

**AP Calculus AB
Related Rates Worksheet #1**

1. Find the rate of change of the volume of a cube with respect to time.
2. Find the rate of change of the area of a square with respect to time.
3. Find the rate of change of the volume of a right circular cone with respect to time.
4. If the length of the edge of a cube is increasing at a rate of 5cm/sec, find the rate of change of the volume of the cube when an edge is 12cm.
5. If the area of a square is decreasing at rate of $50 \text{ ft}^2/\text{sec}$, find the rate of change of the length of a side when a side is 18ft long. Is the length of the side increasing or decreasing?
6. If the radius of a right circular cone is a constant 10 cm and the height is increasing at a rate of 6 cm/min, how fast is the volume of the cone increasing when the height is 4.5cm?
7. Oil spills into a lake in a circular pattern. If the radius of the circle increases a rate of 1 ft/min, how fast is the area of the spill increasing at the end of 1 hour?
8. Air is being pumped into a spherical balloon at a rate of 16 cubic inches per second. Find the rate of change of the radius when the radius is 8.5 inches.
9. A hot-air balloon lifts off the ground 75 feet from an observer. If the balloon rises at a rate of 10 ft/min, how fast is the angle of elevation changing when the balloon is 100 feet high?
10. A 10-foot ladder is leaning against the wall of a house. The base of the ladder slides away from the wall at a rate of 2 in/sec. Find the rate at which the top of the ladder slides down the wall when the base is 3 feet from the wall.

11. Find $\lim_{x \rightarrow 1} \frac{x^2 - 2x + 1}{x - 1}$

12. $\lim_{x \rightarrow \infty} \sin x$

13. $\lim_{x \rightarrow \infty} \frac{\sin x}{x}$

14. $\lim_{x \rightarrow \infty} \frac{\cos x}{3x^2}$

15. $\lim_{x \rightarrow \infty} \frac{\sin \frac{x}{2}}{2x}$

16. $\lim_{x \rightarrow 1} \frac{3}{x - 1}$

Answers:

1. $e = \text{length of an edge}$ $\frac{dV}{dt} = 3e^2 \frac{de}{dt}$ 2. $s = \text{length of a side}$ $\frac{dA}{dt} = 2s \frac{ds}{dt}$

3. $\frac{dV}{dt} = \frac{1}{3}\pi \left[r^2 \frac{dh}{dt} + 2rh \frac{dr}{dt} \right]$ 4. $2160 \text{ cm}^3/\text{sec}$

5. $\frac{-25}{18} \text{ ft/sec}$ 6. $200\pi \frac{\text{cm}^3}{\text{min}}$ 7. $120\pi \text{ ft}^2/\text{min}$ 8. 0.0176 in/sec

9. $\frac{6}{125} \approx 0.05 \text{ rad/min}$ 10. -0.63 in/sec 11. 0 12. DNE 13. 0 14. 0

15. 0 16. DNE