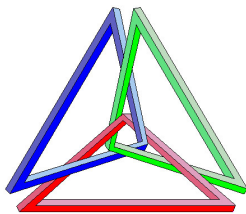


Working With Trigonometric Ratios

J. Garvin



Slide 1/12

Trigonometric Ratios

Recall the three primary trigonometric ratios, and the three secondary trigonometric ratios for a right triangle:

$$\sin A = \frac{\text{opp}}{\text{hyp}}, \cos A = \frac{\text{adj}}{\text{hyp}}, \tan A = \frac{\text{opp}}{\text{adj}},$$

$$\csc A = \frac{\text{hyp}}{\text{opp}}, \sec A = \frac{\text{hyp}}{\text{adj}}, \cot A = \frac{\text{adj}}{\text{opp}}.$$

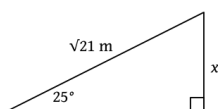
The primary ratios are generally used far more frequently than the secondary ratios, either to calculate lengths or determine the measures of angles.

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Slide 2/12

Solving For Lengths

Example

Determine the length of x in the right triangle shown.



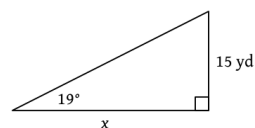
$$\begin{aligned} \sin 25^\circ &= \frac{x}{\sqrt{21}} \\ x &= \sqrt{21} \sin 25^\circ \\ x &\approx 1.94 \text{ m} \end{aligned}$$

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Slide 3/12

Solving For Lengths

Example

Determine the length of x in the right triangle shown.



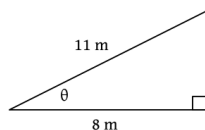
$$\begin{aligned} \tan 19^\circ &= \frac{15}{x} \\ x &= \frac{15}{\tan 19^\circ} \\ x &\approx 43.56 \text{ yd} \end{aligned}$$

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Slide 4/12

Solving For Angles

Example

Determine the measure of θ in the right triangle shown.



$$\begin{aligned} \cos \theta &= \frac{8}{11} \\ \theta &= \cos^{-1} \left(\frac{8}{11} \right) \\ \theta &\approx 43.3^\circ \end{aligned}$$

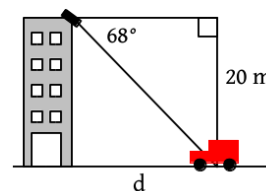
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Slide 5/12

Applications

Example

A camera, mounted atop the roof of an apartment building, is 20 m above the ground. It looks down at a car with an angle of depression of 68° . How far away from the building is the car?

Draw a diagram, like below.

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Slide 6/12

Applications

Use a trigonometric ratio to solve for the horizontal distance, d , from the building.

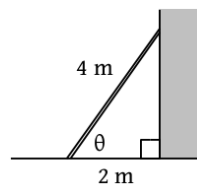
$$\begin{aligned}\tan 68^\circ &= \frac{20}{d} \\ d &= \frac{20}{\tan 68^\circ} \\ d &\approx 8.1 \text{ m}\end{aligned}$$

Applications

Example

A 4 m ladder rests against a wall such that the base of the ladder is 2 m from the wall. What angle does the ladder make with the ground?

Draw a diagram, like below.



Applications

Use a trigonometric ratio to determine the angle, θ .

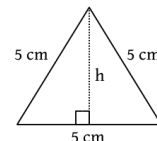
$$\begin{aligned}\cos \theta &= \frac{2}{4} \\ \theta &= \cos^{-1}\left(\frac{2}{4}\right) \\ \theta &= 60^\circ\end{aligned}$$

Applications

Example

Determine the area of an equilateral triangle with a side length of 5 cm.

Since the triangle is equilateral, it can be divided into two congruent right-triangles as shown.



Applications

Recall that an equilateral triangle contains three 60° angles.

Calculate the height, h , using a trigonometric ratio.

$$\begin{aligned}\sin 60^\circ &= \frac{h}{5} \\ h &= 5 \sin 60^\circ \\ h &\approx 4.33 \text{ cm}\end{aligned}$$

Use the formula for the area of a triangle.

$$\begin{aligned}A &\approx \frac{1}{2} \times 5 \times 4.33 \\ &\approx 10.825 \text{ cm}^2\end{aligned}$$

Questions?

