

Related Rates Revisited

Warm-up

1. A derivative is the _____ of the _____.
2. Slope is a _____.
3. Therefore, a derivative is a _____.
4. To represent how fast volume is changing use _____.
5. To represent how fast height is changing use _____.
6. To represent how fast the radius is changing use _____.
7. Given $y = 3x^3 + 7t^2 + 6h + 2$

a) Find $\frac{dy}{dx}$

b) Find $\frac{dy}{dt}$

c) Find $\frac{dy}{dh}$

Steps for Solving Related Rate Word Problems

1. _____
2. _____
3. _____
4. _____
5. _____

Examples

1. Assume that oil spilled from a ruptured tanker spreads in a circular pattern whose radius increases at a constant rate of 2 ft/sec. How fast is the area of the spill increasing when the radius of the spill is 60 ft?

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Class Work

1. A rectangular well is 6 feet long, 4 feet wide, and 8 feet deep. If water is running into the well at the rate of $2 \text{ ft}^3/\text{sec}$, find how fast the water is rising. (Keep in mind which variables are constant and which are changing.)
2. A spherical hot air balloon is being inflated. If air is blown into the balloon at the rate of $2 \text{ ft}^3/\text{sec}$, how fast is the radius of the balloon changing when the radius is 3 feet?
3. How fast does the radius of a spherical soap bubble change when you blow air into it at the rate of $10 \text{ cm}^3/\text{sec}$ at the time when the radius is 2 cm?
4. A spherical Tootsie Roll Pop is giving up volume at a steady rate of $0.25 \text{ in}^3/\text{min}$. How fast will the radius be decreasing when the Tootsie Roll Pop is 0.75 inches across?
5. A 12 foot ladder stands against a vertical wall. If the lower end of the ladder is being pulled away from the wall at the rate of $2 \text{ ft}/\text{sec}$, how fast is the top of the ladder coming down the wall at the instant it is 6 feet above the ground?
6. Superman is in level flight 6 miles above the ground. His flight plan takes him directly over Vista Murrieta High School. How fast is he flying when the distance between him and VMHS is exactly 10 miles and this distance is increasing at the rate of 40 mph?

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7. A boy flies a kite which is 120 feet directly above his hand. If the wind carries the kite horizontally at the rate of 30 ft/min, at what rate is the string being pulled out when the length of the string is 150 feet?
8. A baseball diamond is a 90-foot square. A ball is batted along the third base line at a rate of 100 ft/sec. How fast is its distance changing from first base at the time when the ball is halfway to 3rd base?
9. How fast does the water level drop when a cylindrical tank of radius 6 feet is drained at the rate of 3 ft³/min?
10. Two trucks leave a depot at the same time. Truck A travels east at 40 mph and truck B travels north at 30 mph. How fast is the distance between the trucks changing
- a) 6 minutes later?
 - b) 30 minutes later?
11. Two commercial jets at 40,000 feet are both flying at 520 mph towards an airport. Plane A is flying south and is 50 miles from the airport while Plane B is flying west and is 120 miles from the airport. How fast is the distance between the two planes changing at this time?