Trigonometry

Monday, February 12, 2024 6:21 PM

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Trigono...
Lesson

Lesson 9.3/9.4
Trigonometry
Workbook pages 145-147 and 155-158

Content Objective
Students will solve problems using the trigonometric ratios and inverse trigonometric ratios for acute angles.

Content Objective
Students will solve real-world problems using the trigonometric ratios and their inverses.

Florida's B.E.S.T. Standards for Mathematics

MA.912.T.1.1
Define trigonometric ratios for acute angles in right triangles.

MA.912.T.1.2
Solve mathematical and real-world problems involving right triangles using trigonometric ratios and the Pythagorean Theorem.

Learn
Trigonometry

The word **trigonometry** comes from the Greek terms *trigon*, meaning triangle, and *metron*, meaning measure. So the study of trigonometry involves triangle measurement. A **trigonometric ratio** is a ratio of the lengths of two sides of a right triangle.

The names of the three most common trigonometric ratios are given on the next few slides.

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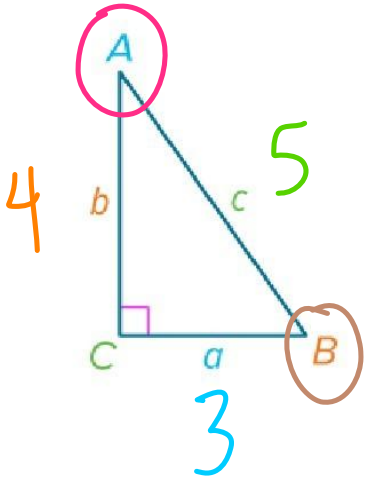
Trigonometry

Key Concept: Trigonometric Ratios

Sine: If $\triangle ABC$ is a right triangle, then the sine of each acute angle in $\triangle ABC$ is the ratio of the length of the leg opposite that angle (opp) to the length of the hypotenuse (hyp).

$$\sin A = \frac{\text{opp}}{\text{hyp}} \text{ or } \frac{a}{c}; \quad \sin B = \frac{\text{opp}}{\text{hyp}} \text{ or } \frac{b}{c}$$



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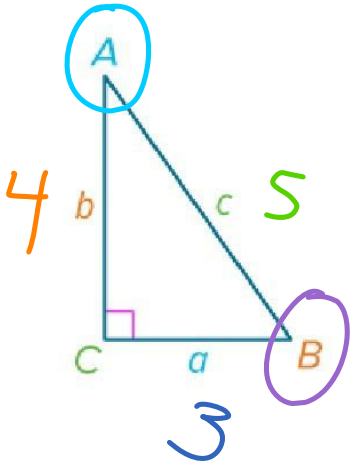
Cosine: If $\triangle ABC$ is a right triangle, then the cosine of each acute angle in $\triangle ABC$ is the ratio of the length of the leg adjacent to that angle (adj) to the length of the hypotenuse (hyp).



$$\cos A = \frac{\text{adj}}{\text{hyp}} \text{ or } \frac{b}{c}; \cos B = \frac{\text{adj}}{\text{hyp}} \text{ or } \frac{a}{c}$$

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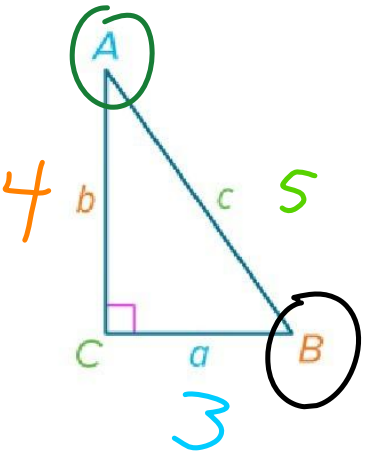
Tangent: If $\triangle ABC$ is a right triangle, then the tangent of each acute angle in $\triangle ABC$ is the ratio of the length of the leg opposite that angle (opp) to the length of the leg adjacent to that angle (adj).



$$\tan A = \frac{\text{opp}}{\text{adj}} \text{ or } \frac{a}{b}; \tan B = \frac{\text{opp}}{\text{adj}} \text{ or } \frac{b}{a}$$

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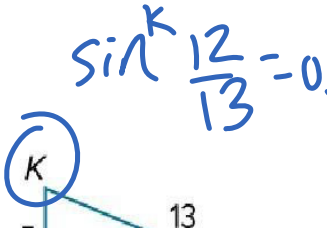
Example 1
Find Trigonometric Ratios

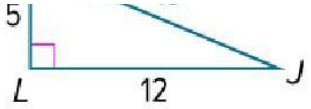
Find sin *J*, cos *J*, tan *J*, sin *K*, cos *K*, and tan *K*. Express each ratio as a fraction and as a decimal to the nearest ~~hundredth~~ thousandth.



Sin J = opp/hyp 5/13 = 0.385

Cos J = adj/hyp 12/13 = 0.92

tan J = opp/adj 5/12 = 0.42



Cos K = 5/13 = 0.38

Tan K = 12/5 = 2.4

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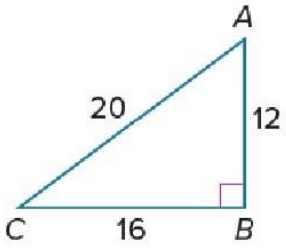
Example 1
Find Trigonometric Ratios

Check

Find sin *A*, cos *A*, tan *A*, sin *C*, cos *C*, and tan *C*.

Express each ratio as a fraction and as a decimal to the nearest hundredth, if necessary.



SOH CAH TOA

Sin A = 16/20 4/5 0.8

Cos A = 12/20 6/10 3/5 = 0.6

Tan A = 16/12 = 4/3 = 1.3

Sin C = 12/20 3/5 = 0.6

Cos C = 16/20 = 4/5 = 0.8

Tan C = 12/16 = 3/4 = 0.75

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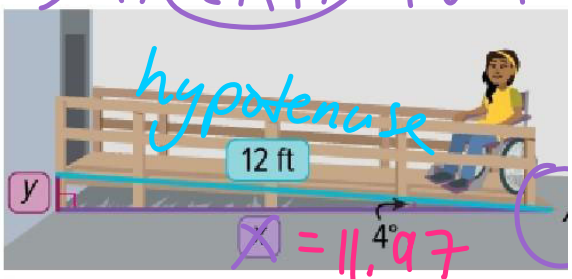
Example 3
Estimate Measures by Using Trigonometry

SOH CAH TOA

ACCESSIBILITY **Mathias builds a ramp so his sister can access the back door of their house. The 12-foot ramp to the house slopes upward from the ground at a 4° angle. What is the horizontal distance between the foot of the ramp and the house?**



12 (Cos 4 = x) 12

Hyp

x = 11.97

Adjacent

$12(\cos 4) = x$ (Adj / hyp)

Example 3

Estimate Measures by Using Trigonometry

ACCESSIBILITY Mathias builds a ramp so his sister can access the back door of their house. The 12-foot ramp to the house slopes upward from the ground at a 4° angle. What is the height of the ramp?

SOH CAH TOA

opposite, hypotenuse

$12\left(\sin 4 = \frac{y}{12}\right)$ (opp / hyp)

$12(\sin 4) = y$

$y = 0.84$

Learn

Inverse Trigonometric Ratios

Key Concept: Inverse Trigonometric Ratios

Inverse Sine	Inverse Cosine	Inverse Tangent
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 $\angle A$.	If $\angle A$ is an acute angle and the cosine of A is x, then the **inverse cosine** of x is the measure of $\angle A$.	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 $\sin A = x$, then $\sin^{-1} x = m\angle A$.	If $\cos A = x$, then $\cos^{-1} x = m\angle A$.	If $\tan A = x$, then $\tan^{-1} x = m\angle A$.

find angle degree

Example 4

Find Angle Measures by Using Inverse Trigonometric Ratios

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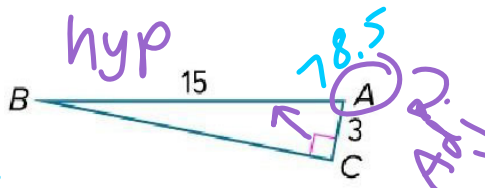
Use a calculator to find $m\angle A$ to the nearest tenth.



Sin = opp/hyp

Cos = adj/hyp

tan = opp/adj

$\cos^{-1} = \frac{Adj}{Hyp}$ $\frac{3}{15}$

78.5°

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Example 4

Find Angle Measures by Using Inverse Trigonometric Ratios

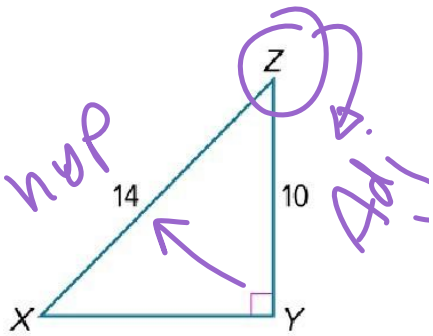
Check

SOH CAH TOA

Use a calculator to find $m\angle Z$ to the nearest tenth.

$\cos^{-1} = \frac{10}{14}$ $\frac{Adj}{Hyp}$

44.4°



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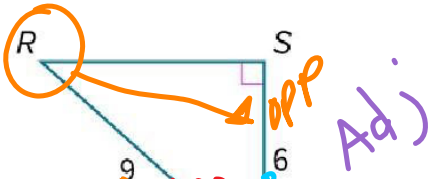
Example 5

Solve a Right Triangle

SOH CAH TOA

Solve the right triangle. Round side and angle measures to the nearest tenth.



$\cos^{-1} = \frac{6}{9}$ Adj / Hyp

$\angle T$ 48.2°

$\sin^{-1} = \frac{opp}{hyp}$ $\frac{6}{9}$

$\angle R$ 41.8

$c^2 = a^2 + b^2$

$9^2 = 6^2 + b^2$

$81 = 36 + b^2$

$-36 \quad -36$

$45 = b^2$

$b = \sqrt{45}$

$\sqrt{9}\ \sqrt{5}$

$3\sqrt{5}$

41.8° 48.2° T

$RS = opp$

$\sin 48.2° = \frac{opp}{hyp}$

$6.7 = RS$

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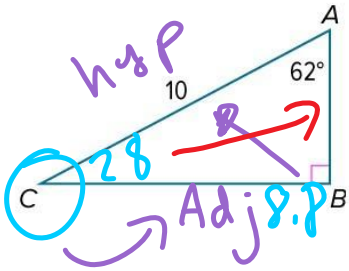
Example 5

Solve a Right Triangle

Check

SOH CAH TOA

Solve the right triangle by finding $m\angle C$, AB, and BC. Round side and angle measures to the nearest tenth.



hyp 10 62° opp 4.7

28 Adj 8.8

$\frac{10}{10}(\cos 28 = \frac{x}{10})10$

$8.8 = x$

$10(\sin 28 = \frac{x}{10})10$ opp / hyp

$4.7 = x$

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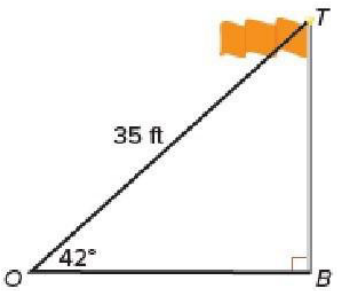
Solve. Round answers to the nearest tenth.

1. Find the height of the flagpole, TB.



2. Find the width of the river, w.