Lesson 82

More Applications of Trigonometry

The sine, cosine, and tangent ratios can be used to find the length of a side of a right triangle. These trigonometric ratios can also be used to find the measure of an angle given two side lengths. To do this, the inverse of each trigonometric function is needed.

The inverse sine is the measure of an angle where the sine ratio is known.

The inverse cosine is the measure of an angle where the cosine ratio is known.

The inverse tangent is the measure of an angle where the tangent is known.

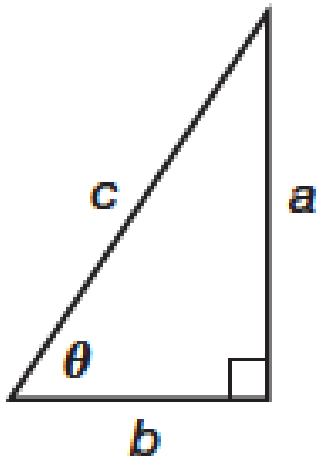
Reading Math

The Greek letter θ (theta) is used to denote the unknown measure of an angle.

The inverse of the sine function is written sin^{-1}. In the diagram, the measure of the unknown angle, θ, can be determined using an inverse trigonometric function as shown below.

$$\theta = sin^{-1}\frac{opposite}{hypotinuse} \quad \theta = cos^{-1}\frac{adjacent}{hypotinuse} \quad \theta = tan^{-1}\frac{opposite}{adjacent}$$

$$\theta = sin^{-1}\frac{a}{c} \qquad \theta = cos^{-1}\frac{b}{c} \qquad \theta = tan^{-1}\frac{a}{b}$$



Example 1 Using Inverse Sine

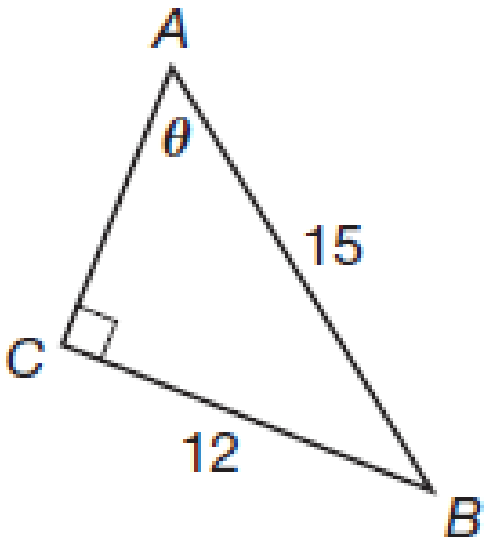
Find θ to the nearest degree.

SOLUTION

$$\theta = sin^{-1}\frac{opposite}{hypotinuse}$$

$$\theta = sin^{-1}\frac{12}{15}$$

$$\theta \approx 53°$$



Example 2 Using Inverse Cosine

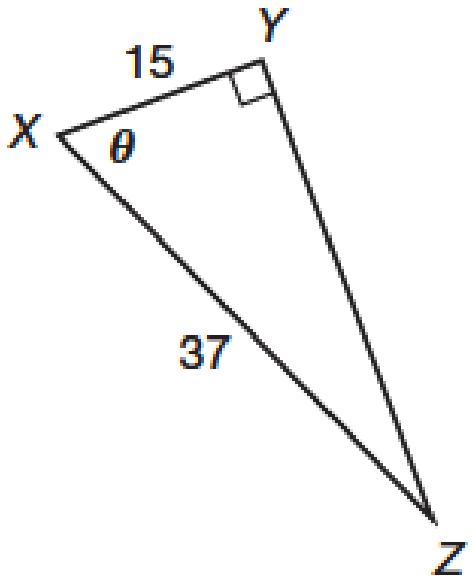
Find θ to the nearest degree.

SOLUTION

$$\theta = cos^{-1}\frac{adjacent}{hypotinuse}$$

$$\theta = cos^{-1}\frac{15}{37}$$

$$\theta \approx 66°$$



Example 3 Using Inverse Tangent

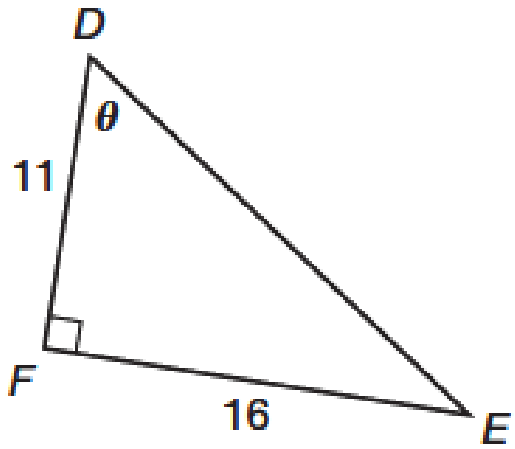
Find θ to the nearest tenth of a degree.

SOLUTION

$$\theta = tan^{-1}\frac{opposite}{adjacent}$$

$$\theta = tan^{-1}\frac{16}{11}$$

$$\theta \approx 55.5°$$



Example 4 Application: Architecture

Below is the design for a bridge. Find θ_1 and θ_2 to the nearest tenth of a degree.

SOLUTION

Since the lengths of the two legs of the right triangle are known, use the inverse tangent function.

$$\theta_1 = tan^{-1}\frac{opposite}{adjacent} \qquad \theta_2 = tan^{-1}\frac{opposite}{adjacent}$$

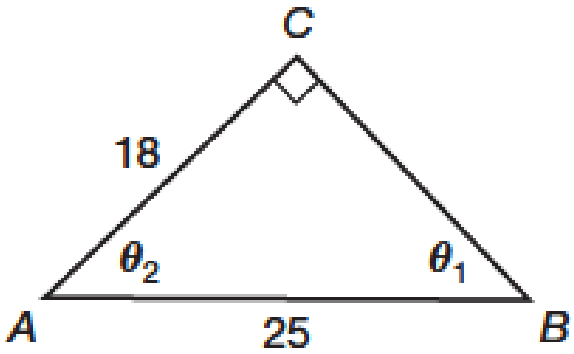
$$\theta_1 = tan^{-1}\frac{17}{15} \qquad \theta_2 = tan^{-1}\frac{15}{17u}$$

$$\theta_1 \approx 48.6° \qquad \theta_2 \approx 41.4°$$

You Try!!!!

a. Find θ_1 to the nearest degree.

b. Find θ_2 to the nearest degree.

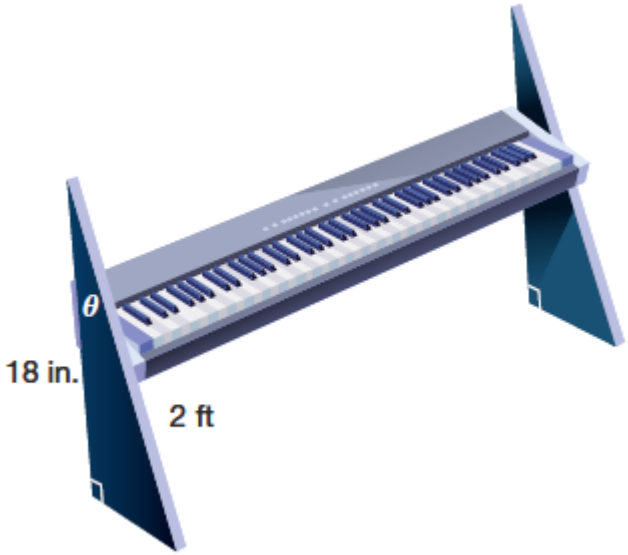


You Try!!!!

c. In a right triangle, the side that is opposite angle θ measures 72 centimeters and the side adjacent to angle θ is 90 centimeters. Find θ.

You Try!!!!

d.A children's piano is made with right triangle supports. The hypotenuse is 2 feet long and the height of the piano is 18 inches. What is θ, to the nearest degree?



Assignment

Page 539

Lesson Practice (Ask Mr. Heintz)

Page 540

Practice 1-30 (Do the starred ones first)