Right Triangle Worksheet

1. Suppose you have been assigned to measure the height of the local water tower. Climbing makes you dizzy, so you decide to do the whole job at ground level. From a point 47.3 meters from the base of the water tower, you find that you must look up at an angle of 53° 45' to see the top of the tower. How tall is the tower? Draw the triangle.

\[
\tan 53.75° = \frac{x}{47.3}
\]

\[
x = 64.51°
\]

2. A ship is passing through the Strait of Gibraltar. At its closest point of approach, Gibraltar radar determines that it is 2400 meters away. Later, the radar determines that it is 2650 meters away. By what angle did the ship’s bearing from Gibraltar change? How far did the ship travel during the two observations?

\[
\cos \theta = \frac{2400}{2650}
\]

\[
\cos^{-1} \left( \frac{2400}{2650} \right) = \theta
\]

\[
\theta = 25.09°
\]

3. Looking up at a building you want to determine the width first story window. Standing 40m away from the building, the angle to the bottom of the window is 20.2° and the angle to the top of the window is 25.5°. What is the width of the window?

\[
\tan 20.2° = \frac{x}{40}
\]

\[
x = 14.72
\]

\[
40 \tan 25.5° = 14.72 + y
\]

\[
y = 4.36m
\]

4. You must order a new rope for the flagpole. To find out what length of rope is needed, you observe that pole casts a shadow 11.6 meters long on the ground. The angle between the sun’s rays and the ground is 36.8°. How tall is the pole?

\[
\tan 36.8° = \frac{x}{11.6}
\]

\[
x = 8.68m
\]
You are in a small airplane flying at an altitude of 1500ft past a large pond. The angle to the far side of the pond is $26^\circ$ and the angle to the near side of the pond is $35^\circ$. What is the width of the pond?

\[
\begin{align*}
\tan 55^\circ &= \frac{x}{1500} \\
1500 \tan 55^\circ &= x \\
x &= 2142.22
\end{align*}
\]

\[
\begin{align*}
\tan 60^\circ &= \frac{y}{1500} \\
1500 \tan 60^\circ &= y \\
y &= 933.24
\end{align*}
\]

6. The tallest freestanding structure in the world is the 553 meter tall CN tower in Toronto, Ontario. Suppose that at a certain time of day it casts a shadow 1100 meters long on the ground. What is the angle of elevation of the sun at that time of day?

\[
\begin{align*}
\tan \theta &= \frac{553}{1100} \\
\theta &= 26.69^\circ
\end{align*}
\]

Scientists estimate the heights of features on the moon by measuring the lengths of the shadows they cast on the moon's surface. From a photograph, you find that the shadow cast on the inside of a crater by its rim is 325 meters long. At the time the photograph was taken, the sun's angle to the horizontal surface was $23.6^\circ$. How high does the rim rise above the inside of the crater?

8. A beam of gamma rays is to be used to treat a tumor known to be 5.7 cm beneath the patient's skin. To avoid damaging a vital organ, the radiologist moves the source over 8.3 cm. At what angle to the patient's skin must the radiologist aim the gamma ray source to hit the tumor? How far will the gamma rays have to pass through the body to hit the tumor?

\[
\begin{align*}
\tan \theta &= \frac{5.7}{8.3} \\
\theta &= 34.48^\circ
\end{align*}
\]

9. When surveyors measure land that slopes significantly, the distance which is measured will be longer than the horizontal distance which must be drawn on a map. Suppose that the distance from the top edge of the Okapilco Creek bed to the edge of the water is 37.8 meters. The land slopes downward at $27^\circ$ $15'$ to the horizontal.

a) What is the horizontal distance from the top of the banks to the edge of the creek?

\[
\sin 62.75^\circ = \frac{x}{37.8}
\]

\[
x = 33.6
\]

b) How far is the surface of the creek below the level of the surrounding land?

\[
\cos 62.75^\circ = \frac{y}{37.8}
\]

\[
y = 17.3
\]
The Sturgeon Bay lighthouse built at sea level is 87 feet high. From its top, the angle of depression of a buoy in Lake Michigan is $30^\circ$. Find the distance from the buoy to the foot of the lighthouse.

$$\tan 60^\circ = \frac{x}{87}$$

$$87 \cdot \tan 60^\circ = x$$

$$150.69 = x$$

11. The dimensions of a rectangular solid are 8, 12, and 9. Find the diagonal through the solid.

$$9^2 + 12^2 + 8^2 = x^2$$

$$289 = x^2$$

$$x = 17$$

12. A regular square pyramid has a base perimeter of 36. The triangular faces are all equilateral.
   a) Find the slant height of the pyramid to the nearest hundredth.

   $$\text{slant height} \approx 7.79$$

   b) Find the altitude of the pyramid to the nearest hundredth.

   $$h^2 + 4.5^2 = 7.79^2$$

   $$h = 6.36$$

13. The dimensions of a rectangular solid are $\frac{3}{8}$, 12, and 9. Find the diagonal through the solid.

   $$\left(\frac{3}{8}\right)^2 + 12^2 = x^2$$

   $$\frac{9}{64} + 144 = x^2$$

   $$\frac{9}{64} + 153 = x^2$$

   $$153.75 = x$$

14. A regular square pyramid has a base perimeter of 20. The triangular faces are all equilateral.
   a) Find the slant height of the pyramid to the nearest hundredth.

   $$\text{slant height} \approx 4.33$$

   b) Find the altitude of the pyramid to the nearest hundredth.

   $$h^2 + 2.5^2 = 4.33^2$$

   $$h = 3.54$$