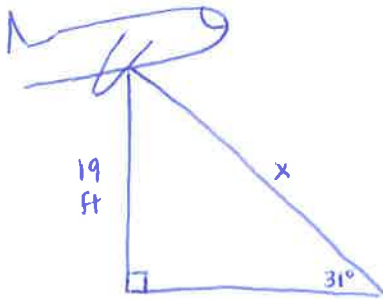


- 1) The door on an airplane is 19 feet off the ground and there is a ramp that extends from the doorway to the ground. The ramp has a  $31^\circ$  angle of elevation. What is the length of the ramp?



$$\frac{\sin 31}{1} = \frac{19}{x}$$

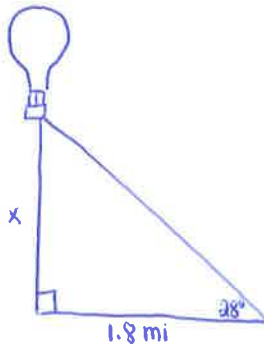
$$19 = x \sin 31$$

$$x = \frac{19}{\sin 31}$$

$$x \approx 36.9$$

The ramp is about  
36.9 ft long

- 2) A hot air balloon is being observed by someone standing 1.8 miles away from the balloon measured along the ground. He measures an angle of elevation of  $28^\circ$  from the ground. How high off the ground is the balloon?



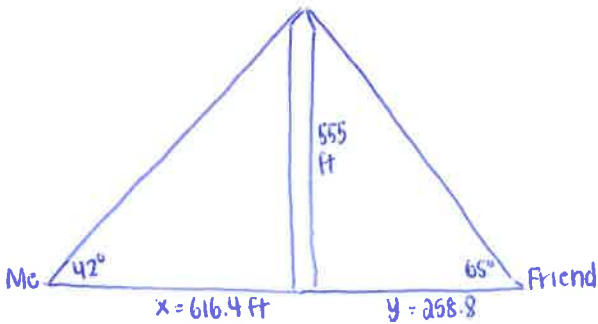
$$\frac{\tan 28^\circ}{1} = \frac{x}{1.8}$$

$$x = 1.8 \tan 28^\circ$$

$$x \approx 0.96$$

The balloon is 0.96  
miles off the ground

- 3) You are on the west side of the Washington Monument which is 555 feet tall. Your friend is on the opposite (east) side. The angle of elevation from your position to the top of the monument is  $42^\circ$ . The angle of elevation from your friend's position to the top of the monument is  $65^\circ$ . How far are you from your friend?



Me:  $\frac{\tan 42}{1} = \frac{555}{x}$

$$555 = x \tan 42$$

$$x = \frac{555}{\tan 42}$$

$$x \approx 616.4$$

Friend:  $\frac{\tan 65}{1} = \frac{555}{y}$

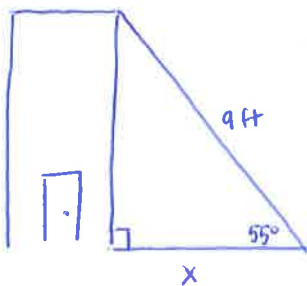
$$555 = y \tan 65$$

$$y = \frac{555}{\tan 65}$$

$$y \approx 258.8$$

$$\text{Distance} = 616.4 + 258.8 = 875.2 \text{ ft apart}$$

- 4) A 9 foot ladder makes an angle of  $55^\circ$  with the ground. How far is the bottom of the ladder from the base of the building?



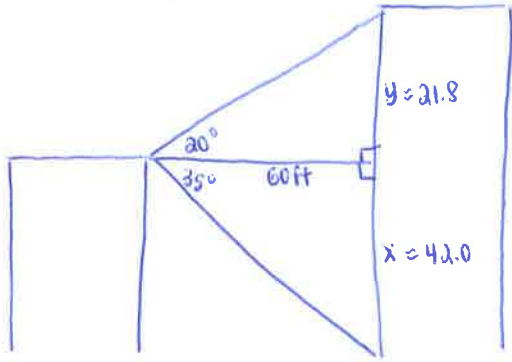
$$\frac{\cos 55}{1} = \frac{x}{9}$$

$$x = 9 \cdot \cos 55$$

$$x = 5.2$$

The bottom of the  
ladder is about  
5.2 ft away

- 5) Two buildings are 60 feet apart across a street. A person on top of the shorter building finds the angle of elevation to the roof of the taller building to be  $20^\circ$ . He also finds the angle of depression down to the base of the taller building to be  $35^\circ$ . How tall is the taller building?



$$\text{Top } \Delta: \frac{\tan 20^\circ = \frac{y}{60}}{1}$$

$$y = 60 \tan 20^\circ$$

$$y = 21.8$$

$$\text{Bottom } \Delta: \frac{\tan 35^\circ = \frac{x}{60}}{1}$$

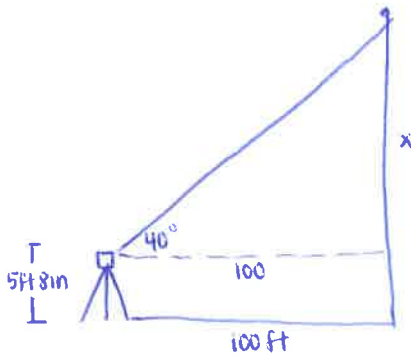
$$x = 60 \tan 35^\circ$$

$$x = 42.0$$

$$\text{Height} = 21.8 + 42.0 = 63.8$$

The taller building is about 63.8 ft tall

- 6) You want to find the height of a tower used to transmit cell phone calls. You stand 100 feet away from the tower. Using a transit placed on a post 5 ft 8 in. off the ground, you measure the angle of elevation to be  $40^\circ$ . How tall is the tower?



$$\frac{\tan 40^\circ = \frac{x}{100}}{1}$$

$$x = 100 \tan 40^\circ$$

$$x \approx 83.9 \text{ ft}$$

$$\text{Transit height: } 5 \text{ ft } 8 \text{ in}$$

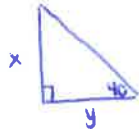
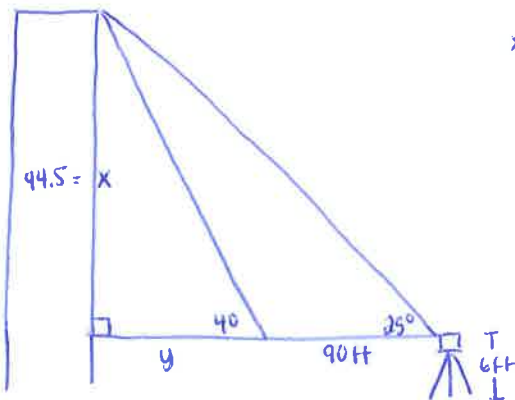
$$\frac{8}{12} = .666$$

$$\approx 5.7 \text{ ft}$$

$$\text{Height} = 83.9 + 5.7 = 89.6$$

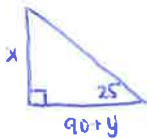
The total height of the tower is about 89.6 feet

- 7) You want to measure the height of a clock tower. You measure the angle of elevation to the top of the clock tower from where you are standing to be  $25^\circ$ . You walk 90 feet towards the tower and measure the angle of elevation from the new point to be  $40^\circ$ . Assuming you measure the angles of elevation on a transit that is 6 ft off the ground, how tall is the clock tower?



$$\frac{\tan 40^\circ = \frac{x}{y}}{1}$$

$$x = y \tan 40^\circ$$



$$\frac{\tan 25^\circ = \frac{x}{90+y}}{1}$$

$$x = \tan 25^\circ (90+y)$$

$$y \tan 40^\circ = \tan 25^\circ (90+y)$$

$$y \tan 40^\circ = 90 \tan 25^\circ + y \tan 25^\circ$$

$$y \tan 40^\circ - y \tan 25^\circ = 90 \tan 25^\circ$$

$$y (\tan 40^\circ - \tan 25^\circ) = 90 \tan 25^\circ$$

$$.3728y = 41.9677$$

$$y = 112.6$$

$$x = 112.6 \tan 40^\circ$$

$$x = 94.5$$

$$\text{Height} = 94.5 + 6 \text{ ft} = 100.5 \text{ ft}$$

The clock tower is about 100.5 ft tall

### Answer Key

- 1) 36.9 ft   2) 0.96 miles   3) 875.2 ft   4) 5.2 ft   5) 63.8 ft   6) 89.6 ft   7) 100.5 ft