8.4 Trigonometry

EQ: Can you find trigonometric ratios and use them to find side lengths and angle measures in right triangles?

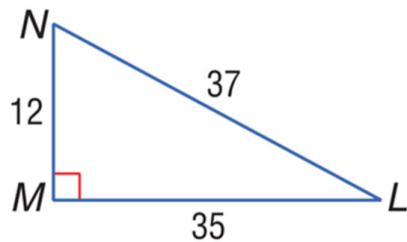How are you doing? Write answer next to Essential Question
1. I don't understand the material
2. I understand a little.
3. I understand this material.
4. I could teach this to someone

Summary: At least 3 sentences...

KeyConcept Trigonometric Ratios

Words	Symbols	
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the **sine** of $\angle A$ (written sin A) is the ratio of the length of the leg opposite $\angle A$ (opp) to the length of the hypotenuse (hyp).	$\sin A = \dfrac{\text{opp}}{\text{hyp}}$ or $\dfrac{a}{c}$ $\sin B = \dfrac{\text{opp}}{\text{hyp}}$ or $\dfrac{b}{c}$	
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the **cosine** of $\angle A$ (written cos A) is the ratio of the length of the leg adjacent $\angle A$ (adj) to the length of the hypotenuse (hyp).	$\cos A = \dfrac{\text{adj}}{\text{hyp}}$ or $\dfrac{b}{c}$ $\cos B = \dfrac{\text{adj}}{\text{hyp}}$ or $\dfrac{a}{c}$	
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the **tangent** of $\angle A$ (written tan A) is the ratio of the length of the leg opposite $\angle A$ (opp) to the length of the leg adjacent $\angle A$ (adj).	$\tan A = \dfrac{\text{opp}}{\text{adj}}$ or $\dfrac{a}{b}$ $\tan B = \dfrac{\text{opp}}{\text{adj}}$ or $\dfrac{b}{a}$	

KeyConcept Inverse Trigonometric Ratios

|	
Words	If $\angle A$ is an acute angle and the sine of A is x, then the **inverse sine** of x is the measure of $\angle A$.
Symbols	If $\sin A = x$, then $\sin^{-1} x = m\angle A$.
Words	If $\angle A$ is an acute angle and the cosine of A is x, then the **inverse cosine** of x is the measure of $\angle A$.
Symbols	If $\cos A = x$, then $\cos^{-1} x = m\angle A$.
Words	If $\angle A$ is an acute angle and the tangent of A is x, then the **inverse tangent** of x is the measure of $\angle A$.
Symbols	If $\tan A = x$, then $\tan^{-1} x = m\angle A$.

1 a-f.

2.

Use a special right triangle to express the cosine of 60° as a fraction and as a decimal to the nearest hundredth.
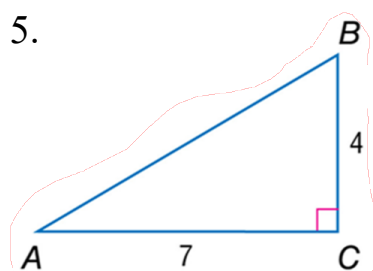
3.

4.
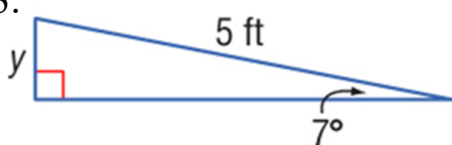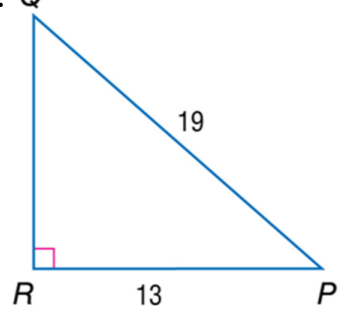
5.

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KEY TERMS

Trigonometry (comes from Greek words trigon meaning triangle and metron meaning measure) -uses relationship with triangle measurement.

Trigonometric Ratio - A ratio of the lengths of two sides of a right triangle.

Solving a Right Triangle - Finding the unknown angles and side measures of a right triangle (need to know 2 side lengths or one side length and one acute angle measure).

Notice: tan 30° ≈ 0.58 and $\tan^{-1} 0.58 ≈ 30°$ (try these on your calculator)

SOH-CAH-TOA

StudyTip

Memorizing Trigonometric Ratios SOH-CAH-TOA is a mnemonic device for learning the ratios for sine, cosine, and tangent using the first letter of each word in the ratios.

$$\sin A = \frac{opp}{hyp}$$

$$\cos A = \frac{adj}{hyp}$$

$$\tan A = \frac{opp}{adj}$$

ReadingMath

Inverse Trigonometric Ratios The expression $\sin^{-1} x$ is read *the inverse sine of x* and is interpreted as the angle with sine x. Be careful not to confuse this notation with the notation for negative exponents—

$$\sin^{-1} x \neq \frac{1}{\sin x}.$$

Instead, this notation is similar to the notation for an inverse function, $f^{-1}(x)$.

StudyTip

Graphing Calculator The second functions of the SIN, COS, and TAN keys are usually the inverses.

Watch Out!

Approximation If using calculated measures to find other measures in a right triangle, be careful not to round values until the last step. So in the following equation, use $\tan^{-1} \frac{9}{5}$ instead of its approximate value, 61°.

$$XY = \frac{9}{\sin X}$$

$$= \frac{9}{\sin\left(\tan^{-1} \frac{9}{5}\right)}$$

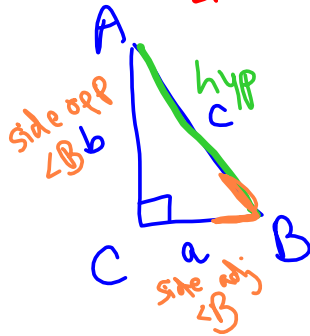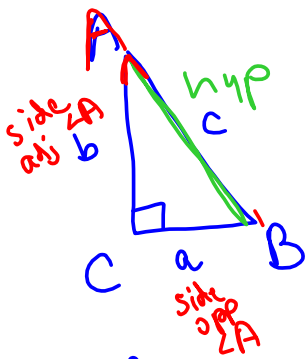$$\approx 10.3$$

Watch Out!

Rounding When finding missing measures of a triangle, the angles may not add to 180° because of rounding errors.

KeyConcept Trigonometric Ratios ~~used to find Lengths of Sides~~

Words	Symbols
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the **sine** of $\angle A$ (written sin A) is the ratio of the length of the leg opposite $\angle A$ (opp) to the length of the hypotenuse (hyp).	$\sin A = \dfrac{opp}{hyp}$ or $\dfrac{a}{c}$ $\sin B = \dfrac{opp}{hyp}$ or $\dfrac{b}{c}$
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the **cosine** of $\angle A$ (written cos A) is the ratio of the length of the leg adjacent $\angle A$ (adj) to the length of the hypotenuse (hyp).	$\cos A = \dfrac{adj}{hyp}$ or $\dfrac{b}{c}$ $\cos B = \dfrac{adj}{hyp}$ or $\dfrac{a}{c}$
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the **tangent** of $\angle A$ (written tan A) is the ratio of the length of the leg opposite $\angle A$ (opp) to the length of the leg adjacent $\angle A$ (adj).	$\tan A = \dfrac{opp}{adj}$ or $\dfrac{a}{b}$ $\tan B = \dfrac{opp}{adj}$ or $\dfrac{b}{a}$

SOH CAH TOA
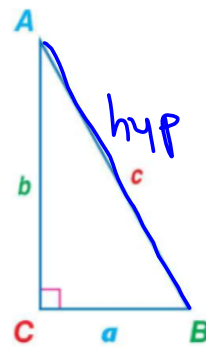
KeyConcept Inverse Trigonometric Ratios ~~Use to find Missing Angle~~

Words	If $\angle A$ is an acute angle and the sine of A is x, then the **inverse sine** of x is the measure of $\angle A$.
Symbols	If $\sin A = x$ then $\sin^{-1} x = m\angle A$.
Words	If $\angle A$ is an acute angle and the cosine of A is x, then the **inverse cosine** of x is the measure of $\angle A$.
Symbols	If $\cos A = x$ then $\cos^{-1} x = m\angle A$.
Words	If $\angle A$ is an acute angle and the tangent of A is x, then the **inverse tangent** of x is the measure of $\angle A$.
Symbols	If $\tan A = x$ then $\tan^{-1} x = m\angle A$.

$$\sin A = \frac{opp}{hyp} = \frac{a}{c}$$

$$\cos A = \frac{adj}{hyp} = \frac{b}{c}$$

$$\tan A = \frac{opp}{adj} = \frac{a}{b}$$

$$\sin B = \frac{opp}{hyp} = \frac{b}{c}$$

$$\cos B = \frac{adj}{hyp} = \frac{a}{c}$$

$$\tan B = \frac{opp}{adj} = \frac{b}{a}$$

SOH CAH TOA

SOH CAH TOA

Sentence Frame: Learning SOHCAHTOA
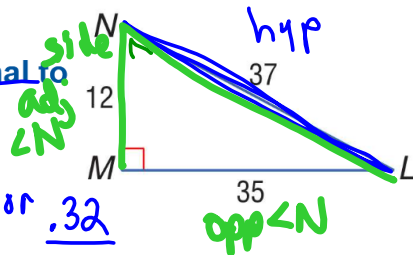
The_____ of an angle is the ratio of
_____ over _____.

Example 1   **Find Sine, Cosine, and Tangent Ratios**

A. Express sin *L* as a fraction and as a decimal to the nearest hundredth.

N side   hyp
adj   37
12    $\angle N$
M ⌐   35 L
opp $\angle N$

SOH CAH TOA

1a. $\sin L = \frac{opp}{hyp} = \frac{12}{37}$ or .32

1b. $\cos L = \frac{adj}{hyp} = \frac{35}{37}$ or .95

1c. $\tan L = \frac{opp}{adj} = \frac{12}{35}$ or .34

1d. $\sin N = \frac{35}{37}$ or .95

1e. $\cos N = \frac{12}{37}$ or .32

1f. $\tan N = \frac{35}{12}$ or 2.92

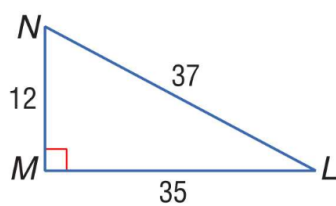**Example 1**   Find Sine, Cosine, and Tangent Ratios

B. Express cos *L* as a fraction and as a decimal to the nearest hundredth.
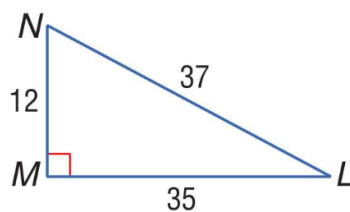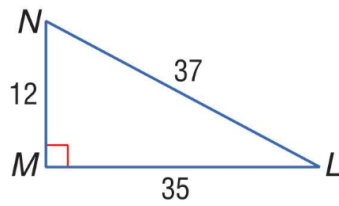
Example 1   Find Sine, Cosine, and Tangent Ratios

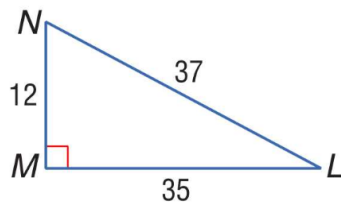**C. Express tan *L* as a fraction and as a decimal to the nearest hundredth.**

Example 1   **Find Sine, Cosine, and Tangent Ratios**

D. Express sin *N* as a fraction and as a decimal to the nearest hundredth.
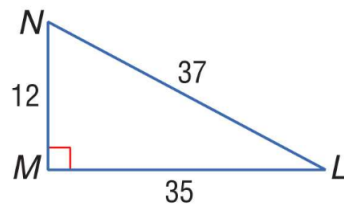
Example 1   Find Sine, Cosine, and Tangent Ratios

E. Express cos *N* as a fraction and as a decimal to the nearest hundredth.

Example 1   Find Sine, Cosine, and Tangent Ratios

F. Express tan *N* as a fraction and as a decimal to the nearest hundredth.

Now do worksheet:

"HW4W 2 sin, cos, and tan"