Trigonometry & Special Right Triangles

Monday, March 9, 2026 10:19 PM

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Trigonometry and Sp...

Trigonometry and Special Right Triangles

Workbook page 143-158

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.

Content Objective

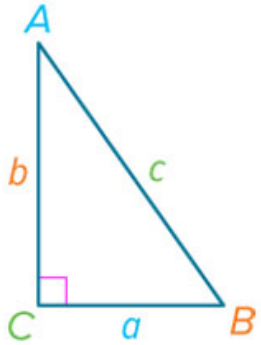
Students will solve problems using the trigonometric ratios and inverse trigonometric ratios for acute angles. Students will solve real-world problems using the trigonometric ratios and their inverses. Students will find the area of triangles using a formula based on the sine function.

Students will solve problems by using the properties of $45° - 45° - 90°$ and $30° - 60° - 90°$ triangles.

Learn
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).



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

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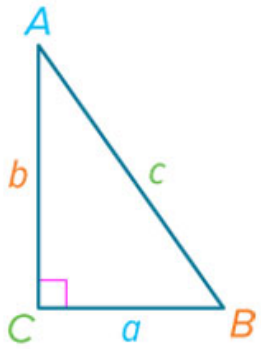
Cosine: If $\triangle ABC$ is a right triangle, then the cosine of each acute angle in $\triangle ABC$ is the ratio of the length of the leg adjacent to that angle (adj) to the length of the hypotenuse (hyp).



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

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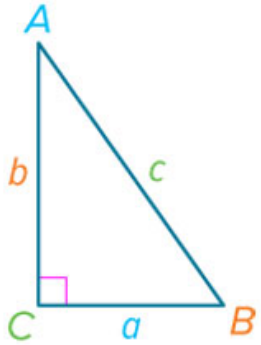
Tangent: If $\triangle ABC$ is a right triangle, then the tangent of each acute angle in $\triangle ABC$ is the ratio of the length of the leg opposite that angle (opp) to the length of the leg adjacent to that angle (adj).



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

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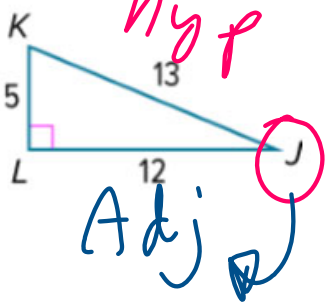
Example 1
Find Trigonometric Ratios

SOH CAH TOA

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.



hyp

Sin $\frac{5}{13}$ $\frac{\text{opp}}{\text{hyp}}$ Cos $\frac{12}{13}$ $\frac{\text{Adj}}{\text{Hyp}}$ opp

Adj

Tan $\frac{5}{12}$ $\frac{\text{opp}}{\text{Adj}}$

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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 $\tan^{-1} x = m\angle A$.

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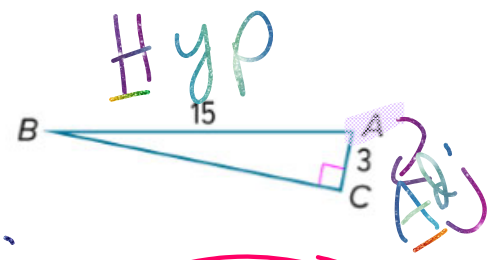
Example 4

Find Angle Measures by Using Inverse Trigonometric Ratios

SOH CAH TOA

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



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

78.5°

3 ÷ 15 = 2nd Button cos

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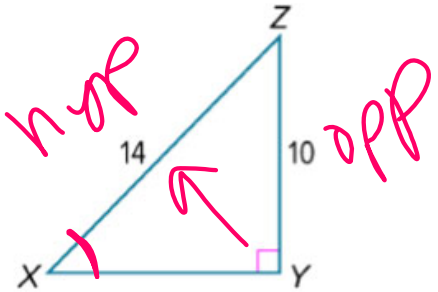
Example 4

Find Angle Measures by Using Inverse Trigonometric Ratios

SOH CAH TOA

Check

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



hyp

opp

$\sin^{-1}\frac{10}{14}$ $\frac{\text{opp}}{\text{Hyp}}$

45.6°

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Example 1

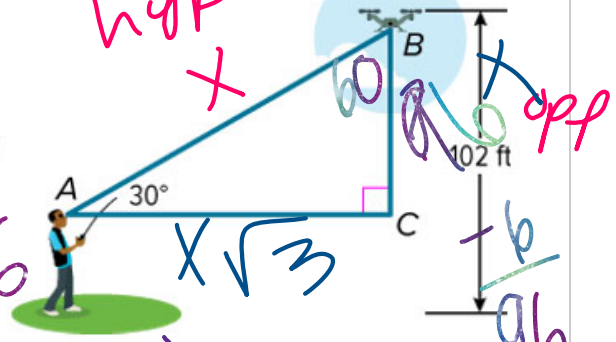
Angle of Elevation

DRONES Rakeem is flying his drone at the park. He spots the drone at an angle of elevation that he estimates to be $30°$. The remote control tells Rakeem that his drone is 102 feet above the ground. If Rakeem is 6 feet tall, how far is he from the drone to the nearest foot?

2(96)

hyp

x



opp

$x\sqrt{3}$

$96-6$

$x(\sin 30) = 96$

$\frac{x(\sin 30)}{(\sin 30)} = \frac{96}{(\sin 30)}$

$x = 192$

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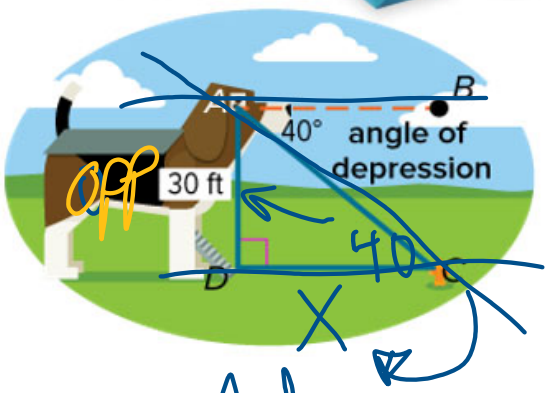
Example 2
Angle of Depression SOH CAH TOA

SIGHTSEEING Cottonwood, Idaho's Dog Bark Park Inn is a popular tourist attraction featuring a hotel in the shape of a 30-foot wood-carved beagle. Pedro looks out the window 30 feet from the ground and spots a fire hydrant on the ground at an estimated angle of depression of 40°. What is the horizontal distance from Pedro to the hydrant to the nearest foot?



OPP

$\tan 40 = \frac{30}{X}$ Opp / Adj

$\frac{X(\tan 40)}{(\tan 40)} = \frac{30}{(\tan 40)}$ Adj

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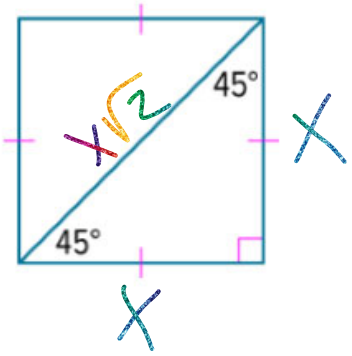
Learn
45° – 45° – 90° Triangles

Theorem 9.5: 45° – 45° – 90° Triangle Theorem

In a 45° – 45° – 90° triangle, the legs ℓ are congruent and the length of the hypotenuse h is $\sqrt{2}$ times the length of a leg.



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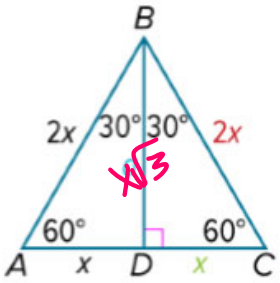
Learn

$30° - 60° - 90°$ Triangles

Use the Pythagorean Theorem to find *a*, the length of the altitude $\overline{BD}$, which is also the longer leg of $\triangle BDC$.

$$a^2 + x^2 = (2x)^2 \quad \text{Pythagorean Theorem}$$
$$a^2 + x^2 = 4x^2 \quad \text{Simplify.}$$
$$a^2 = 3x^2 \quad \text{Subtract } x^2 \text{ from each side.}$$
$$a = x\sqrt{3} \quad \text{Simplify.}$$



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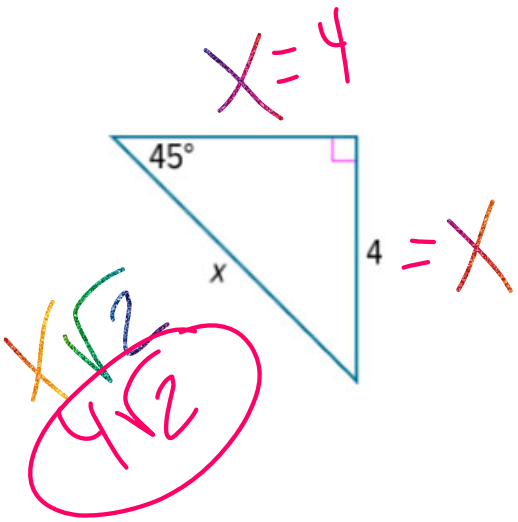
Example 1

Find the Hypotenuse Length Given an Angle Measure

Find the value of *x*.



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Example 1
Find the Hypotenuse Length Given an Angle Measure

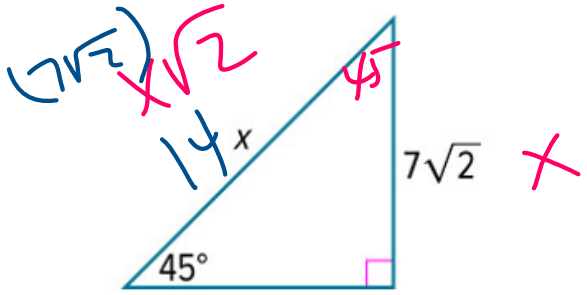
Check

Find the value of *x*.

$(7\sqrt{2})(\sqrt{2})$

$7(\sqrt{4})$

$7(2) = 14$



$(7\sqrt{2}) \times \sqrt{2}$

14

x

$x = 7\sqrt{2}$

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Example 4
Find Leg Lengths in a $30° - 60° - 90°$ Triangle

Check

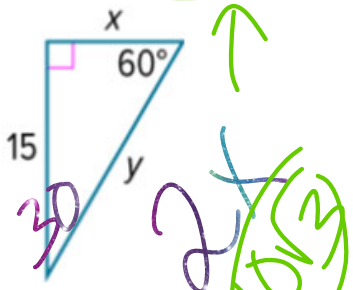
Find the values of *x* and *y*.

$\frac{x\sqrt{3}}{\sqrt{3}} = \frac{15}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{15\sqrt{3}}{3}$

$\sqrt{9}$

$x = 5\sqrt{3}$

$x = 5\sqrt{3}$



$x\sqrt{3}$

$2x$

$10\sqrt{3}$

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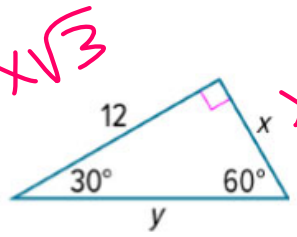
Example 4

Find Leg Lengths in a $30° - 60° - 90°$ Triangle

Find the values of *x* and *y*.



$x\sqrt{3}$

$x = 4\sqrt{3}$

$\frac{x\sqrt{3}}{\sqrt{3}} = \frac{12}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{12\sqrt{3}}{3} = 4\sqrt{3}$

$\sqrt{9}$

$x = 4\sqrt{3}$

$2x$

$2(4\sqrt{3})$

$8\sqrt{3}$

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