Name: Kelly

Date: _____

UNIT 6

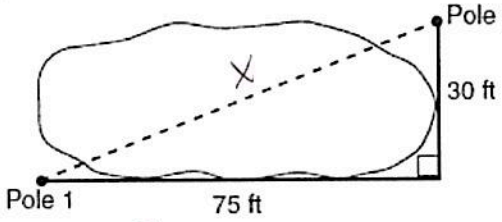
LESSON 2

AIM: HOW DO WE FIND RATIOS USING SOHCAHTOA?

Do Now:

1.) What is the distance between the two poles, to the *nearest foot*?

1) 105
2) 81
3) 69
4) 45



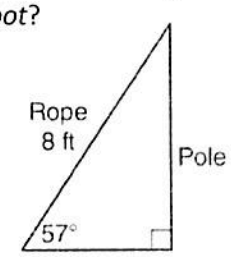
$30^2 + 75^2 = x^2$

$6525 = x^2$

$x = 80.7774 \approx 81$ ft

2.) An 8-foot rope is tied from the top of a pole to a stake in the ground, as shown in the diagram below. If the rope forms a 57° angle with the ground, what is the height of the pole, to the *nearest tenth of a foot*?

1) 4.4
2) 6.7
3) 9.5
4) 12.3



Not enough info!

- What is the difference between the information given in the *Do Now* problems?

#1 gave 2 sides, #2 gave 1 side and 1 ∠

- What is the problem with solving #2 based on what we know so far?

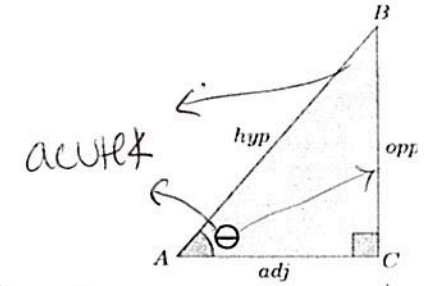
we need 2 sides to do pythagorean theorem

...Therefore, we need a new method to find missing sides of right triangles!

TRIGONOMETRIC RATIOS

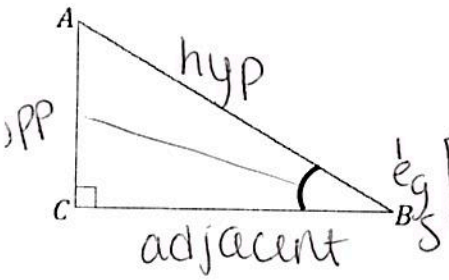
$$S\ \frac{O}{H}\ C\ \frac{A}{H}\ T\ \frac{O}{A}$$

sine of θ	cosine of θ	tangent of θ
$\sin\theta = \frac{opp}{hyp}$	$\cos\theta = \frac{adj}{hyp}$	$\tan\theta = \frac{opp}{adj}$



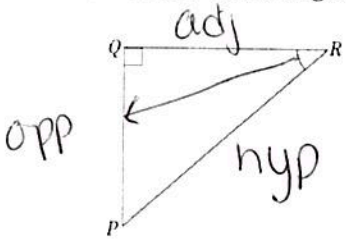
θ = fancy x for ∠'s

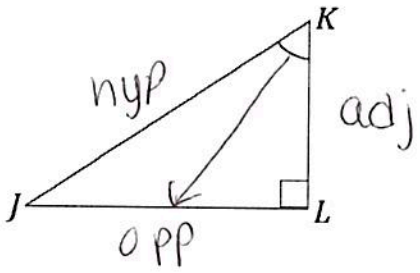
Trigonometry is a branch of mathematics that studies the relationships between sides and angles in triangles. Sine, cosine and tangent are 3 ratios that remain true when comparing an acute angle of right triangle to its corresponding side lengths.

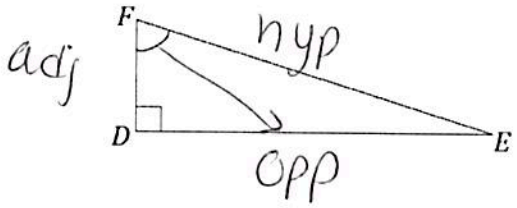


TERM	DEFINITION
Hypotenuse	The side of a right triangle **opposite** the **right angle.**
opposite	The side of a right triangle **opposite** the **marked acute angle.**
adjacent	The side of a right triangle NEXT to the **marked acute angle.**

Example 1: For each triangle, label the appropriate sides as hypotenuse, opposite, and adjacent with respect to the marked acute angle.

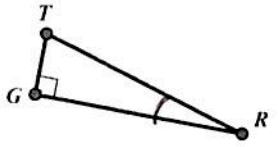






Example 2: Determine the correct side based on the reference angle.

a)



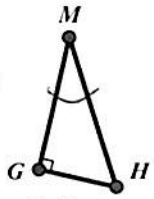
Reference ∠R

Opposite Side TG

Adjacent Side GR

Hypotenuse TR

b)



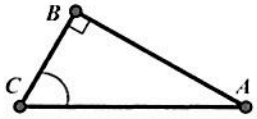
Reference ∠M

Opposite Side GH

Adjacent Side MG

Hypotenuse MH

c)



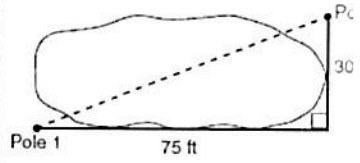
Reference ∠C

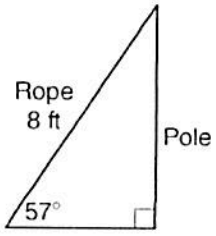
Opposite Side BA

Adjacent Side BC

Hypotenuse AC

***WHEN* DO WE USE THE PYTHAGOREAN THEOREM?**	• We use the Pythagorean Theorem to find missing sides in right triangles. • When we are given two sides of a right triangle.
***WHEN* DO WE USE SOH-CAH-TOA?**	• When we are trying to find a missing sides or ∠'s of a right triangle. • When we are given one side and one ∠ of a right triangle.

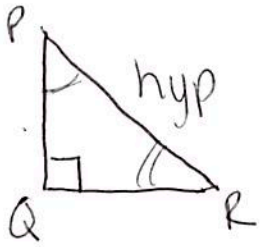




HOW DO WE WRITE TRIGONOMETRIC RATIOS?

Ratios WITHOUT Side Lengths

Example 1: Given a ΔPQR with a right angle at Q, write down each of the following ratios using the side names.

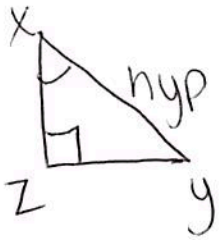


(a) $\sin P = \frac{QR}{PR}$ (b) $\cos P = \frac{QR}{PR}$ (c) $\tan P = \frac{QR}{PQ}$

(d) $\sin R = \frac{PQ}{PR}$ (e) $\cos R = \frac{QR}{PR}$ (f) $\tan R = \frac{PQ}{QR}$

S O/H C A/H T O/A

Example 2: Given a ΔXYZ with $m\angle Z = 90°$, write down each of the following ratios using the side names.



(a) $\sin X = \frac{ZY}{XY}$ (b) $\cos X = \frac{XZ}{XY}$ (c) $\tan X = \frac{ZY}{XZ}$

(d) $\sin Y = \frac{XZ}{XY}$ (e) $\cos Y = \frac{ZY}{XY}$ (f) $\tan Y = \frac{XZ}{ZY}$

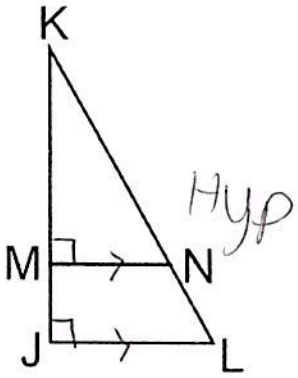
S O/H C A/H T O/A

Example 3: Using the diagram of right triangle KJL with $m\angle J = 90°$ and $\overline{MN} \parallel \overline{JL}$, complete the following ratios.

a) $\cos K = \frac{KM}{KN} = \frac{KJ}{KL}$

b) $\sin K = \frac{MN}{KN} = \frac{JL}{KL}$

c) $\tan K = \frac{MN}{KM} = \frac{JL}{KJ}$

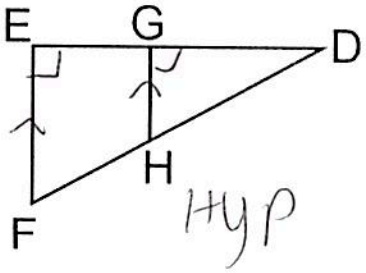


Example 4: Using the diagram of right triangle DEF with $m\angle E = 90°$ and $\overline{GH} \parallel \overline{EF}$, complete the following ratios.

a) $\cos D = \frac{GD}{DH} = \frac{DE}{DF}$

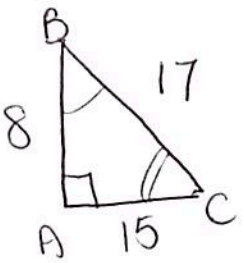
b) $\sin D = \frac{GH}{DH} = \frac{EF}{DF}$

c) $\tan D = \frac{GH}{GD} = \frac{EF}{ED}$



Ratios WITH Side Lengths

Example 1: Given a ΔABC with $m\angle A = 90°$, $AB = 8$ and $BC = 17$, write down each of the following ratios as fractions using the side lengths.

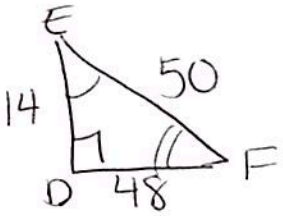


(b) $\sin B = \frac{15}{17}$ (c) $\cos B = \frac{8}{17}$ (d) $\tan B = \frac{15}{8}$

(e) $\sin C = \frac{8}{17}$ (f) $\cos C = \frac{15}{17}$ (g) $\tan C = \frac{8}{15}$

TIPPLE!

Example 2: Given a ΔDEF with $m\angle D = 90°$, $m\angle D = 90°$ $DE = 14$ and $DF = 48$, write down each of the following ratios as fractions using the side lengths..



(a) $\sin E = \frac{48}{50}$ (b) $\cos E = \frac{14}{50}$ (c) $\tan E = \frac{48}{14}$

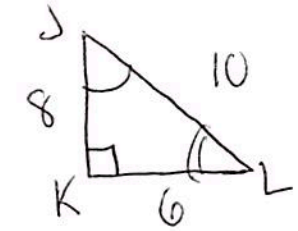
(d) $\sin F = \frac{14}{50}$ (e) $\cos F = \frac{48}{50}$ (f) $\tan F = \frac{14}{48}$

$14^2 + 48^2 = c^2$

$c^2 = 2500$

$c = 50$

Example 3: Given a ΔJKL with $m\angle K = 90°$, and $\tan J = \frac{6}{8}$ (Opp / Adj), write down each of the following ratios as fractions using the side lengths.



(a) $\sin J = \frac{6}{10}$ (b) $\cos J = \frac{8}{10}$ (c) $\tan J = \frac{6}{8}$

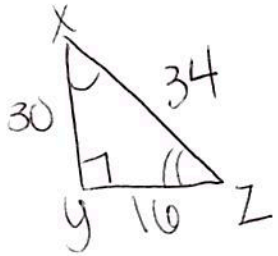
(d) $\sin L = \frac{8}{10}$ (e) $\cos L = \frac{6}{10}$ (f) $\tan L = \frac{8}{6}$

$6^2 + 8^2 = x^2$

$100 = x^2$

$10 = x$

Example 4: Given a ΔXYZ with $m\angle Y = 90°$ and $\sin X = \frac{16}{34}$ (Opp / hyp), write down each of the following ratios using the sides using the side lengths..



(a) $\sin X = \frac{16}{34}$ (b) $\cos X = \frac{30}{34}$ (c) $\tan X = \frac{16}{30}$

(d) $\sin Z = \frac{30}{34}$ (e) $\cos Z = \frac{16}{34}$ (f) $\tan Z = \frac{30}{16}$

$x^2 + 16^2 = 34^2$

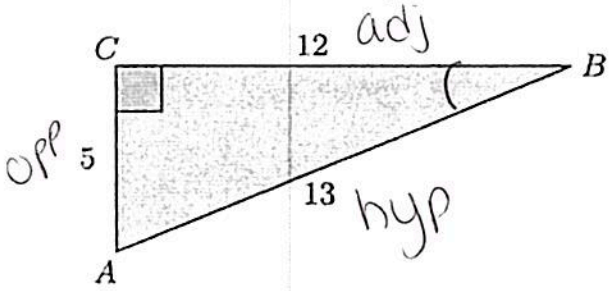
$x^2 = 900$

$x = 30$

PRACTICE PROBLEMS:

Example:

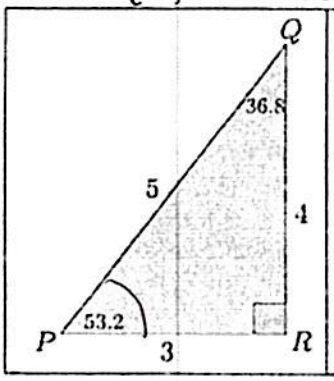
1. With respect to angle B, label the sides as opposite, adjacent, and hypotenuse.



Find the value of

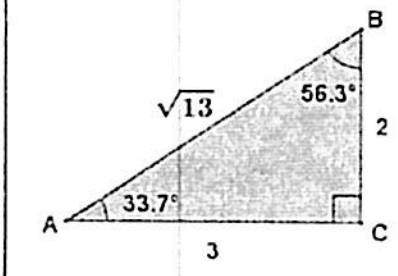
a) Sin A $\frac{12}{13}$	b) Cos A $\frac{5}{13}$	c) Tan A $\frac{12}{5}$
d) Sin B $\frac{5}{13}$	e) Cos B $\frac{12}{13}$	f) Tan B $\frac{5}{12}$

2. In $\triangle PQR$, $m\angle P=53.2°$ and $m\angle Q=36.8°$. Complete the following table.



Measure of Angle	Sine $\left(\frac{opp}{hyp}\right)$	Cosine $\left(\frac{adj}{hyp}\right)$	Tangent $\left(\frac{opp}{adj}\right)$
53.2	$\frac{4}{5}$	$\frac{3}{5}$	$\frac{4}{3}$
36.8	$\frac{3}{5}$	$\frac{4}{5}$	$\frac{3}{4}$

3. In the triangle below, $m\angle A=33.7°$ and $m\angle B=56.3°$. Complete the following table.



Measure of Angle	Sine	Cosine	Tangent
33.7	$\frac{2}{\sqrt{13}}$	$\frac{3}{\sqrt{13}}$	$\frac{2}{3}$
56.3	$\frac{3}{\sqrt{13}}$	$\frac{2}{\sqrt{13}}$	$\frac{3}{2}$

WHAT DO RELATIONSHIPS DO YOU NOTICE?

Sine & cosine flip when you switch ∠'s
tangent = reciprocal when you switch ∠'s

$\cos A = \sin B$
$\sin A = \cos B$

Name: Kly

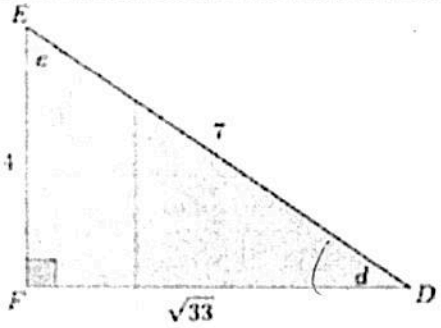
Date: _____

UNIT 6

LESSON 2

HOMEWORK

1. In the triangle below, let e be the measure of $\angle E$ and d be the measure of $\angle D$. Complete the following table.



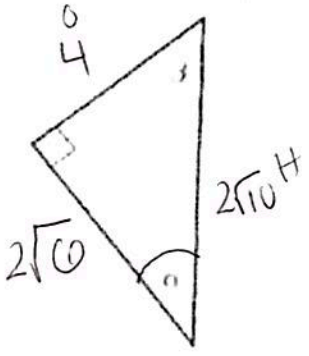
Measure of Angle	Sine	Cosine	Tangent
d	$\frac{4}{7}$	$\frac{\sqrt{33}}{7}$	$\frac{4}{\sqrt{33}}$
e	$\frac{\sqrt{33}}{7}$	$\frac{4}{7}$	$\frac{\sqrt{33}}{4}$

2. Tamer did not finish completing the table below for a diagram similar to the previous problems that the teacher had on the board where p was the measure of $\angle P$ and q was the measure of $\angle Q$. Complete the table for Tamer.

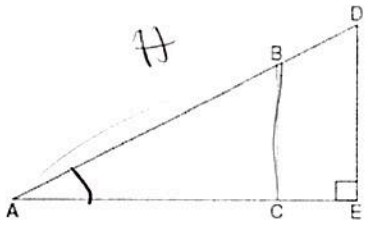
Measure of Angle	Sine	Cosine	Tangent
p	$\sin p = \frac{11}{\sqrt{157}}$	$\cos p = \frac{6}{\sqrt{157}}$	$\tan p = \frac{11}{6}$
q	$\frac{6}{\sqrt{157}}$	$\frac{11}{\sqrt{157}}$	$\frac{6}{11}$

3. Given the table of values below (not in simplest radical form), label the sides and angles in the right triangle.

Angle Measure	sin	cos	tan
α	$\frac{4}{2\sqrt{10}}$ O H	$\frac{2\sqrt{6}}{2\sqrt{10}}$	$\frac{4}{2\sqrt{6}}$
β	$\frac{2\sqrt{6}}{2\sqrt{10}}$ A	$\frac{4}{2\sqrt{10}}$	$\frac{2\sqrt{6}}{4}$



4. In the diagram of right triangle *ADE* below, $\overline{BC} \parallel \overline{DE}$.
Which ratio is always equivalent to the sine of $\angle A$?



1) $\frac{AD}{DE}$

2) $\frac{AE}{AD}$

3) $\frac{BC}{AB}$

4) $\frac{AB}{AC}$

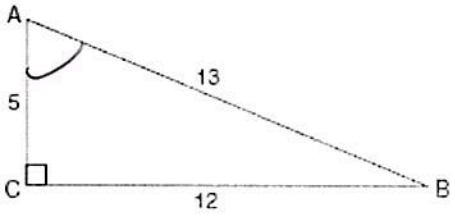
5. Which ratio represents $\cos A$ in the accompanying diagram of $\triangle ABC$?

1) $\frac{5}{13}$

2) $\frac{12}{13}$

3) $\frac{12}{5}$

4) $\frac{13}{5}$



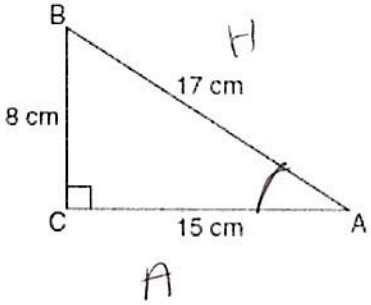
6. Which equation shows a correct trigonometric ratio for angle *A* in the right triangle below?

1) $\sin A = \frac{15}{17}$

2) $\tan A = \frac{8}{17}$

3) $\cos A = \frac{15}{17}$

4) $\tan A = \frac{5}{8}$



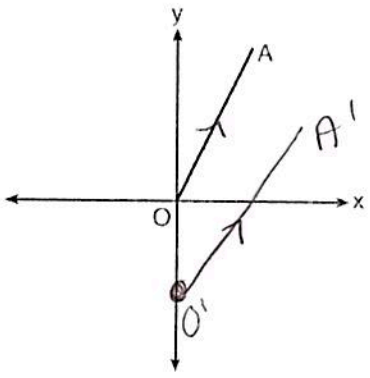
7. Which transformation of $\overline{OA}$ would result in an image parallel to $\overline{OA}$?

(1) a translation of two units down

(2) a reflection over the *x*-axis

(3) a reflection over the *y*-axis

(4) a clockwise rotation of 90° about the origin



Where sine and cosine got their names! https://www.youtube.com/watch?v=AzVL432IEWA

Corny SOHCAHTOA story: https://www.youtube.com/watch?v=s8R7ysURvkw