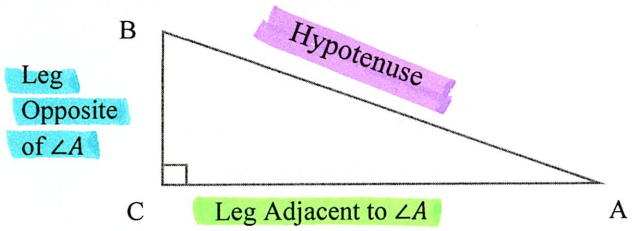
Chapter 7.7: Solve Right Triangles

Inverse Trigonometric Ratios:

Let $\angle A$ be an acute angle.



Inverse Tangent: If $\tan A = x$, then $\tan^{-1} x = m\angle A$ → $\tan^{-1}\left(\frac{BC}{CA}\right) = m\angle A$

Inverse Sine: If $\sin A = y$, then $\sin^{-1} y = m\angle A$ → $\sin^{-1}\left(\frac{BC}{AB}\right) = m\angle A$

Inverse Cosine: If $\cos A = z$, then $\cos^{-1} z = m\angle A$ → $\cos^{-1}\left(\frac{CA}{AB}\right) = m\angle A$

Example #1: Find the approximate $m\angle A$ to the nearest tenth of a **degree** using…

a.) Tangent $m\angle A = \tan^{-1}\left(\frac{16}{20}\right)$

$m\angle A \approx 38.7°$ ←

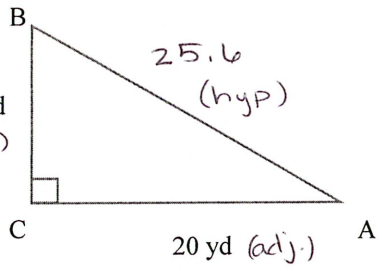
b.) Sine $m\angle A = \sin^{-1}\left(\frac{16}{25.6}\right)$

$m\angle A \approx 38.7°$ ←

c.) Cosine $m\angle A = \cos^{-1}\left(\frac{20}{25.6}\right)$

$m\angle A = 38.7°$ ←

* it doesn't matter which trig ratio you use, you will get the same value *



d.) Find the approximate $m\angle B$ to the nearest tenth of a degree.

You can use any trig ratio

Ex. $m\angle B = \tan^{-1}\left(\frac{20}{16}\right)$

$m\angle B = 51.3°$

OR just subtract $m\angle A$ from 90°

$m\angle B = 90° - 38.7°$

$m\angle B = 51.3°$

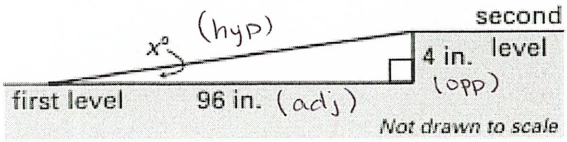
e.) Find the length of AB. (use pythagorean thm)

$16^2 + 20^2 = c^2$

$\sqrt{656} = \sqrt{c^2}$

$c = 25.6$ units

Example #2: You are building a track for a model train. You want the track to incline from the first level to the second level, 4 inches higher, in 96 inches. Is the angle of elevation less than 3°?

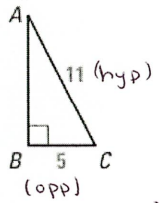


$m\angle X = \tan^{-1}\left(\frac{4}{96}\right)$

$m\angle X = 2.4°$; Yes, the angle of elevation is less than 3°

Example #3: Use a calculator to approximate the measure of $\angle A$ to the nearest tenth of a degree.

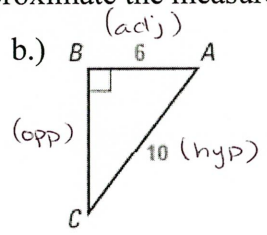
a.)



$m\angle A = \sin^{-1}\left(\frac{5}{11}\right)$

$m\angle A = 27.0°$

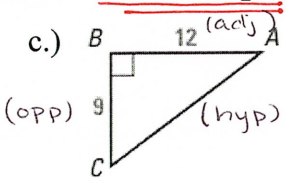
b.)



$m\angle A = \cos^{-1}\left(\frac{6}{10}\right)$

$m\angle A = 53.1°$

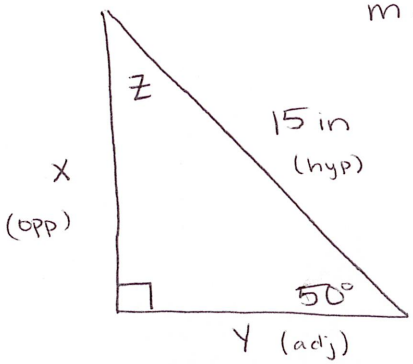
c.)



$m\angle A = \tan^{-1}\left(\frac{9}{12}\right)$

$m\angle A = 36.9°$

Example #4: Solve a right triangle (find the measure of all unknown angles and side lengths) that has a 50° angle and a 15 inch hypotneuse. Round decimal answers to the nearest tenth.



$m\angle Z = 90° - 50°$

$m\angle Z = 40°$

$15 \cdot (\sin 50°) = \left(\frac{X}{15}\right) 15$

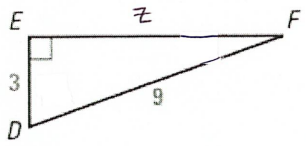
$X = 11.5$ units

$15\ (\cos 50°) = \left(\frac{Y}{15}\right) \cdot 15$

$Y = 9.6$ units

Concept Check: Solve the right triangles (find the measure of all unknown angles and side lengths). Round decimal answers to the nearest tenth.

1.



$Z^2 + 3^2 = 9^2$

$Z^2 = \sqrt{72}$

$Z = 8.9$ units

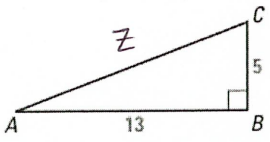
$m\angle D = \cos^{-1}\left(\frac{3}{9}\right)$

$m\angle D = 70.5°$

$m\angle F = 90° - 70.5°$

$m\angle F = 19.5°$

2.



$13^2 + 5^2 = Z^2$

$\sqrt{194} = \sqrt{Z^2}$

$Z = 13.9$ units

$m\angle A = \tan^{-1}\left(\frac{5}{13}\right)$

$m\angle A = 21.0°$

$m\angle C = 90° - 21°$

$m\angle C = 69°$