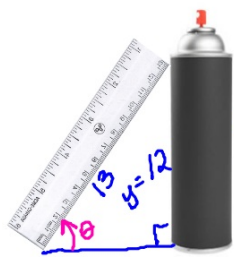# Calculus Warm Up
day after 5.4

A ruler 13 inches long leans against the side of a vertical spray can. If the
top of the ruler is sliding down the side of the spray can at a rate of 2 in/sec:

a) <u>How fast is the ruler moving away from the base of the can if the top of the ruler is 12 in from the ground?</u>

<u>Know</u>

$$\frac{dy}{dt} = -2 \text{ in/sec}$$

$$\frac{dy}{dt} = -2 \text{ in/sec.} \qquad x^2 + y^2 = 13^2$$

$$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$$

$$2(5)\frac{dx}{dt} + 2(12)(-2) = 0$$

$$10\frac{dx}{dt} = 48 \qquad \frac{dx}{dt} = 4.8$$

$$\frac{dx}{dt} = ?$$

$$5^2 + 12^2 = 13^2$$

<u>Want</u>

$$\frac{dx}{dt} = 4.8 \frac{\text{in}}{\text{sec}} \quad \text{when } y = 12 \text{ in.}$$

sentence

b) <u>At that instant, how fast is the angle between the ruler and the ground changing?</u>

<u>Know</u>

$$\sin\theta = \frac{y}{13}$$

$$\cos\theta \cdot \frac{d\theta}{dt} = \frac{1}{13}\frac{dy}{dt}$$

$$\left(\frac{5}{13}\right)\left(\frac{d\theta}{dt}\right) = \frac{1}{13}(-2)$$

$$\frac{d\theta}{dt} = \frac{-2}{13}\cdot\frac{13}{5} = \frac{-2}{5}$$

<u>Want</u>

$$\frac{d\theta}{dt} = -\frac{2}{5}\frac{\text{rad}}{\text{sec.}} \quad \text{when } y = 12 \text{ in.}$$

The angle is decreasing at a speed of $\frac{2}{5}$ rad/sec.