11.1 Trig Ratios and Sine

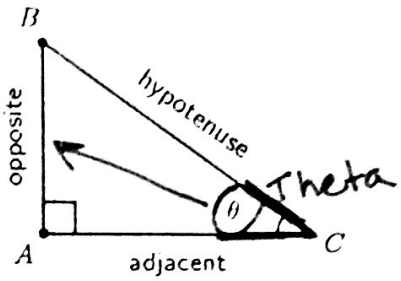
What is a trigonometric ratio?
A ratio of two side lengths of a right triangle

Reference angle: Angle that you base ratios off of

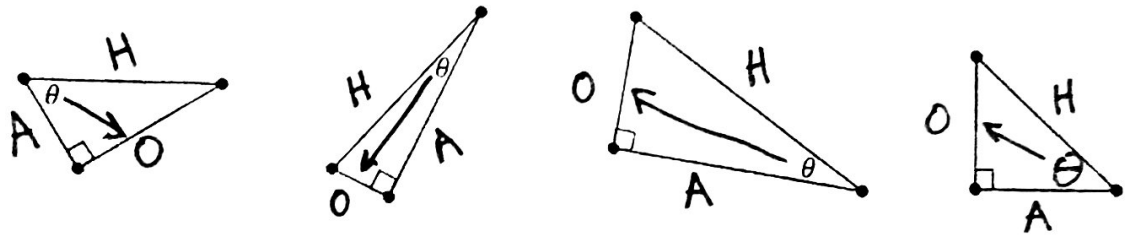
Opposite side: Side across from reference angle

Adjacent side: Side that creates the reference angle with the hypotenuse

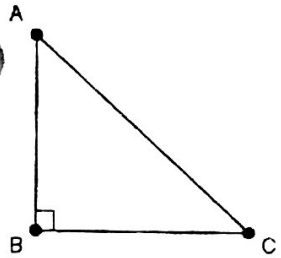
Hypotenuse: Longest side, side that doesn't touch the right angle



1) Given the reference angle θ, label the three sides of the triangle as *opposite, adjacent,* or *hypotenuse.*



2) Given ΔABC and the listed reference angle, fill in the blanks:

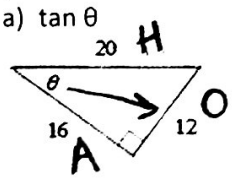


Reference: $\angle A$	Reference: $\angle B$	Reference: $\angle C$
Opposite is $\overline{BC}$	Opposite is $\overline{AC}$	Opposite is $\overline{AB}$
Adjacent is $\overline{AB}$	Adjacent is $\overline{AB}$, $\overline{BC}$	Adjacent is $\overline{BC}$
Hypotenuse is $\overline{AC}$	Hypotenuse is $\overline{AC}$	Hypotenuse is $\overline{AC}$

Sine	Cosine	Tangent
$\sin(\theta) = \frac{opp}{hyp}$ SOH	$\cos(\theta) = \frac{adj}{hyp}$ CAH	$\tan(\theta) = \frac{opp}{adj}$ TOA

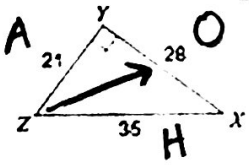
3) Find the value of the trig ratio:

a) tan θ



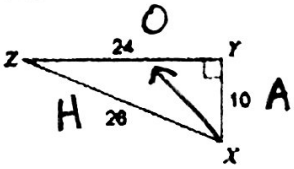
$\frac{12}{16} = \boxed{\frac{3}{4}}$

b) cos Z



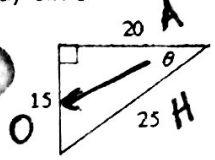
$\frac{21}{35} = \boxed{\frac{3}{5}}$

c) cos X



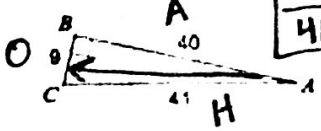
$\frac{10}{26} = \boxed{\frac{5}{13}}$

d) sin θ



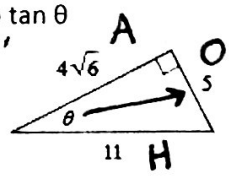
$\frac{15}{25} = \boxed{\frac{3}{5}}$

e) sin A



$\boxed{\frac{9}{41}}$

*f) tan θ



$\frac{5}{4\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}}$

$\frac{5\sqrt{6}}{4 \cdot 6} = \boxed{\frac{5\sqrt{6}}{24}}$

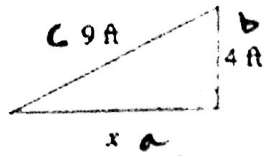
* Rationalize denominator: multiply by the square root on top & bottom

Pythagorean Theorem: $a^2 + b^2 = c^2$ (hyp)

*use when you have two sides of a right triangle

4) Find the missing side of each right triangle.

a.



$x^2 + 4^2 = 9^2$

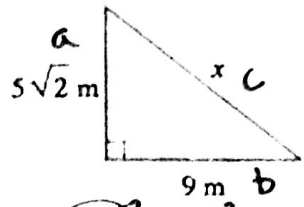
$x^2 + 16 = 81$

$\sqrt{x^2} = \sqrt{65}$

$\boxed{x = \sqrt{65}\text{ ft}}$

5 13

b.



$(5\sqrt{2})^2 + 9^2 = x^2$

$25 \cdot 2$

$50 + 81 = x^2$

$\sqrt{x^2} = \sqrt{131}$

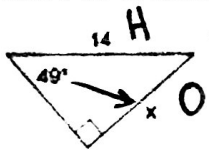
$\boxed{x = \sqrt{131}\text{ m}}$

What happens when we need to find a missing side, but we are only given a side and an angle? This is where we can use trig to help us. Because trig ratios are set values that apply to any right triangle, we can use trig ratios to solve for a missing side. Today we are going to focus on the use of sine.

In order to use **sine**, we need the opposite side from the reference angle and the hypotenuse.

5) Solve for x. Round to the nearest hundredth.

a.

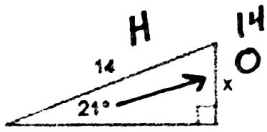


$14 \cdot \sin 49 = \frac{x}{\cancel{14}} \cdot \cancel{14}$

$x = 14\sin 49$

$\approx \boxed{10.57}$

b.

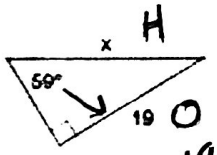


$14 \cdot \sin 21 = \frac{x}{\cancel{14}} \cdot \cancel{14}$

$x = 14\sin 21$

$\approx \boxed{5.02}$

c.

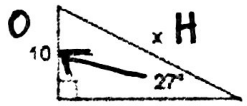


$\frac{\sin 59}{1} = \frac{19}{x}$

$19 \cdot \frac{1}{\sin 59} = \frac{x}{\cancel{19}} \cdot \cancel{19}$

$x = \frac{19}{\sin 59} \approx \boxed{22.17}$

d.



$\frac{\sin 27}{1} = \frac{10}{x}$

$10 \cdot \frac{1}{\sin 27} = \frac{x}{\cancel{10}} \cdot \cancel{10}$

$x = \frac{10}{\sin 27} \approx \boxed{22.03}$

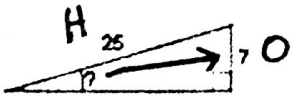
Your calculator knows the value for any trig ratio given any size of reference angle. Because of this, we can use trig ratios to solve for angles in a triangle as well. We use what is called the inverse to do this, $\sin^{-1}(\frac{opp}{hyp})$.

$\theta = \sin^{-1}(\frac{O}{H})$

2nd sin

6) Find the indicated angle. Round your answer to the nearest hundredth.

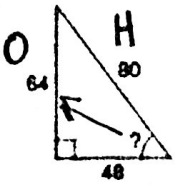
a.



$\theta = \sin^{-1}(\frac{7}{25})$

$\approx \boxed{16.26°}$

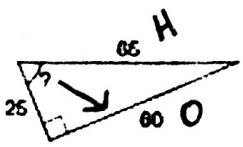
b.



$\theta = \sin^{-1}(\frac{64}{80})$

$\approx \boxed{53.13°}$

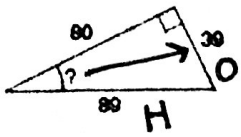
c.



$\theta = \sin^{-1}(\frac{60}{65})$

$= \boxed{67.38°}$

d.



$\theta = \sin^{-1}(\frac{39}{89})$

$= \boxed{25.99°}$