

# Related Rates Exercises

1. A forest fire spreads in a circle with radius changing at a rate of 2 m/min. When the radius reaches 100 m, at what rate is the area of the burning region increasing?
2. Air is being pumped into a spherical balloon so that its volume increases at a rate of  $100 \text{ cm}^3/\text{s}$ . How fast is the radius of the balloon increasing when the diameter is 50 cm?
3. A 5 ft long ladder rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of 3 ft/s, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is 4 ft from the wall?
4. Gravel is being dumped from a conveyor belt at a rate of  $30 \text{ ft}^3/\text{min}$ . It forms a pile in the shape of a cone whose base diameter and height are always equal. At what rate is the height of the pile changing when the pile is 10 ft high?
5. A balloon rising straight up at a rate of 140 ft/min is tracked by a rangefinder at a point A located on the ground 500 ft from the point of takeoff. How fast is the angle at A increasing when the balloon is 1200 ft above the ground?
6. A plane at a constant altitude of 300 m passes over a radar station on the ground. If the distance between the radar station and the plane is increasing at a rate of 100 m/s when the angle of elevation is  $30^\circ$ , then how fast is the angle of elevation changing when the angle is  $30^\circ$ ?
7. At a certain moment the ladder on a fire truck is 20 m long and makes an angle of  $\pi/3$  radians with the horizontal. At what rate is a firefighter on the far end of the ladder rising if
  - (a) the ladder is rotating at a rate of 0.1 rad/s?
  - (b) the ladder is rotating at a rate of 0.1 rad/s and extending at a rate of 0.5 m/s?