

More Optimization and Related Rates

1. A page of a book is to have an area of 90 square inches, with one inch margins at the bottom and sides, and a one half inch margin at the top. Find the dimension of the page that will allow the largest printed area.
2. A right triangle whose hypotenuse is $\sqrt{3}$ meters is revolved about one of its legs to generate a right circular cone. Find the radius, height, and volume of the cone of the greatest volume that can be made this way.
3. Sand falls from a conveyor belt at the rate of twenty cubic meters per minute onto the top of a cone-shaped pile. The height of the pile is always three-eighths of the base diameter. How fast is the height of the pile changing when it is 4 meters high? How fast is the radius changing when the pile is 4 meters high?
4. A balloon is rising vertically above a level, straight road at a constant rate of one foot per second. Just when the balloon is 65 feet above the ground, a bicycle moving at a constant rate of 17 feet per second passes under it. How fast is the distance between the bicycle and balloon increasing 3 seconds later?
5. A 13 foot ladder is leaning against the side of a house when its base starts to slide away. By the time the base is 12 feet from the house, the base is moving at a rate of 5 feet per second.
 - a. How fast is the top of the ladder sliding down the wall?
 - b. At what rate is the area of the triangle formed by the ladder, wall, and ground changing at that moment?
 - c. At what rate is the angle θ between the ladder and the ground changing at that moment?
6. A water tank has the shape of an inverted right circular cone of altitude 12 feet and base radius 6 feet. If water is begin pumped into the tank at a rate of 10 gallons per minute, approximate the rate at which the water level is rising when the water is 3 feet deep (1 gallon is approximately 0.1337 cubic feet).
7. A softball diamond has the shape of a square with sides 60 feet long. If a player is running from second base to third at a speed of 24 feet per second, at what rate is her distance from home plate changing when she is 20 feet from third?