



# LESSON 2.8

RELATED RATES

## **WELCOME TO RELATED RATES**

**A LADDER 10 FT LONG RESTS AGAINST A VERTICAL WALL. IF THE BOTTOM OF THE LADDER SLIDES AWAY FROM THE WALL AT A RATE OF 1 FT/SEC, HOW FAST IS THE TOP OF THE LADDER SLIDING DOWN THE WALL WHEN THE BOTTOM OF THE LADDER IS 6 FEET FROM THE WALL?**

# PROBLEM

As gravel is being poured into a conical pile, its volume  $V$  changes with time. As a result, the height  $h$  and radius  $r$  also change with time.

Knowing that at any moment  $V = \frac{1}{3}\pi r^2 h$ ,

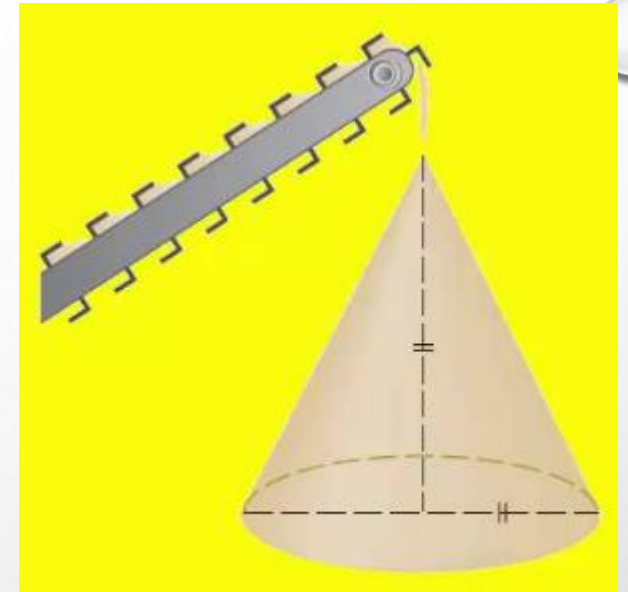
the relationship between the changes with respect to time in the volume, radius, and height is

$$(a) \quad \frac{dV}{dt} = \frac{1}{3}\pi \left( 2r \frac{dr}{dt} h + r^2 \frac{dh}{dt} \right)$$

$$(b) \quad \frac{dV}{dt} = \frac{1}{3}\pi \left( 2r \frac{dr}{dt} \cdot \frac{dh}{dt} \right)$$

$$(c) \quad \frac{dV}{dt} = \frac{1}{3}\pi \left( 2rh + r^2 \frac{dh}{dt} \right)$$

$$(d) \quad \frac{dV}{dt} = \frac{1}{3}\pi \left( r^2 (1) + 2r \frac{dr}{dh} h \right)$$

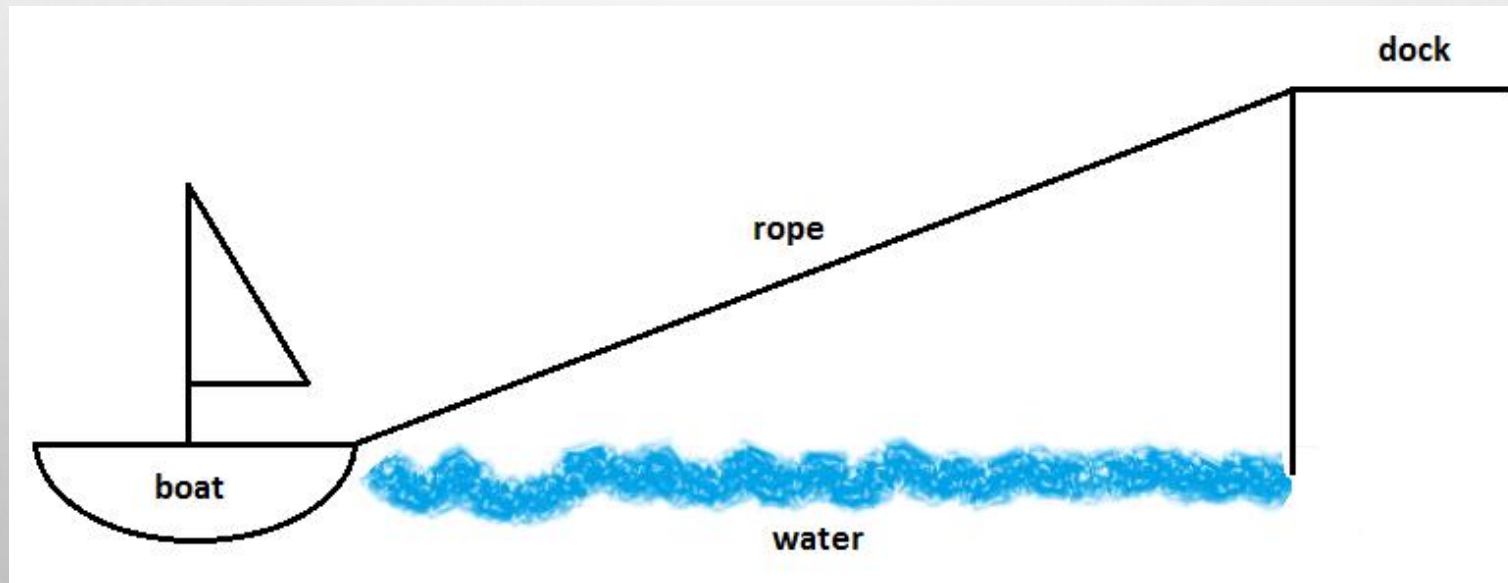


Source: wnytutor

# PROBLEM

A BOAT IS DRAWN CLOSE TO A DOCK BY PULLING IN A ROPE AS SHOWN. HOW IS THE **RATE AT WHICH THE ROPE IS PULLED IN** RELATED TO THE **RATE AT WHICH THE BOAT APPROACHES THE DOCK?**

- (a) ONE IS A CONSTANT MULTIPLE OF THE OTHER.
- (b) THEY ARE EQUAL.
- (c) IT DEPENDS ON HOW CLOSE THE BOAT IS TO THE DOCK.



# PROBLEM

A BOAT IS DRAWN CLOSE TO A DOCK BY PULLING IN THE ROPE AT A CONSTANT RATE. **TRUE** OR **FALSE**: THE CLOSER THE BOAT GETS TO THE DOCK, THE FASTER IT IS MOVING.

