

03-04 - Related Rates**Multiple Choice**

Identify the choice that best completes the statement or answers the question.

- _____ 1. Consider the following relationship exists between y and x over time, t :

$$x^2 + y^2 = 9$$

Determine $\frac{dy}{dt}$ at the moment that $\frac{dx}{dt} = 2$, $x = 6$, and $y = -3$

a. $\frac{dy}{dt} = -4$

d. $\frac{dy}{dt} = \frac{1}{2}$

b. $\frac{dy}{dt} = -2$

e. $\frac{dy}{dt} = 2$

c. $\frac{dy}{dt} = -\frac{1}{2}$

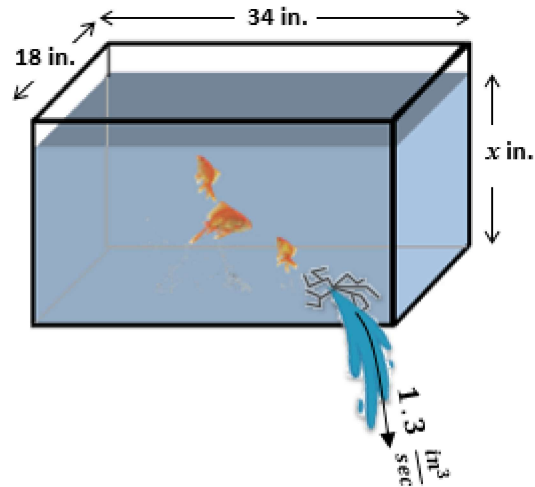
f. $\frac{dy}{dt} = 4$

- _____ 2.

A fish aquarium in the shape of a rectangular prism cracked near the bottom of the tank. Water is pouring out at a rate of $\frac{dV}{dt} = 1.3 \frac{\text{in}^3}{\text{sec}}$. The dimensions of the aquarium tank are:

$$18 \text{ inches} \times 34 \text{ inches} \times 24 \text{ inches}$$

What is the rate at which the water level is decreasing?



a. $\frac{dx}{dt} = -0.002 \frac{\text{in.}}{\text{sec}}$

d. $\frac{dx}{dt} = -0.212 \frac{\text{in.}}{\text{sec}}$

b. $\frac{dx}{dt} = -0.048 \frac{\text{in.}}{\text{sec}}$

e. $\frac{dx}{dt} = -0.471 \frac{\text{in.}}{\text{sec}}$

c. $\frac{dx}{dt} = -0.116 \frac{\text{in.}}{\text{sec}}$

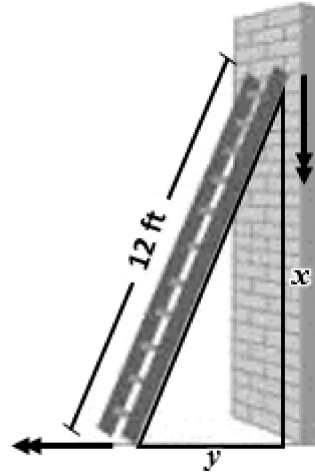
f. $\frac{dx}{dt} = -0.885 \frac{\text{in.}}{\text{sec}}$

3.

A 12 foot ladder is leaning against a wall and top of the ladder begins to slide down the wall. Let the height the ladder reaches up the wall be the variable x in feet and the distance the foot of the ladder is horizontally away from the bottom of the wall be the variable y in feet.

At the moment the value of $x = 10$ feet, the velocity of the top of the ladder is falling at is $\frac{dx}{dt} = -2$ ft/s.

Determine the approximate speed at which the foot of the ladder is moving (i.e. find $\left| \frac{dy}{dt} \right|$).



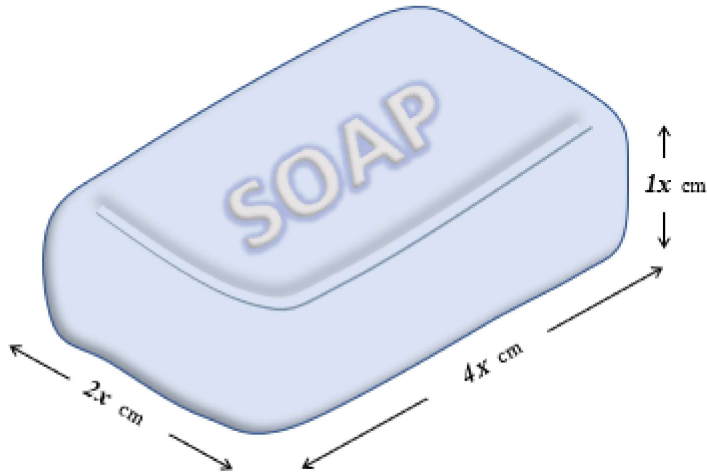
- | | |
|--------------|--------------|
| a. 1.51 ft/s | d. 2.51 ft/s |
| b. 1.78 ft/s | e. 2.78 ft/s |
| c. 2.00 ft/s | f. 3.02 ft/s |

4.

A consumer researcher noticed that a particular brand of soap is roughly a rectangular prism and reduced in size as it was used in a specific ratio of height, length, and width to respectively 1:2:4. If this ratio remains consistent and the volume of the bar of soap is decreasing at a rate of

$$\frac{dV}{dt} = -5.8 \frac{\text{cm}^3}{\text{day}},$$

determine the rate at which the height is decreasing when the bar of soap has the dimensions $2 \text{ cm} \times 4 \text{ cm} \times 8 \text{ cm}$.



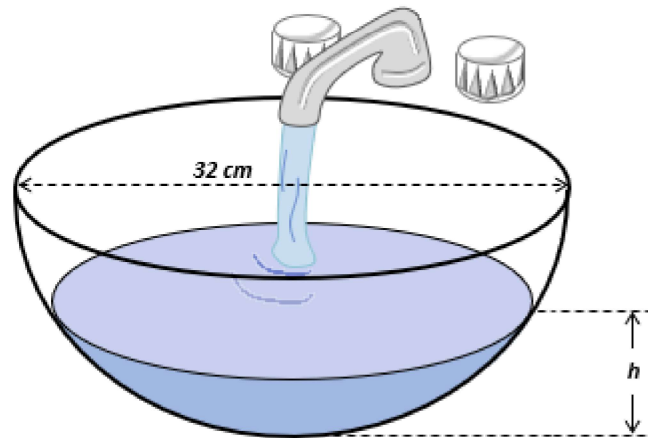
- | | |
|---|---|
| a. $\frac{dx}{dt} \approx -0.03 \frac{\text{cm}}{\text{day}}$ | d. $\frac{dx}{dt} \approx -0.12 \frac{\text{cm}}{\text{day}}$ |
| b. $\frac{dx}{dt} \approx -0.06 \frac{\text{cm}}{\text{day}}$ | e. $\frac{dx}{dt} \approx -0.15 \frac{\text{cm}}{\text{day}}$ |
| c. $\frac{dx}{dt} \approx -0.09 \frac{\text{cm}}{\text{day}}$ | f. $\frac{dx}{dt} \approx -0.39 \frac{\text{cm}}{\text{day}}$ |

5.

A sink is approximately the shape of a hemisphere with a diameter of 32 cm, as shown in the diagram, and is filling from the bottom up. The volume of the water can be described as a function of the height of the water using the function:

$$V = \pi \left(16h^2 - \frac{1}{3}h^3 \right)$$

If the faucet is filling the sink at a rate of $\frac{dV}{dt} = 90 \frac{\text{cm}^3}{\text{sec}}$, how fast is the level of water rising when the height is 6 cm?



a. $\frac{dh}{dt} \approx 0.036 \frac{\text{cm}}{\text{sec}}$

b. $\frac{dh}{dt} \approx 0.122 \frac{\text{cm}}{\text{sec}}$

c. $\frac{dh}{dt} \approx 0.184 \frac{\text{cm}}{\text{sec}}$

d. $\frac{dh}{dt} \approx 0.256 \frac{\text{cm}}{\text{sec}}$

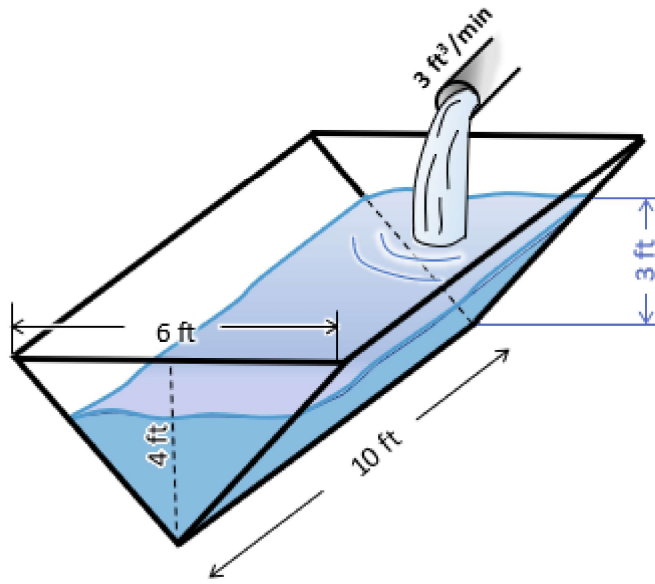
e. $\frac{dh}{dt} \approx 0.328 \frac{\text{cm}}{\text{sec}}$

f. $\frac{dh}{dt} \approx 0.391 \frac{\text{cm}}{\text{sec}}$

6.

Water is being pumped in to a trough at $3 \text{ ft}^3/\text{min}$. The trough is a triangular prism that is 10 feet long. The ends or bases of the trough are isosceles triangles. The isosceles triangles have a base of 6 feet and 4 feet high as shown in the diagram.

How fast is the height of the water level rising when the water is 3 feet high?



a. $\frac{1}{135} \text{ ft/min}$

d. $\frac{1}{12} \text{ ft/min}$

b. $\frac{1}{45} \text{ ft/min}$

e. $\frac{1}{6} \text{ ft/min}$

c. $\frac{1}{15} \text{ ft/min}$

f. $\frac{1}{5} \text{ ft/min}$

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Answer Section

MULTIPLE CHOICE

- | | | |
|-----------|--------|-------------------------|
| 1. ANS: F | PTS: 1 | REF: Matt's Math Labs © |
| 2. ANS: A | PTS: 1 | REF: Matt's Math Labs © |
| 3. ANS: F | PTS: 1 | REF: Matt's Math Labs © |
| 4. ANS: B | PTS: 1 | REF: Matt's Math Labs © |
| 5. ANS: C | PTS: 1 | REF: Matt's Math Labs © |
| 6. ANS: C | PTS: 1 | REF: Matt's Math Labs © |