

## Related Rates and Optimization Review #2

- 1) A 17 foot ladder is leaning against a wall. It is sliding down the wall at a rate of 2 ft/min.
  - A) How fast is the ladder moving away from the wall when the top is 15 ft from the ground?
  - B) How fast is the area enclosed by the ladder changing at that time?
  - C) How fast is the angle with the ground changing at that time?
  
- 2) A cone with a diameter of 14 ft and a height of 28 ft is being filled with oil at a rate of  $2 \text{ ft}^3$  per second.
  - A) Express the volume of the water as a function of the water level (h).
  - B) How fast is the level of the oil rising in the cone when the height reaches 10 ft?
  - C) How fast is the radius increasing at that time?
  - D) How fast is the exposed surface area increasing at that time?
  
- 3) A man observes the launching of a rocket from a distance of 300 ft. The rocket is launched at the speed of 100 ft/s.
  - A) How fast is the rocket moving away from the man 4 seconds after launch?
  - B) How fast is the angle changing at this same moment?
  
- 4) A spherical balloon is being inflated at the rate of  $2 \text{ in}^3$  per second. How fast is the radius increasing when the radius is 10 in?
  
- 5) A six foot tall man is walking towards a light pole at a speed of 2 ft per second. The light 10 ft up casts a shadow behind the man. How fast is the tip of the shadow moving toward the light pole when he is 8 ft from the light pole?
  
- 6) Melted chocolate is flowing into a giant cone at a rate of  $3 \text{ ft}^3$  per second into a giant ice cream cone with diameter 30 ft in height 180 ft.
  - A) Find the volume of the melted chocolate as a function of the chocolate level h.
  - B) How fast is the level of the cone rising when the height is 12 feet?
  - C) How fast is the radius changing when the height is 12 feet?
  
- 7) Determine the maximum area of a rectangle that can be enclosed with 200 meters of fencing if one side is not fenced in.
  
- 8) Determine the minimum area of a poster that will contain 50 square inches of printed material and have 4 inch margins on the top and bottom and 2 inch margins on the left and right.
  
- 9) Determine the dimensions of a box of maximum volume that can be made from a piece of material  $8'' \times 10''$ . The box is to be made by cutting square pieces from the corners and folding up the sides. The box will not have a top.
  
- 10) Given a length of string  $L = 50$  inches, construct a circle and a square such that the sum of the areas is a maximum.

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Answers:

1. a) 3.75 ft/min  
b)  $20.125 \text{ ft}^2/\text{min}$   
c)  $-0.25 \text{ rad/min}$
2. a)  $V = \frac{\pi}{48} h^3$   
b)  $\frac{8}{25\pi} \text{ ft/sec}$   
c)  $\frac{2}{25\pi} \text{ ft/sec}$   
d)  $\frac{2}{5} \text{ ft}^3/\text{sec}$
3. a) 80 ft/sec  
b) 0.12 rad/sec
4.  $\frac{1}{200\pi} \text{ in/sec}$
5.  $-5 \text{ ft/sec}$
6. a)  $V = \frac{\pi}{432} h^3$   
b)  $\frac{3}{\pi} \text{ ft/sec}$   
c)  $\frac{1}{4\pi} \text{ ft/sec}$
7.  $5000 \text{ m}^2$
8.  $162 \text{ in}^2$
9.  $1.47'' \times 5.06'' \times 7.06''$
10. radius of the circle is 3.5 in.  
length of the side of the square is 7 in.