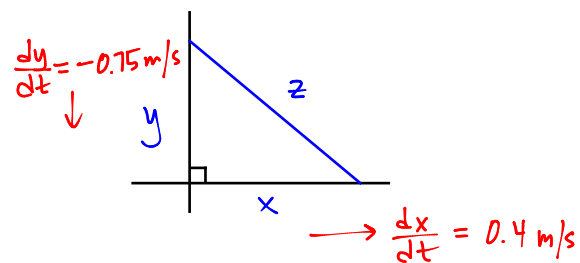


Read directions carefully and show all your work. Partial credit will be assigned based upon the correctness, completeness, and clarity of your answers.

The top of a ladder slides down a vertical wall at a rate of 0.75 m/sec. At the moment when the bottom of the ladder is 15 meters from the wall, it slides away from the wall at a rate of 0.4 m/sec. How long is the ladder?

- a. Draw a picture and use *letters* to label the appropriate variables and unknown values.



- b. Identify *all* rates that you know.

$$\frac{dx}{dt} = 0.4 \text{ m/s} ; \quad \frac{dy}{dt} = -0.75 \text{ m/s} ; \quad \frac{dz}{dt} = 0 \text{ m/s} \quad (\text{since length of ladder is constant})$$

- c. What quantity are you trying to find?

find z

- d. Find an equation that relates the *undifferentiated* variables (NOT the rates).

$$x^2 + y^2 = z^2$$

- e. Differentiate implicitly with respect to t (time).

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

$$x \cdot \frac{dx}{dt} + y \frac{dy}{dt} = z \frac{dz}{dt}$$

- f. Substitute numbers for the quantities and rates you know and solve for the unknown. Use this to find the desired quantity. Include units in your answer.

if $x=15$ then :

$$15(0.4) + y(-0.75) = z \cdot 0$$

$$0.75y = 6 \Rightarrow y = 8$$

$$\text{so } x=15, y=8 \Rightarrow z = \sqrt{x^2 + y^2} = \sqrt{15^2 + 8^2} = 17 \text{ ft}$$