

Name: \_\_\_\_\_

## Unit 9 Test Review 1

### *Related Rates & Optimization:*

1. A paper cup has the shape of a cone with height 10 cm and radius 3 cm (at the top). If water is poured into the cup at a rate of  $2 \text{ cm}^3/\text{s}$ , how fast is the water level rising when the water is 5 cm deep?
2. A balloon is rising at a constant speed of 5 ft/s. A boy is cycling along a straight road at a speed of 15 ft/s. When he passes under the balloon, it is 45 ft above him. How fast is the distance between the boy and the balloon increasing 3 seconds later?
3. A water skier skis at a speed of 30 ft/s over a ramp that is 15ft long and 4 ft high above the water. How fast is she rising as she leaves the ramp?
4. The angle of elevation of the Sun is decreasing at a rate of 0.25 rad/h. How fast is the shadow cast by a 400 ft tall building increasing when the angle of elevation of the Sun is  $\frac{\pi}{6}$ ?

5. A box is constructed by cutting equal corners from a 10 x 12 in piece of material. Find the dimensions that will maximize the volume of the box. (no top to the box)

6. A farmer has 2400 ft of fencing and wants to fence off a rectangular field that borders a river. He won't need fence along the river. What are the dimensions of the field that would maximize the area of the field?

7. A cylindrical can is to be made for 3 L ( $3000\text{cm}^3$ ) of oil. Find the dimensions (diameter and height) that will minimize the cost of material used if the top is open.

8. Find the area of the largest rectangle that can be inscribed in the parabola  $y = 16 - x^2$  above the x-axis.

***Answers:***

1.  $\frac{8}{9}\pi$  cm/s

2. 13 ft/s

3. 7.7 ft/s

4. 400 ft/h

5. 96.8 in<sup>3</sup>

6. 600 ft, 1200 ft

7.  $d = 19.69$  cm,  $h = 9.84$  cm

8. 49.267