

Homework Set 12: Related Rates

1. A stone dropped into a still pond sends out a circular ripple whose radius increases at a rate of 1.2 m/s. How rapidly is the area enclosed by the ripple increasing after 10 s?
2. A spherical balloon is inflated so that its volume is increasing at the rate of $1.2 \text{ m}^3/\text{min}$. How fast is the radius of the balloon increasing when the radius is 0.5 m?
3. A 3 m plank is leaning against a wall, and the bottom of the plank is being pushed toward the wall at a rate of 0.4 m/s. How fast is the angle that the plank makes with the ground changing at the instant the bottom of the plank is 0.5 m from the wall?
4. Grain pouring from a chute at the rate of $8 \text{ m}^3/\text{min}$ forms a conical pile whose height is always twice the radius. How fast is the height of the pile increasing when the pile is 2 m high? When the pile is 6 m high?
5. A person 1.8 m tall is walking at a rate of 1 m/s toward a streetlight 6 m tall. At what rate is the length of their shadow changing?
6. A beacon that makes one revolution every 10 s is located on a ship anchored 4 kilometers from a straight shoreline. How fast is the beam moving along the shoreline when it makes an angle of 45° with the shore?
7. On a certain clock the minute hand is 4 cm long and the hour hand is 3 cm long. How fast is the distance between the tips of the hands changing at 8 o'clock?
8. A point P is moving along the curve whose equation is $y = \sqrt{x}$. Suppose that x is increasing at the rate of 4 units/s when $x = 3$. How fast is the distance between P and the point (2, 0) changing at this instant?
9. A spherical meteor enters the atmosphere and begins to burn up. If the rate at which it burns up is proportional to its surface area at each instant show that its radius will decrease at a constant rate.