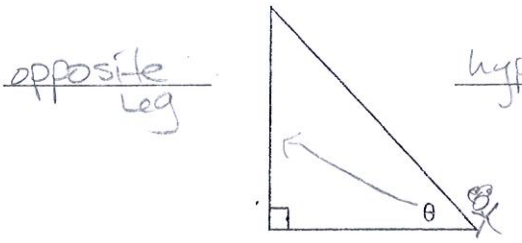
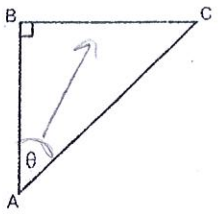
Geometry
Trigonometric Ratios & Cofunctions

Name: Key
Date: _____

## Triangle Sides (based on θ)





Which side is the hypotenuse? $\overline{AC}$

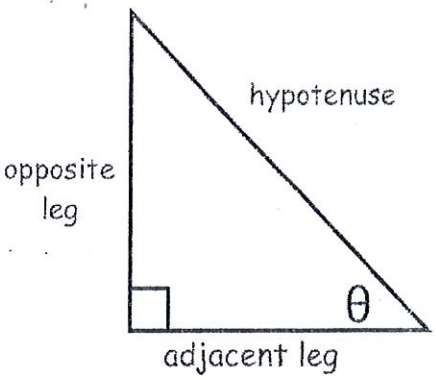
Which leg is opposite θ? $\overline{BC}$

Which leg is adjacent to θ? $\overline{AB}$

Which side is the hypotenuse? $\overline{PN}$

Which leg is opposite θ? $\overline{MN}$

Which leg is adjacent to θ? $\overline{PM}$




### What are the Trigonometric Ratios?

| | |
|---|---|
| Sine (sin) | opposite / hypotenuse |
| Cosine (cos) | adjacent / hypotenuse |
| Tangent (tan) | opposite / adjacent |
| | sin / cos |

↳ $\frac{opp}{hyp} \cdot \frac{hyp}{adj} = \frac{opp}{adj}$

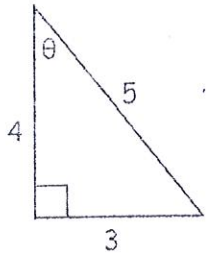
**SohCahToa**

SOH sin equals opp over hyp

CAH cos equals adj over hyp

TOA tan equals opp over adj

How do we use these ratios?

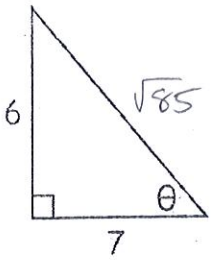



$\sin\theta = \frac{o}{h} = \frac{3}{5}$

$\cos\theta = \frac{a}{h} = \frac{4}{5}$

$\tan\theta = \frac{o}{a} = \frac{3}{4}$

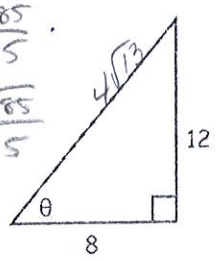
**Find the missing side and evaluate each for sin θ, cos θ, and tan θ.** SOHCAHTOA




$\sin\theta = \frac{o}{h} = \frac{6}{\sqrt{85}} \cdot \frac{\sqrt{85}}{\sqrt{85}} = \frac{6\sqrt{85}}{85}$

$\cos\theta = \frac{a}{h} = \frac{7}{\sqrt{85}} \cdot \frac{\sqrt{85}}{\sqrt{85}} = \frac{7\sqrt{85}}{85}$

$\tan\theta = \frac{o}{a} = \frac{6}{7}$




$\sin\theta = \frac{o}{h} = \frac{12}{4\sqrt{13}} \cdot \frac{\sqrt{13}}{\sqrt{13}} = \frac{3\sqrt{13}}{13}$

$\cos\theta = \frac{a}{h} = \frac{8}{4\sqrt{13}} \cdot \frac{\sqrt{13}}{\sqrt{13}} = \frac{2\sqrt{13}}{13}$

$\tan\theta = \frac{o}{a} = \frac{12}{8} = \frac{3}{2}$

$8^2 + 12^2 = x^2$

$x^2 = 208$

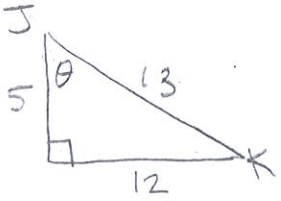
$x = \sqrt{208} = 4\sqrt{13}$

**How would you solve the following problem?**

Suppose ∠J and ∠K are complementary angles in a right triangle. The value of $\tan J = \frac{12}{5} \cdot \frac{o}{a}$

What is the value of sin J?

1. Draw and label a triangle for the problem.




2. Use the given trig ratio to label the lengths of two sides. Then use the Pythagorean Theorem to find the third side.

$5^2 + 12^2 = x^2$

$169 = x^2$

$x = 13$

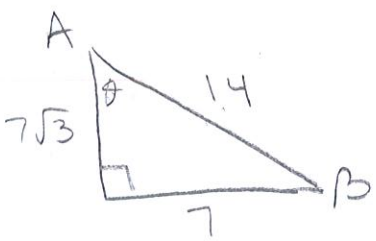
3. Using the measures of the sides of the triangle, find sin J.

$\sin J = \frac{12}{13}$

**Try this one...**

Suppose ∠A and ∠B are complementary angles in a right triangle. The value of $\sin A = \frac{7}{14} \cdot \frac{o}{h}$

What is the value of cos A?




$7^2 + x^2 = 14^2$

$x^2 = 147$

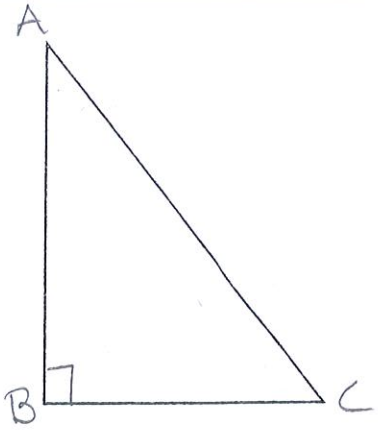
$x = \sqrt{147}$

$x = 7\sqrt{3}$

$\cos A = \frac{7\sqrt{3}}{14} = \frac{\sqrt{3}}{2}$

## Trigonometry Co-Functions

Let's look at the relationship between our trig ratios.




- Start with a right triangle $\Delta ABC$ where $\angle B = 90°$
- The acute angles will always be Complementary.
  - If $\angle A = 30°$, then $\angle C =$ 90-30=60°
  - If $\angle A = 45°$, then $\angle C =$ 90-45=45°
  - If $\angle A = 22°$, then $\angle C =$ 90-22=68°

- Let's summarize:
  - If $\angle A = \theta$, then $\angle C =$ 90°-θ

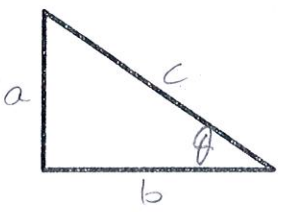

SOHCAHTOA

For each of the following find the trigonometric ratio.

$\sin\theta =$ $\frac{a}{c}$ (o/h)

$\cos\theta =$ $\frac{b}{c}$ (a/h)

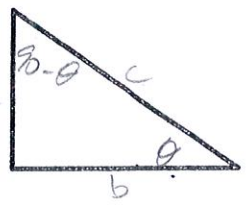
$\tan\theta =$ $\frac{a}{b}$ (o/a)




$\sin(90-\theta) =$ $\frac{b}{c}$

$\cos(90-\theta) =$ $\frac{a}{c}$

$\tan(90-\theta) =$ $\frac{b}{a}$




**Trigonometry Co-Functions**

**sin θ° =** Cos(90-θ) **cos θ° =** Sin(90-θ) **tan θ° =** Reciprocal of tan(90-θ)

Use co-functions to answer the following:

1. $\sin\theta = \frac{21}{29}$ $\quad \cos(90-\theta) =$ $\frac{21}{29}$

2. $\cos\theta = \frac{8}{17}$ $\quad \sin(90-\theta) =$ $\frac{8}{17}$

3. $\tan\theta = \frac{12}{37}$ $\quad \tan(90-\theta) =$ $\frac{37}{12}$ reciprocal

4. $\sin 15 = \cos$ 90-15 Sin15=cos75°

5. $\sin$ 90-54 $= \cos 54$ Sin36=cos54°

6. $\sin 11 = \cos$ 90-11 Sin11=cos79°