

## RELATED RATES PRACTICE

1. Assume that oil spilled from a ruptured tanker spreads in a circular pattern whose radius increases at a constant rate of 2 ft/s. How fast is the area of the spill increasing when the radius of the spill is 60 ft?
2. Suppose that liquid is to be cleared of sediment by allowing it to drain through a conical filter that is 16 cm high and has a radius of 4 cm at the top. Suppose also that the liquid flows out of the cone at a constant rate of  $2 \text{ cm}^3/\text{min}$ . At what rate is the depth of the liquid changing at the instant when the liquid in the cone is 8 cm deep?
3. Let  $l$  be the length of a diagonal of a rectangle whose sides have lengths  $x$  and  $y$ , and assume that  $x$  and  $y$  vary with time. If  $x$  increases at a constant rate of  $\frac{1}{2} \text{ ft/s}$  and  $y$  decreases at a constant rate of  $\frac{1}{4} \text{ ft/s}$ , how fast is the size of the diagonal changing when  $x = 3 \text{ ft}$  and  $y = 4 \text{ ft}$ ? Is the diagonal increasing or decreasing at that instant?
4. A spherical balloon is inflated so that its volume is increasing at the rate of  $3 \text{ ft}^3/\text{s}$ . How fast is the diameter of the balloon increasing when the radius is 1 ft?
5. A 17-ft ladder is leaning against a wall. If the top of the ladder slips down the wall at a rate of 2 ft/s, how fast will the foot be moving away from the wall when the top is 5 ft above the ground?
6. Grain pouring from a chute at the rate of  $8 \text{ ft}^3/\text{min}$  forms a conical pile whose altitude is always twice its radius. How fast is the altitude of the pile increasing at the instant when the pile is 6 ft high?
7. On Halloween night, Linus and Charlie Brown have been trying to catch the Great Pumpkin as it rises from the pumpkin patch to bring all good calculus students candy. Linus and Charlie spot the Great Pumpkin just starting to rise at a distance of 80 feet away. If the angle of elevation of the Great Pumpkin is changing at the rate of  $\frac{\pi}{36}$  radians per second, answer each of the following.
  - a) How fast is the Great Pumpkin rising when the Great Pumpkin is 6 feet off the ground?
  - b) How fast is the distance from Linus and Charlie to the Great Pumpkin changing when the Great Pumpkin is 6 feet off the ground?

Answers: 1.  $240\pi \text{ ft}^2/\text{sec}$  2.  $\frac{-1}{2\pi} \text{ cm/min}$  3.  $\frac{1}{10} \text{ ft/sec}$  4.  $\frac{3}{2\pi} \text{ ft/sec}$  5.  $\frac{10}{\sqrt{264}} \text{ ft/sec}$  6.  $\frac{8}{9\pi} \text{ ft/sec}$   
7a. 7.021 ft/sec 7b. 0.525 ft/sec