Modeling with Right Triangles

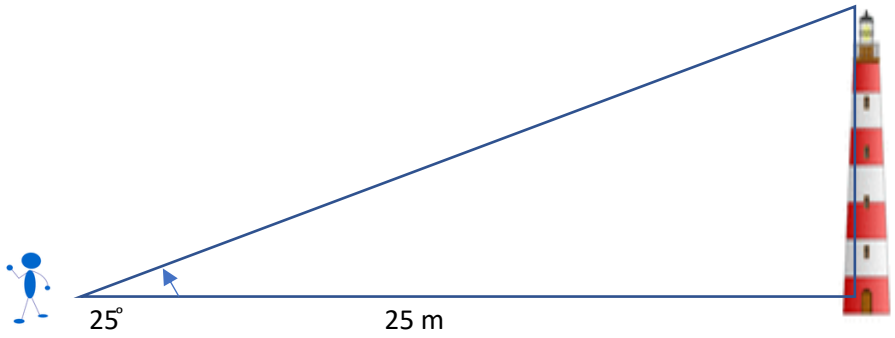
*There are many ways that right triangles and trigonometric relations can be used to model aspects of the physical world, including both stationary and moving objects. In either case, it is a good idea to draw a diagram and to label as many parts of the right triangle that can be obtained from the given problem.

* When objects are moving, the motion can be represented as the hypotenuse of a right triangle. Given the angle of elevation or depression, this side can then be resolved into horizontal and vertical sides (which form the other two sides of the right triangle). Trigonometric relations be utilized to determine the sides of this right triangle.

*Example using stationary object.

The angle of elevation from an observer on level ground is 25° to the top of a monument. If this observer is standing 25 meters from the base of the structure, how tall is the monument?

(1) Draw and label a diagram



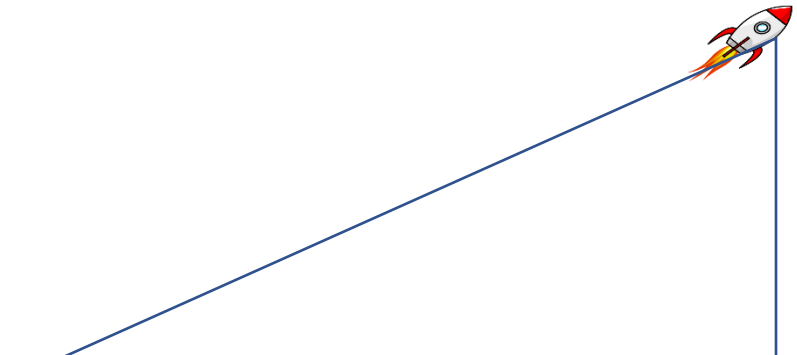
(2) Determine the trigonometric relation that will solve the problem.

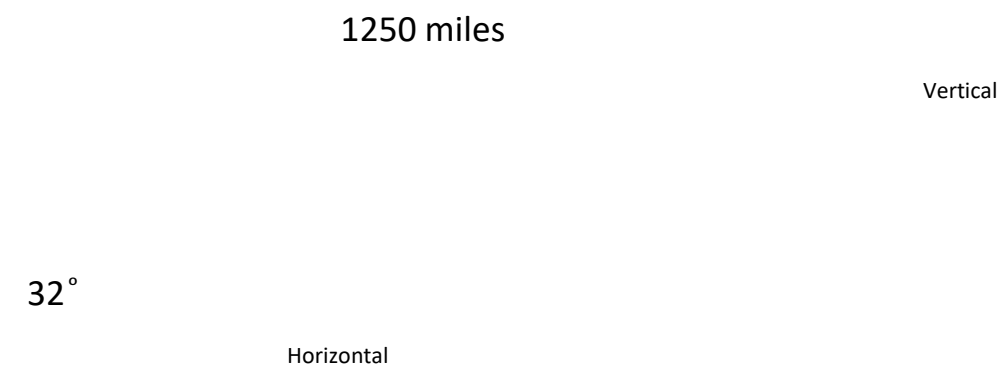
$\tan 25 = \frac{x}{25}$ $\qquad$ $25 \times \tan 25 = 11.66$ meters

The monument is 11.66 meters tall.

*Example using moving object.

A rocket is launched at an angle of 32° from a horizontal surface. Maintaining that angle, it travels in a line through the air for a distance of 1250 miles. How many miles high is the rocket above the surface? How far is it horizontally from its starting point?





Resolving this right triangle into horizontal and vertical vectors produces the following relations.

$\cos 32^\circ = \frac{Horizontal}{1250}$ $\sin 32^\circ = \frac{Opposite}{1250}$

Calculating these distance yields the following results:

Horizontal distance = 1060 miles Vertical distance = 662 miles