


## AP Calculus

TEST: 3.6 to 3.8, **Calculator Permitted**

- \_\_\_\_\_ 1. If the radius and the height of a right circular cone both increase at a constant rate of  $\frac{1}{2}$  centimeters per second, at what rate, in cubic centimeters per second, is the volume increasing when the height is 9 centimeters and the radius is 6 centimeters?  
 (A)  $\frac{f}{2}$       (B)  $10f$       (C)  $24f$       (D)  $54f$       (E)  $108f$
- \_\_\_\_\_ 2. A canvas wind shelter like the one at right is to be built for use along parts of the Guadalupe River. It is to have a back, two square sides, and a top. If  $\frac{147}{2}$  square feet of canvas is to be used in the construction, find the depth of the shelter for which the space inside is maximized assuming all the canvas is used.  
 (A) depth =  $\frac{7}{2}$  feet      (B) depth =  $\frac{7}{4}$  feet      (C) depth = 4 feet      (D) depth = 7 feet      (E) none of these
- 
- \_\_\_\_\_ 3. A rectangle has one side on the  $x$ -axis and the upper two vertices on the graph of  $y = e^{-2x^2}$ . Give a decimal approximation for the maximum possible area for this rectangle.  
 (A) 1.649      (B) 1      (C) 2.031      (D) 0.545      (E) 0.606
- \_\_\_\_\_ 4. The *derivative* of  $f(x) = \frac{x^4}{3} - \frac{x^5}{5}$  attains its maximum value at  $x =$   
 (A)  $-1$       (B)  $0$       (C)  $1$       (D)  $\frac{4}{3}$       (E)  $\frac{5}{3}$
- \_\_\_\_\_ 5. A baseball diamond is a square with side 90 feet. If a batter hits the ball and runs towards first base with a speed of 25 ft/sec, at what speed is his distance from second base decreasing when he is two thirds of the way to first base?  
 (A)  $\frac{5}{2}\sqrt{10}$  ft/sec      (B)  $\frac{3}{2}\sqrt{10}$  ft/sec      (C)  $4\sqrt{5}$  ft/sec      (D)  $2\sqrt{10}$  ft/sec      (E)  $3\sqrt{5}$  ft/sec
- \_\_\_\_\_ 6. The approximate value of  $f(x) = \sqrt{4 + \sin x}$  at  $x = 0.12$ , obtained from the equation of the tangent line to the graph of  $f(x)$  at  $x = 0$  is  
 (A) 2.00      (B) 2.03      (C) 2.06      (D) 2.12      (E) 2.24

Part II: Free Response. Do all work below the line. Label each part. Notation, Notation, Notation. Include units in ALL of your final answers.

10. Coffee is draining from a conical filter into a cylindrical coffeepot at the rate of  $10 \text{ in}^3 / \text{min}$ . The dimensions of the filter and coffeepot are indicated in the diagram at right.

Note:  $6'' = 6$  inches .

- (a) Using similar triangles, find an equation relating the height,  $h$ , of the coffee in the cone in terms of the radius,  $r$ , of the coffee in the cone.
- (b) Write a simplified equation for the volume,  $V$ , of the coffee in the cone in terms of the height,  $h$ , of coffee in the cone. (get rid of the  $r$  variable!)
- (c) How much coffee, in cubic inches, is in the cone when the coffee in the cone is 5 inches deep?
- (d) How fast is the level,  $h$ , in the cone falling when the coffee in the cone is 5 inches deep?
- (e) How fast is the depth level,  $y$ , in the pot rising when the coffee in the cone is 5 inches deep?
- (f) Do you prefer hot coffee or iced coffee? Precalculus or Calculus?

