

### EXAMPLE 6 Verify a real-life trigonometric identity

**SHADOW LENGTH** A vertical *gnomon* (the part of a sundial that projects a shadow) has height  $h$ . The length  $s$  of the shadow cast by the gnomon when the angle of the sun above the horizon is  $\theta$  can be modeled by the equation below. Show that the equation is equivalent to  $s = h \cot \theta$ .

$$s = \frac{h \sin (90^\circ - \theta)}{\sin \theta}$$

#### Solution

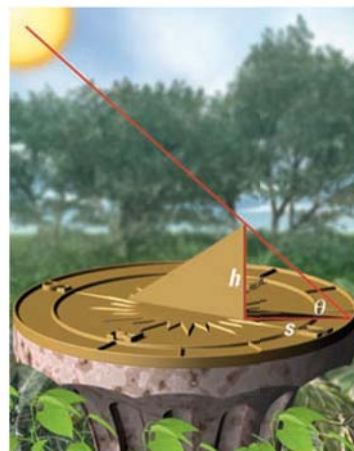
Simplify the equation.

$$s = \frac{h \sin (90^\circ - \theta)}{\sin \theta} \quad \text{Write original equation.}$$

$$= \frac{h \sin \left( \frac{\pi}{2} - \theta \right)}{\sin \theta} \quad \text{Convert } 90^\circ \text{ to radians.}$$

$$= \frac{h \cos \theta}{\sin \theta} \quad \text{Cofunction identity}$$

$$= h \cot \theta \quad \text{Cotangent identity}$$



### GUIDED PRACTICE for Examples 4, 5, and 6

Verify the identity.

6.  $\cot(-\theta) = -\cot \theta$

7.  $\csc^2 x (1 - \sin^2 x) = \cot^2 x$

8.  $\cos x \csc x \tan x = 1$

9.  $(\tan^2 x + 1)(\cos^2 x - 1) = -\tan^2 x$

## 14.3 EXERCISES

### HOMEWORK KEY

= **WORKED-OUT SOLUTIONS**  
on p. WS1 for Exs. 5, 11, and 41

= **TAKS PRACTICE AND REASONING**  
Exs. 9, 24, 42, 43, 44, 46, and 47

= **MULTIPLE REPRESENTATIONS**  
Ex. 41

### SKILL PRACTICE

1. **VOCABULARY** What is a trigonometric identity?

2. **WRITING** What does the cofunction identity  $\sin\left(\frac{\pi}{2} - \theta\right) = \cos \theta$  tell you about the graphs of  $y = \sin x$  and  $y = \cos x$ ?

**FINDING VALUES** Find the values of the other five trigonometric functions of  $\theta$ .

3.  $\sin \theta = \frac{1}{3}, 0 < \theta < \frac{\pi}{2}$

4.  $\tan \theta = \frac{3}{7}, 0 < \theta < \frac{\pi}{2}$

5.  $\cos \theta = \frac{5}{6}, \frac{3\pi}{2} < \theta < 2\pi$

6.  $\sin \theta = -\frac{7}{10}, \pi < \theta < \frac{3\pi}{2}$

7.  $\cot \theta = -\frac{2}{5}, \frac{\pi}{2} < \theta < \pi$

8.  $\sec \theta = -\frac{9}{4}, \frac{\pi}{2} < \theta < \pi$

**EXAMPLE 1**  
on p. 925  
for Exs. 3–9