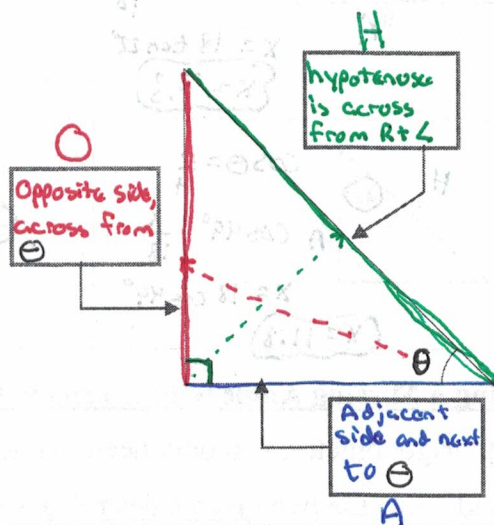


Unit 6.3 – Right Triangle Trigonometry: Trigonometric Ratios

Trigonometric Ratios in Right Triangles

Words	Symbol	Definition
Sine	$\sin \theta$	$\sin \theta = \frac{O}{H}$
Cosine	$\cos \theta$	$\cos \theta = \frac{A}{H}$
Tangent	$\tan \theta$	$\tan \theta = \frac{O}{A}$



**Note: The symbol θ (called Theta) is used to refer to angles or indicated angles.

Example 1: Find the trig ratios for the indicated angle θ or angle A.

a.)
$$\sin \theta = \frac{O}{H} \rightarrow \sin \theta = \frac{36}{39} \rightarrow \sin \theta = \frac{12}{13}$$

$$\cos \theta = \frac{A}{H} \rightarrow \cos \theta = \frac{15}{39} \rightarrow \cos \theta = \frac{5}{13}$$

$$\tan \theta = \frac{O}{A} \rightarrow \tan \theta = \frac{36}{15} \rightarrow \tan \theta = \frac{12}{5}$$

b.)
$$\sin \theta = \frac{4\sqrt{5}}{12} \rightarrow \sin \theta = \frac{\sqrt{5}}{3}$$

$$\cos \theta = \frac{8}{12} \rightarrow \cos \theta = \frac{2}{3}$$

$$\tan \theta = \frac{4\sqrt{5}}{8} \rightarrow \tan \theta = \frac{\sqrt{5}}{2}$$

c.)
$$\sin \theta = \frac{\sqrt{3}}{2\sqrt{3}} \rightarrow \sin \theta = \frac{1}{2}$$

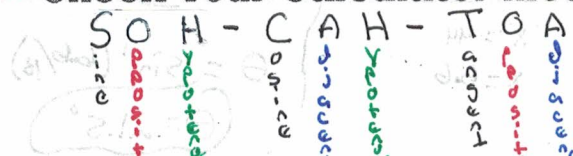
$$\cos \theta = \frac{3}{2\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} \rightarrow \cos \theta = \frac{3\sqrt{3}}{6} \rightarrow \cos \theta = \frac{\sqrt{3}}{2}$$

$$\tan \theta = \frac{\sqrt{3}}{3}$$

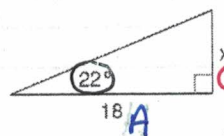
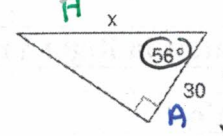
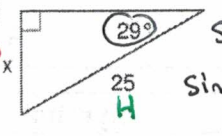

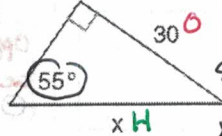
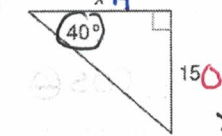
Finding a Missing Side with a Trigonometric Ratio

- With trigonometry, you only need to know 1 side and 1 angle (other than the right angle) in order to find the missing side LENGTH X in a right triangle.
- Decide how the given side and given angle relates to the missing side X.
- Set up a(n) equation using the appropriate trigonometric ratio.
 - If "x" is on TOP, then multiply → Ex: $\tan 56^\circ = \frac{x}{21}$ → $x = 21 \tan 56^\circ$ → $x \approx 31.1$
 - If "x" is on Bottom, then divide (rightside/leftside) → Ex: $\sin 72^\circ = \frac{16}{x}$ → $x = \frac{16}{\sin 72^\circ}$ → $x \approx 16.8$

*** Check Your Calculator Mode - It needs to be in DEGREES! ***



Example 2: Find the missing side x for each given right triangle. Round to nearest tenth.

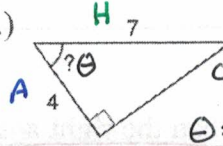
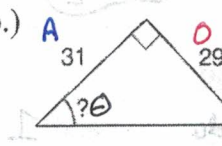
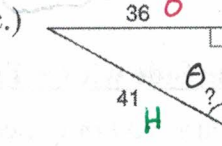
<p>a.)  $\tan \theta = \frac{O}{A}$ $\tan 22^\circ = \frac{x}{18}$ $x = 18 \tan 22^\circ$ $x = 7.3$</p>	<p>b.)  $\cos \theta = \frac{A}{H}$ $\cos 56^\circ = \frac{x}{30}$ $x = \frac{30}{\cos 56^\circ}$ $x = 53.6$</p>	<p>c.)  $\sin \theta = \frac{O}{H}$ $\sin 29^\circ = \frac{x}{25}$ $x = 25 \sin 29^\circ$ $x = 12.1$</p>
<p>d.)  $\cos \theta = \frac{A}{H}$ $\cos 49^\circ = \frac{x}{18}$ $x = 18 \cos 49^\circ$ $x = 11.8$</p>	<p>e.)  $\sin \theta = \frac{O}{H}$ $\sin 55^\circ = \frac{x}{30}$ $x = \frac{30}{\sin 55^\circ}$ $x = 36.6$</p>	<p>f.)  $\tan \theta = \frac{O}{A}$ $\tan 40^\circ = \frac{15}{x}$ $x = \frac{15}{\tan 40^\circ}$ $x = 17.9$</p>

Finding a Missing Angle with a Trigonometric Ratio

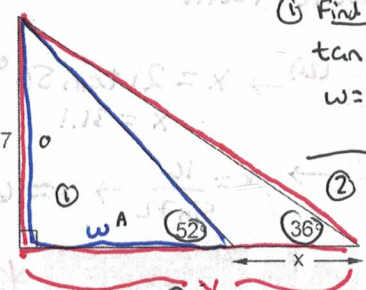
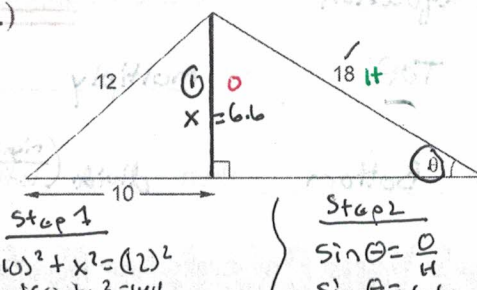
- With trigonometry, you only need to know 2 sides in order to find a(n) angle in a right triangle.
- Decide how the two given sides relate to the missing angle.
- Set up a(n) equation using the appropriate "trig" ratio (sin cos tan) BUT will have to use the INVERSE "trig" ratio in calculator to produce the angle measurement!

Trig Ratios	Inverse Trig Ratios	Calculator Keys	Example: Find θ
$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$	$\theta = \sin^{-1} \left(\frac{O}{H} \right)$ arcsin	2nd sin (<u>sin⁻¹</u>)	$\sin \theta = \frac{1}{2} \rightarrow \theta = \sin^{-1} \left(\frac{1}{2} \right)$ $\theta = 30^\circ$
$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$	$\theta = \cos^{-1} \left(\frac{A}{H} \right)$ arccos	2nd cos (<u>cos⁻¹</u>)	$\cos \theta = 0.7498 \rightarrow \theta = \cos^{-1} (0.7498)$ $\theta = 41.4^\circ$
$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$	$\theta = \tan^{-1} \left(\frac{O}{A} \right)$ arctan	2nd tan (<u>tan⁻¹</u>)	$\tan \theta = \frac{\sqrt{19}}{3} \rightarrow \theta = \tan^{-1} \left(\frac{\sqrt{19}}{3} \right)$ $\theta = 55.5^\circ$

Example 3: Find the missing angle measure. Round to nearest tenth.

<p>a.)  $\cos \theta = \frac{A}{H}$ $\cos \theta = \frac{4}{7}$ $\theta = \cos^{-1} (4/7)$ $\theta = 55.2^\circ$</p>	<p>b.)  $\tan \theta = \frac{O}{A}$ $\tan \theta = \frac{29}{31}$ $\theta = \tan^{-1} (29/31)$ $\theta = 43.1^\circ$</p>	<p>c.)  $\sin \theta = \frac{O}{H}$ $\sin \theta = \frac{36}{41}$ $\theta = \sin^{-1} (36/41)$ $\theta = 61.4^\circ$</p>
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Critical Thinking Examples: Find the missing side x or missing angle θ . Round to nearest tenth.

<p>4.)  $\tan \theta = \frac{O}{A}$ $\tan 52^\circ = \frac{7}{w}$ $w = \frac{7}{\tan 52^\circ} \rightarrow w = 5.5$ $\tan 36^\circ = \frac{7}{y}$ $y = \frac{7}{\tan 36^\circ}$ $y = 9.6$ $x = y - w$ $x = 9.6 - 5.5$ $x = 4.1$</p>	<p>5.)  $\sin \theta = \frac{O}{H}$ $\sin \theta = \frac{6.6}{18}$ $\theta = \sin^{-1} (6.6/18)$ $\theta = 21.5^\circ$</p>
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