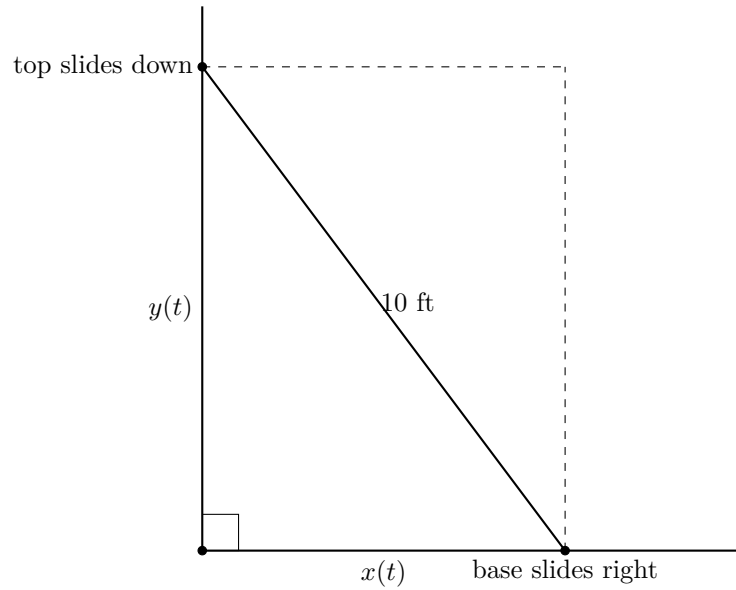


Question 8

Problem:

A 10-foot ladder is leaning against a vertical wall. The bottom of the ladder is sliding away from the wall at a rate of 2 ft/s. How fast is the top of the ladder sliding down the wall when the bottom of the ladder is 6 feet from the wall?



Question 8 - Solution

Let:

- $x(t)$: distance from the wall to the base of the ladder
- $y(t)$: height of the top of the ladder on the wall
- Given: $\frac{dx}{dt} = 2 \text{ ft/s}$, $x = 6$

Using the Pythagorean theorem:

$$x^2 + y^2 = 10^2 = 100$$

Differentiate both sides with respect to time t :

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

We know:

$$x = 6, \quad \frac{dx}{dt} = 2$$

Solve for y :

$$36 + y^2 = 100 \Rightarrow y^2 = 64 \Rightarrow y = 8$$

Substitute into the differentiated equation:

$$6(2) + 8 \frac{dy}{dt} = 0 \Rightarrow 12 + 8 \frac{dy}{dt} = 0 \Rightarrow \frac{dy}{dt} = -\frac{12}{8} = -\frac{3}{2}$$

Answer:

$$\boxed{\frac{dy}{dt} = -\frac{3}{2} \text{ ft/s}}$$

The negative sign indicates that the top of the ladder is sliding downward.