

Related Rates and Optimization

1. Find the area of the largest rectangle that can be inscribed in the parabola $y = 4 - x^2$ above the x-axis.
2. A camera is located 50 ft from a straight road along which a car is traveling at 100 ft per second. The camera turns so that it is pointed at the car at all times. In radians per second, how fast is the angle of the camera changing as the car passes closest to the camera?
3. A box for golf balls is constructed by cutting equal corners from a 20 x 30 in piece of material. Find the dimensions that will maximize the volume of the box. (no top to the box)
4. A kite 100 ft above the ground is being blown away from the person holding its string in a direction parallel to the ground at the rate of 10 ft/s. At what rate must the string be let out when the length of the string already let out is 200 ft?
5. A rocket is rising at a constant speed of 5 mi/s. A person is filming from their car on a straight road at a speed of $\frac{13}{12}$ mi/s. When the car passes directly under the rocket, the rocket is 3 miles above the car. How fast is the distance between the car and the rocket increasing 2 seconds later?
6. A manufacturer of baseball glove cleaner needs to make a cylindrical container that will hold 10 ounces of liquid. Determine the dimensions (diameter and height) of the container that will minimize the amount of material used in its construction.
7. At noon a distress call is made from Ship A to ship B for medical supplies. Ship A is 200 km west of Ship B. Ship A is sailing South at 35 km/h and ship B is sailing north at 25 km/h. Ship A sends a boat to Ship B at 2:00pm. How fast is the distance between the ships changing at this time?
8. A baseball park has 3200ft of fencing and wants to fence off a rectangular section for batting cages that sit next to a building. They won't need fence along the building. What are the dimensions of the batting cages that would maximize the area?

Answers

1. $\frac{32\sqrt{3}}{9} \approx 6.158$

2. -2 radians/sec

3. $3.9 \times 12.2 \times 22.2$

4. 8.67 ft/s

5. 5.1 mi/s

6. $d = 2.34, h = 2.34$

7. $\frac{90\sqrt{34}}{17} \approx 30.9$ km/h

8. 800×1600