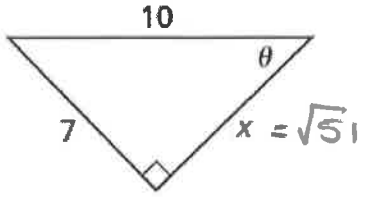
# 9.6 Solving Right Triangles

**Find the value of *x*. Then find the value of sin $\theta$, cos $\theta$, and tan $\theta$ for the triangle.**

**1.**




$7^2 + x^2 = 10^2$

$49 + x^2 = 100$

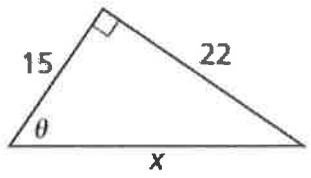
$x^2 = 51$

$x = \sqrt{51}$

$\sin\theta = \frac{7}{10}$ $\tan\theta = \frac{7}{\sqrt{51}} = \frac{7\sqrt{51}}{51}$

$\cos\theta = \frac{\sqrt{51}}{10}$

**2.**




$15^2 + 22^2 = x^2$

$225 + 484 = x^2$

$709 = x^2$

$x = \sqrt{709}$

$\sin\theta = \frac{22}{\sqrt{709}} = \frac{22\sqrt{709}}{709}$

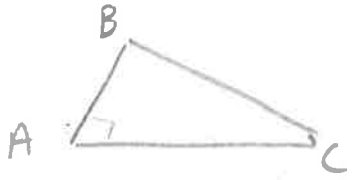
$\cos\theta = \frac{15}{\sqrt{709}} = \frac{15\sqrt{709}}{709}$

$\tan\theta = \frac{22}{15}$

**Decide whether you can use the given information to prove $\triangle ABC \cong \triangle XYZ$. Explain your reasoning.**

**1.** $\angle A \cong \angle X$, $\angle Z \cong \angle C$, $\overline{BC} \cong \overline{YZ}$

Yes; AAS

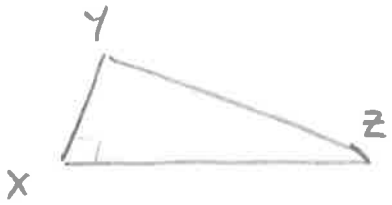



**2.** $\angle Y \cong \angle B$, $\angle A \cong \angle X$, $\angle Z \cong \angle C$

No; Similar but not $\cong$

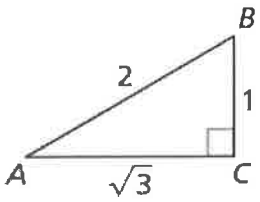
**3.** $\overline{CA} \perp \overline{AB}, \overline{ZX} \perp \overline{XY}, \overline{CB} \cong \overline{ZY}, \overline{YX} \cong \overline{BA}$

Yes; HL



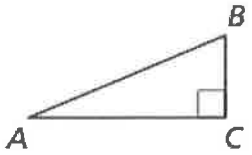
Determine which of the two acute angles has a cosine of 0.5.

$\cos B = \frac{1}{2}$




**Inverse Trigonometric Ratios**

Let $\angle A$ be an acute angle.




**Inverse Tangent** If $\tan A = x$, then $\tan^{-1} x = m\angle A$. $\tan^{-1} \frac{BC}{AC} = m\angle A$

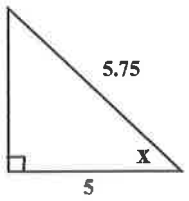
**Inverse Sine** If $\sin A = y$, then $\sin^{-1} y = m\angle A$. $\sin^{-1} \frac{BC}{AB} = m\angle A$

**Inverse Cosine** If $\cos A = z$, then $\cos^{-1} z = m\angle A$. $\cos^{-1} \frac{AC}{AB} = m\angle A$

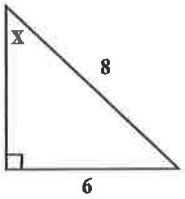
***To find unknown angles in a Right Triangle, we use inverse trig functions

****To know which trig function to use, look at what sides are given to us.

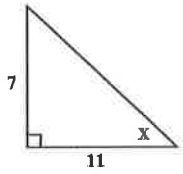
Find the measure of the missing angle.




$\cos^{-1}\left(\frac{5}{5.75}\right) = 29.59°$




$\sin^{-1}\left(\frac{6}{8}\right) = 48.59°$




$\tan^{-1}\left(\frac{7}{11}\right) = 32.47°$

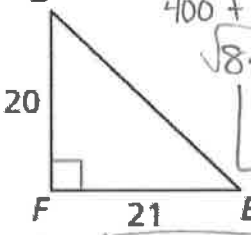
## Solving a Right Triangle

To solve a right triangle means to find all unknown side lengths and angle measures. You can solve a right triangle when you know either of the followin

- two side lengths
- one side length and the measure of one acute angle

**Solve the right triangle. Round decimal answers to the nearest tenth.**

6.




$20^2 + 21^2 = X^2$

$400 + 441 = X^2$

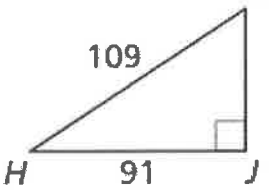
$\sqrt{841} = \sqrt{X^2}$

$X = \sqrt{841}$

$m\angle E = \tan^{-1}\left(\frac{20}{21}\right) = 43.60^\circ$

$m\angle D = 90 - 43.60 = 46.4^\circ$

7.




$m\angle G = \sin^{-1}\left(\frac{91}{109}\right) = 56.60^\circ$

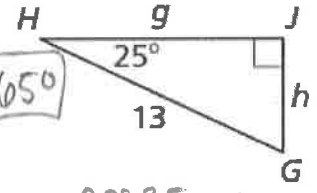
$m\angle H = 90 - 56.60 = 33.4^\circ$

$91^2 + (JG)^2 = 109^2$

$8281 + (JG)^2 = 11881$

$(JG)^2 = 3600$

$JG = 60$




$m\angle G = 90 - 25 = 65^\circ$

$\sin 25 = \frac{h}{13}$

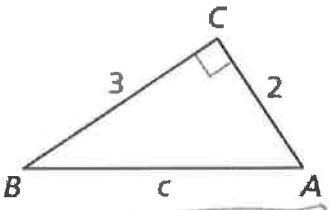
$13 \sin 25 = h$

$5.49 = h$

$\cos 25 = \frac{g}{13}$

$13 \cos 25 = g$

$11.78 = g$




$2^2 + 3^2 = c^2$

$4 + 9 = c^2$

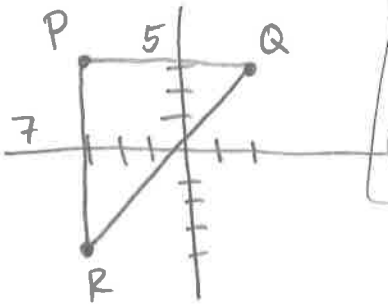
$13 = c^2$

$\sqrt{13} = c$

$m\angle B = \tan^{-1}\left(\frac{2}{3}\right) = 33.69^\circ$

$m\angle A = 90 - 33.69 = 56.31^\circ$

**The coordinates of the vertices of $\Delta PQR$ are $P(-3, 3)$, $Q(2, 3)$, and $R(-3, -4)$. Find the side lengths to the nearest hundredth and the angle measures to the nearest degree.**




$PQ = 5$

$PR = 7$

$QR = \sqrt{74}$

$5^2 + 7^2 = c^2$

$25 + 49 = c^2$

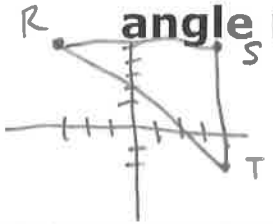
$74 = c^2$

$m\angle P = 90^\circ$

$m\angle Q = \tan^{-1}\left(\frac{7}{5}\right) = 54.46^\circ$

$m\angle R = 90 - 54.46 = 35.54^\circ$

**The coordinates of the vertices of $\Delta RST$ are $R(-3, 5)$, $S(4, 5)$, and $T(4, -2)$. Find the side lengths to the nearest hundredth and the angle measures to the nearest degree.**




$RS = 7$

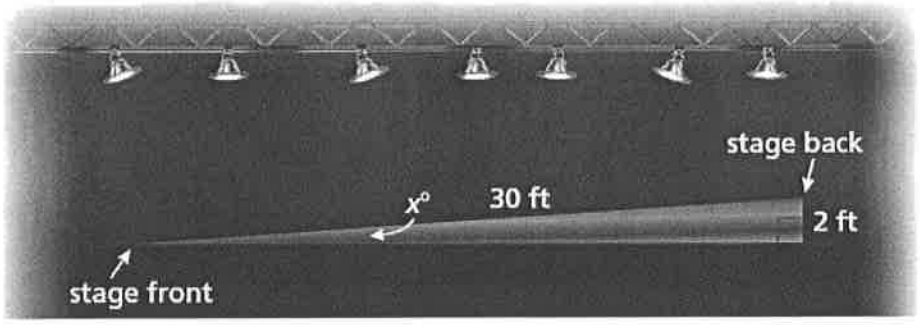
$ST = 7$

$RT = 7\sqrt{2}$

$m\angle S = 90$

$m\angle R = m\angle T = 45^\circ$

Your school is building a *raked stage*. The stage will be 30 feet long from front to back, with a total rise of 2 feet. You want the rake (angle of elevation) to be 5° or less for safety. Is the raked stage within your desired range?




$X = \sin^{-1}\left(\frac{2}{30}\right) = 3.82°$

Yes, $3.82 < 5$

**9.** WHAT IF? In Example 5, suppose another raked stage is 20 feet long from front to back with a total rise of 2 feet. Is the raked stage within your desired range?

$\sin^{-1}\left(\frac{2}{20}\right) = 5.74°$

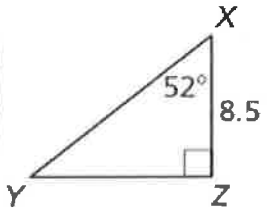
No, $5.74 > 5$

Solve the right triangle. Round decimal answers to the nearest tenth.

$Y = 8.5$ $\quad m\angle X = 52$

$Z = 13.8$ $\quad m\angle Z = 90$

$X = 10.9$ $\quad m\angle Y = 90 - 52 = 38°$




$\cos 52 = \frac{8.5}{Z}$

$Z = \frac{8.5}{\cos 52} = 13.8$

$\tan 52 = \frac{X}{8.5}$

$8.5 \tan 52 = X$

$10.9 = X$

# Homework:
# WS 9.6 - Solving Right Triangles