9.5 Trigonometric Ratios

LEARNING TARGETS: *Find the sine, the cosine, and the tangent of an acute angle.*
Use trig ratios to solve real life problems.

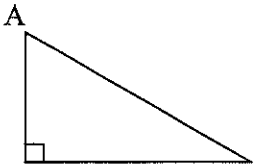
What is trigonometry? It comes from Greek and means triangle measurement. Basically, it is the study of relationships between angles and sides of a right triangle.

ΔABC is a right triangle.
Begin by naming the sides relative to angle A.

Opposite from angle A = o

Adjacent to angle A = a

Hypotenuse = h



sin $\frac{o}{h}$

cos $\frac{a}{h}$

$\frac{o}{a}$

Using these terms we are introduced to the 3 fundamental ratios of trigonometry.

Sine- sinA = $\frac{o}{h}$

Cosine- cosA = $\frac{a}{h}$

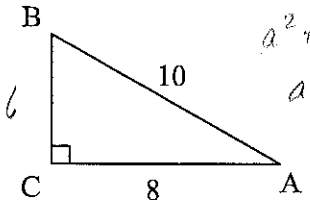
Tangent- tanA = $\frac{o}{a}$

Ex 1) Using the given triangle find the following:

sinA = $\frac{3}{5}$ = 0.6 sinB = $\frac{4}{5}$ = 0.8

cosA = $\frac{4}{5}$ = 0.8 cosB = $\frac{3}{5}$ = 0.6

tanA = $\frac{3}{4}$ = 0.75 tanB = $\frac{4}{3}$ = 1.3333



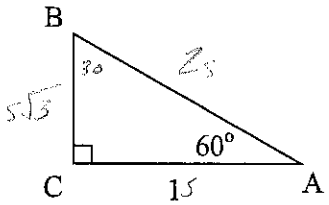
$a^2+b^2=c^2$
$a^2+8^2=10^2$
$a^2+64=100$
$a^2=36$
$a=6$

Ex 2) Find the sine, the cosine, and the tangent of 60°.

sin 60° = $\frac{5\sqrt{3}}{25} = \frac{\sqrt{3}}{2}$

cos60° = $\frac{1}{2}$

tan60° = $\sqrt{3}$

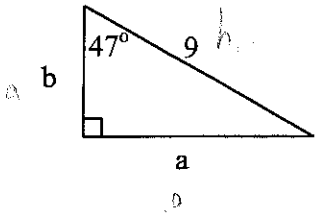


Use calculator.

sin 60° = $\frac{\sqrt{3}}{2}$ cos60° = $\frac{1}{2}$ tan60° = $\sqrt{3}$

Ex 3) Find the value of each variable. *Hint- label sides relative to angle shown.

a)



$\frac{\sin 47}{1} = \frac{a}{9}$

$a = 9 \sin 47$

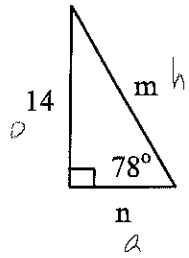
$a \approx 6.5822$

$\frac{\cos 47}{1} = \frac{b}{9}$

$b = 9\cos 47$

$b \approx 6.1380$

b)



$\frac{\tan 78}{1} = \frac{14}{n}$

$\frac{n\tan 78}{\tan 78} = \frac{14}{\tan 78}$

$n \approx 2.9758$

$\frac{\sin 78}{1} = \frac{14}{m}$

$\frac{m\sin 78}{\sin 78} = \frac{14}{\sin 78}$

$m \approx 14.3128$

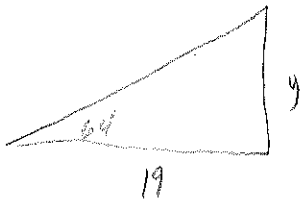
Ex 4) If $\sin \angle D = \frac{7}{25}$, what is the $\cos\angle D$?

Ex 5) Use a calculator to find the following trig values to 4 decimal places.

a) sin21°= 0.3584 b) tan52°= 1.2799 c) cos60° = $\frac{1}{2}$ = .5

ANGLE OF ELEVATION AND ANGLE OF DEPRESSION

Ex 6) You are measuring the height of a flag pole. You stand 19 ft away from the base of the pole. You measure an angle of elevation from a point on the ground to the top of the pole to be 64°. Estimate the height of the pole.



$\frac{\tan 64}{1} = \frac{y}{19}$

$y = 19 \tan 64$

$y \approx 38.9558$

9.6 Solving Right Triangles Day 1

LEARNING TARGETS: *Solve right triangles.*
Use right triangles for real-life applications.

To **solve** a right triangle means to determine the measures of all angles and the lengths of all sides.

This chapter we have practiced:
Pythagorean Theorem Triples Special triangles Trig Functions

To solve a right triangle, you need to know:

ONE side and ONE angle **OR** 2 sides

Trig functions can be used to find angles as well as sides.

INVERSE TRIG FUNCTIONS:
(used to find the angle measure)

If $\sin\angle A = x$, then $\sin^{-1}x = A$

If $\cos\angle A = x$, then $\cos^{-1}x = A$

If $\tan\angle A = x$, then $\tan^{-1}x = A$

Ex 1) Use your calculator to find the measure of these angles to the nearest degree.

a) $\sin\angle A = .6947$

$\sin^{-1}(.6947) \approx 44°$

b. $\cos\angle A = .8988$

$\cos^{-1}(.8988) \approx 26°$

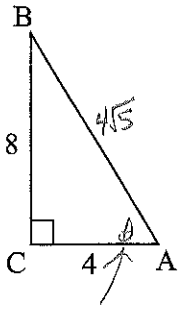
c. $\tan\angle A = 28.636$

$\tan^{-1}(28.636) \approx 88°$

d. $\sin\angle A = \frac{5}{13}$

$\sin^{-1}\left(\frac{5}{13}\right) \approx 23°$

Ex 2) Solve the right triangle.



$4^2 + 8^2 = c^2$

$16 + 64 = c^2$

$80 = c^2$

$c = \sqrt{80} = 4\sqrt{5}$

$\frac{\tan A}{1} = \frac{8}{4}$

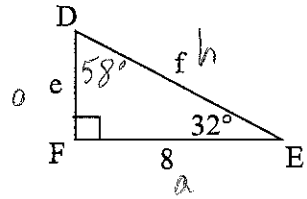
$\frac{4 \tan A}{4} = \frac{8}{4}$

$\tan A = 2$

$A = \tan^{-1}(2) \approx 63°$

So, if $\angle A = 63°$
$\angle B$ must be $27°$

Ex 3) Solve the right triangle.



$\frac{\cos 32}{1} = \frac{8}{h}$

$\frac{h \cos 32}{\cos 32} = \frac{8}{\cos 32}$

$h \approx 9.4834$

$\frac{\tan 32}{1} = \frac{o}{8}$

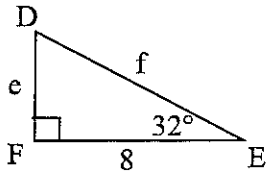
$o = 8 \tan 32$

$o \approx 4.9990$

9.6 Solving Right Triangles Day 2

WARM UP: Solve the right triangle when given a side length and an acute angle.

a.



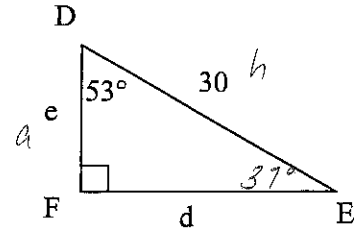
Same as previous page

$\angle D = 58°$

$f \approx 9.4334$

$e \approx 4.9990$

b.

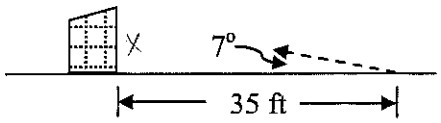


$\frac{\sin 53}{1} = \frac{d}{30}$ $\qquad$ $\frac{\cos 53}{1} = \frac{e}{30}$

$d = 30 \sin 53$ $\qquad$ $e = 30 \cos 53$

$d \approx 23.9591$ $\qquad$ $e \approx 18.0545$

Ex 1) When a hockey player is 35 feet from the goal line, he shoots the puck directly at the goal. The angle of elevation at which the puck leaves the ice is 7°. The height of the goal is 4 feet. Will the player score a goal?



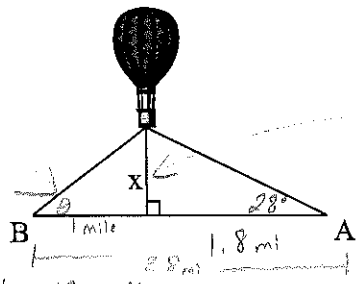
$\frac{\tan 7}{1} = \frac{X}{35}$

$X = 35 \tan 7$

$X \approx 4.2975$ ft

So, no the puck will go over the goal

Ex 2) During a flight, a hot air balloon is observed by two persons standing at points A and B as illustrated in the diagram. The angle of elevation of point A is 28°. Point A is 1.8 miles from the balloon as measured along the ground.



a) What is the height x of the balloon?

$\frac{\tan 28}{1} = \frac{x}{1.8}$

$x = .9571$ miles

b) Point B is 2.8 miles from point A. Find the angle of elevation of point B.

$\tan \theta = \frac{.9571}{1}$

$\theta = \tan^{-1}(.9571) \approx 43.7°$