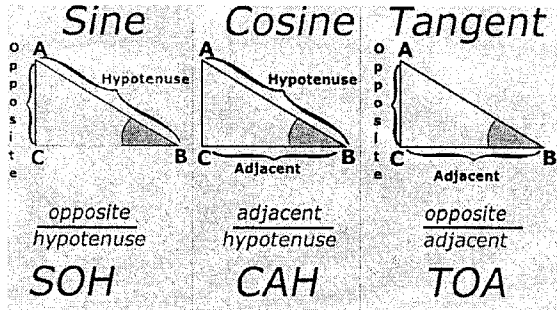


NOTES--Right Triangle Trigonometry



$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{y}{r}$$

$$\csc \theta = \frac{\text{hypotenuse}}{\text{opposite}} = \frac{r}{y}$$

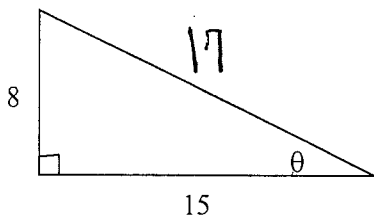
$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{x}{r}$$

$$\sec \theta = \frac{\text{hypotenuse}}{\text{adjacent}} = \frac{r}{x}$$

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}} = \frac{y}{x}$$

$$\cot \theta = \frac{\text{adjacent}}{\text{opposite}} = \frac{x}{y}$$

**Example 1** Find the 6 trig ratios for the given triangle.



$$h^2 = 8^2 + 15^2$$

$$h^2 = 289$$

$$h = 17$$

$$\sin \theta = \frac{8}{17}$$

$$\csc \theta = \frac{17}{8}$$

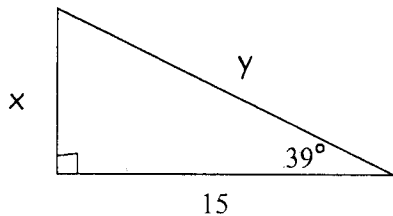
$$\cos \theta = \frac{15}{17}$$

$$\sec \theta = \frac{17}{15}$$

$$\tan \theta = \frac{8}{15}$$

$$\cot \theta = \frac{15}{8}$$

**Example 2** Find the values of x and y.



$$\tan 39^\circ = \frac{x}{15}$$

$$\cos 39^\circ = \frac{15}{y}$$

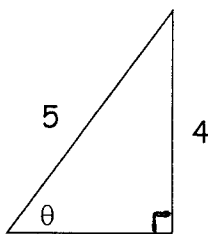
$$x = 15 \tan 39^\circ$$

$$y \cdot \cos 39^\circ = 15$$

$$x = 12.15$$

$$y = \frac{15}{\cos 39^\circ} = 19.30$$

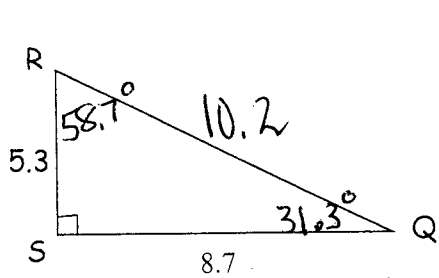
**Example 3** Find  $\theta$ .



$$\sin \theta = \frac{4}{5}$$

$$\theta = \sin^{-1}\left(\frac{4}{5}\right) = 53.13^\circ$$

**Example 4** Find the missing sides and angle measures.



$$h^2 = 5.3^2 + 8.7^2$$

$$h^2 = 103.78$$

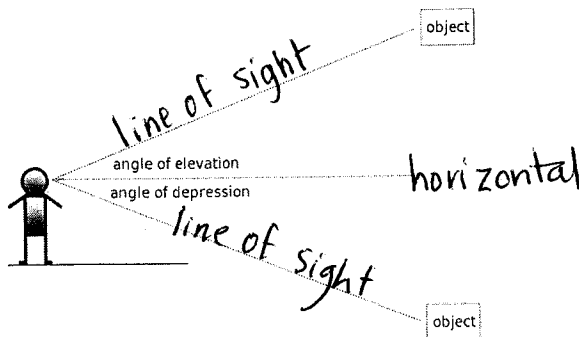
$$h = 10.2$$

$$\tan Q = \frac{5.3}{8.7}$$

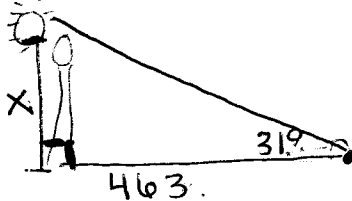
$$Q = \tan^{-1}\left(\frac{5.3}{8.7}\right)$$

$$R = 180^\circ - 90^\circ - 31.3^\circ = 58.7^\circ$$

$$Q = 31.3^\circ$$



**Example 5** A tree casts a 463 ft shadow when the angle of elevation to the sun is  $31^\circ$ . Find the height of the tree.

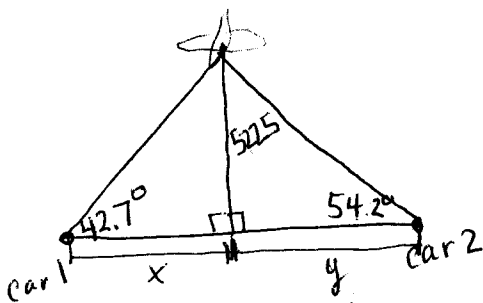


$$\tan 31^\circ = \frac{x}{463}$$

$$x = 463 \tan 31^\circ$$

$$x = 278.2 \text{ ft}$$

**Example 6** An airplane is flying at an elevation of 5225 ft, directly above a straight highway. Two motorists are driving cars on the highway on opposite sides of the plane, and the angle of depression to one car is  $42.7^\circ$  and to the other is  $54.2^\circ$ . How far apart are the cars? (Round your answer to the nearest tenth of a foot.)



$$\tan 42.7^\circ = \frac{5225}{x}$$

$$x \cdot \tan 42.7^\circ = 5225$$

$$x = \frac{5225}{\tan 42.7^\circ} = 5662.3$$

$$\tan 54.2^\circ = \frac{5225}{y}$$

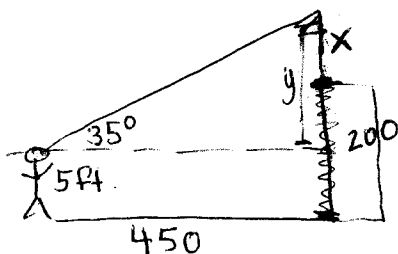
$$y \cdot \tan 54.2^\circ = 5225$$

$$y = \frac{5225}{\tan 54.2^\circ} = 3768.1$$

$$\boxed{9430.7 \text{ feet}}$$

**Example 7**

A person 5 ft tall sights a flag on top of a 200 ft tall building at an angle of elevation of  $35^\circ$ . The person is 450 ft from the base of the building. How tall is the flagpole?



$$\tan 35^\circ = \frac{y}{450}$$

$$y = 450 \tan 35^\circ = 315.1$$

$$x = 315.1 - 195 = \boxed{120.1 \text{ ft}}$$