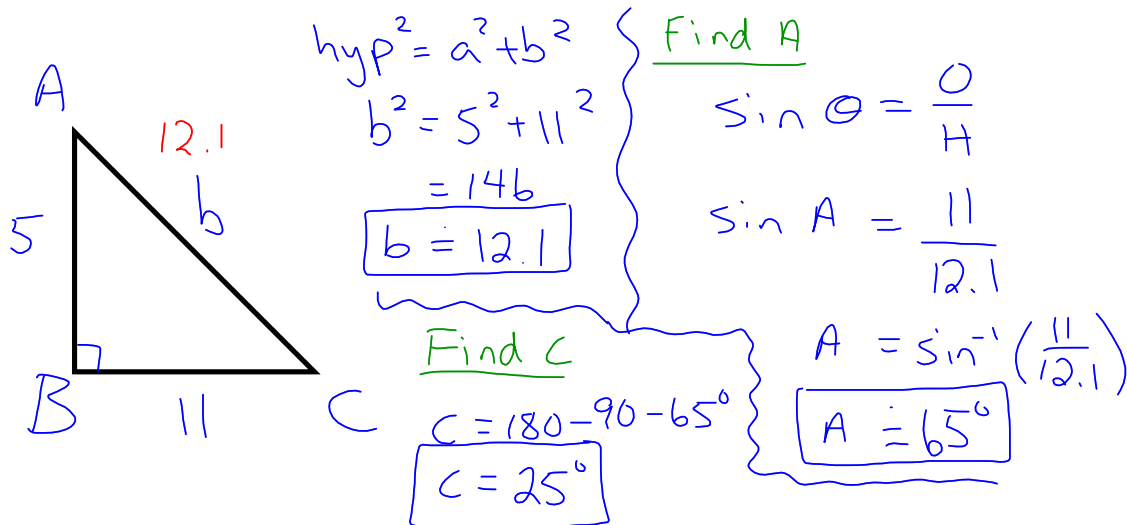
$$A = \cos^{-1}\left(\frac{4}{7.2}\right)$$

$$\approx 56^\circ$$

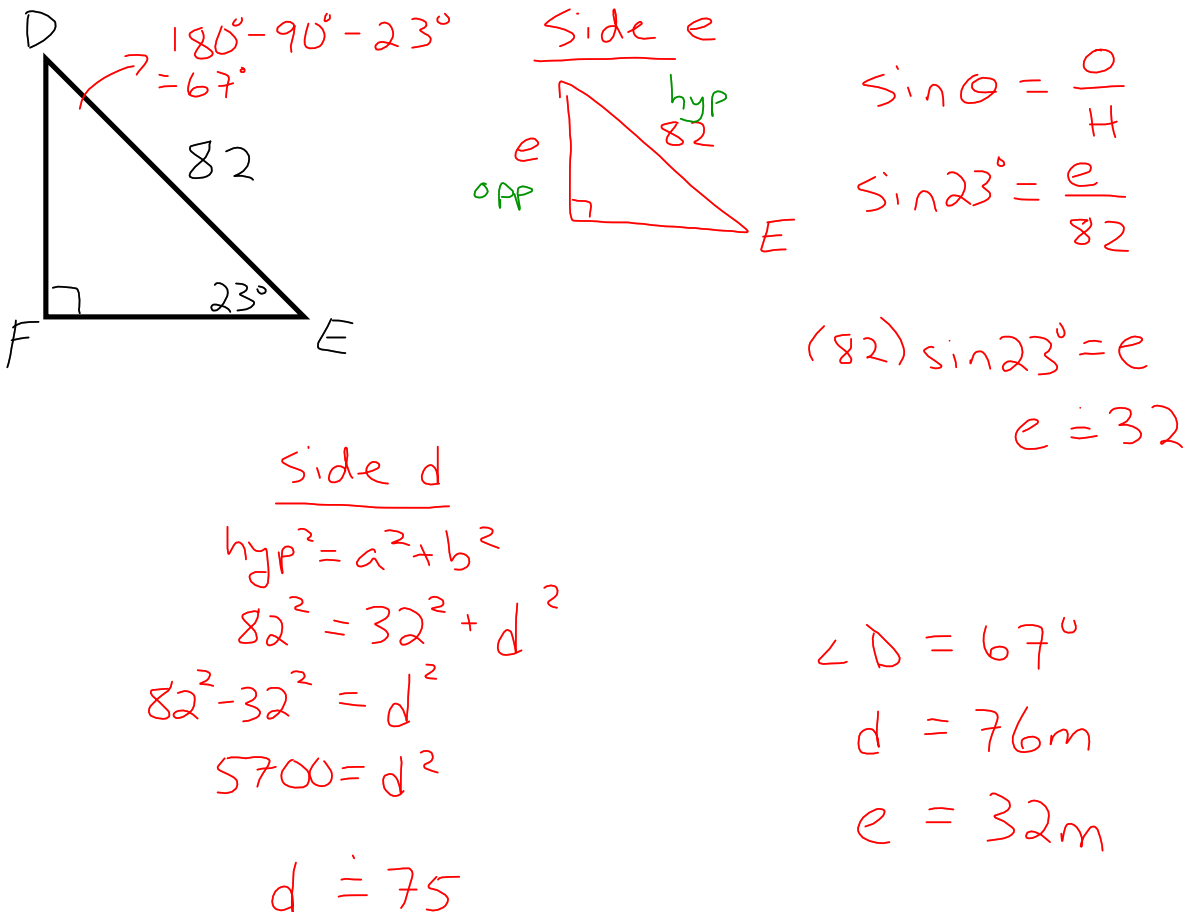
2) Solve the following triangles.

Include a labelled diagram as part of your solution.

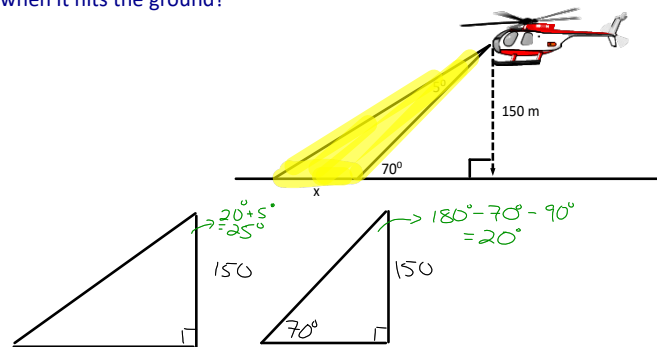
a) In $\triangle ABC$, $\angle B = 90^\circ$, $c = 5\text{ cm}$ and $a = 11\text{ cm}$.



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



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?



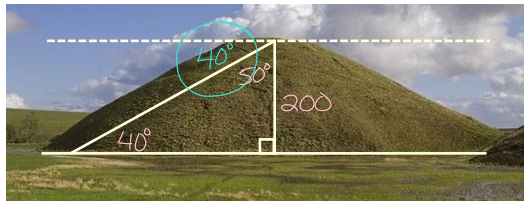
$$\begin{aligned} \tan 25^\circ &= \frac{a}{150} \\ a &= 150 \tan 25^\circ \\ a &\approx 70 \end{aligned}$$

$$\begin{aligned} \tan 20^\circ &= \frac{b}{150} \\ b &= 150 \tan 20^\circ \\ b &\approx 55 \end{aligned}$$

$x = 70 - 55 = 15$

$\therefore$ The beam is 15m wide

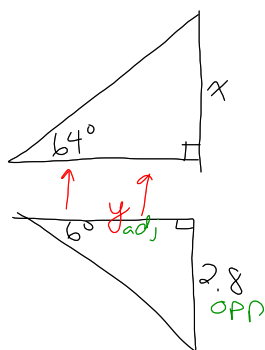
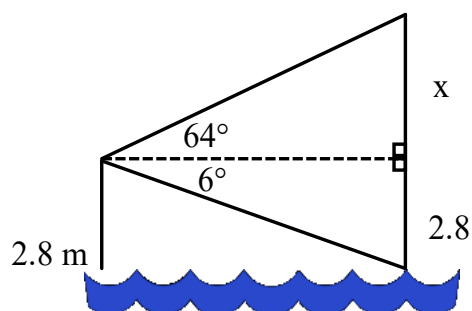
A student is standing at the top of a hill that is 200 m high. Using a clinometer, she sights the base of the hill at an angle of depression of 40° from the horizontal. If the slope of the hill is constant, how far will the walk be from the top of the hill to the base? Draw a diagram!



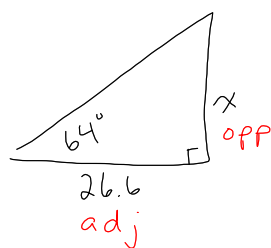
$$\begin{aligned} \sin 40^\circ &= \frac{200}{d} \\ d &= \frac{200}{\sin 40^\circ} \\ d &\approx 311 \end{aligned}$$

$\therefore$ The walk is 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.



$$\begin{aligned}\tan \theta &= \frac{O}{A} \\ \tan 6^\circ &= \frac{2.8}{y} \\ y \cdot \tan 6^\circ &= 2.8 \\ y &= \frac{2.8}{\tan 6^\circ} \\ &= 26.6\end{aligned}$$



$$\begin{aligned}\tan \theta &= \frac{O}{A} \\ \tan 64^\circ &= \frac{x}{26.6} \\ 26.6 \cdot \tan 64^\circ &= x \\ x &= 54.5\end{aligned}$$

$$\begin{aligned}54.5 + 2.8 \\ = 57.3\text{m}\end{aligned}$$

$\therefore$ Total 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*