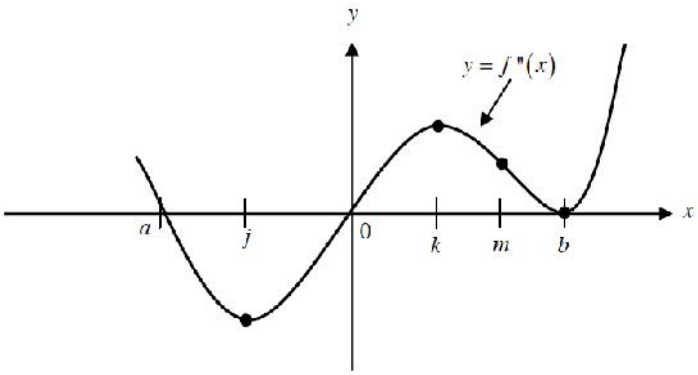
Name_____Date_____ Period_____

AP Calculus AB/BC, TEST: 3.1 to 3.8

_____ 1. The second derivative of a function f is given by $f''(x) = x(x-a)(x-b)^2$. The graph of f'' is shown at right. For what values of x does the graph of f have a point of inflection?



(A) 0 and a only (B) 0 and m only
(C) j and b only (D) 0, a, and b (E) j, b, and k

_____ 2. Determine of the function $f(x) = x\sqrt{6-x}$ satisfies the hypothesis of the MVT on the interval $[0,6]$, and if it does, find all numbers c satisfying the conclusion of that theorem.

(A) $c = 5$ (B) $c = 4$ (C) $c = 3$ (D) $c = 2,\ 3$ (E) $c = 4,\ 5$ (F) hypothesis not satisfied

_____ 3. Let f be the function given by $f(x) = 2xe^x$. The graph of f is concave down when

(A) $x > -2$ (B) $x < -1$ (C) $x > -1$ (D) $x < 0$ (E) $x < -2$

_____ 4. The function f is twice differentiable with $f(2) = 1$, $f'(2) = 4$, and $f''(2) = 3$. What is the value of the approximation of $f(1.9)$ using the line tangent to the graph of f at $x = 2$?

(A) 1.4 (B) 1.3 (C) 0.7 (D) 0.6 (E) 0.4

_____ 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) $2\sqrt{10}$ ft/sec (B) $3\sqrt{5}$ ft/sec (C) $\frac{5}{2}\sqrt{10}$ ft/sec (D) $\frac{3}{2}\sqrt{10}$ ft/sec (E) $4\sqrt{5}$ ft/sec

_____ 6. Find the values of x at which the graph of $y = x^2 - 4\cos x$ changes concavity on $\left(-\frac{®}{2}, \frac{®}{2}\right)$.

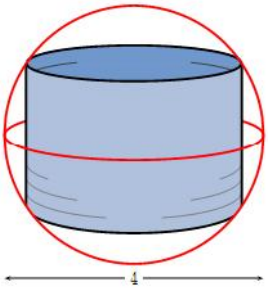
(A) $x = \frac{®}{3}$ (B) $x = -\frac{®}{3}$ (C) $x = -\frac{®}{3},\ \frac{®}{3}$ (D) $x = -\frac{®}{6},\ \frac{®}{6}$

(E) $x = \frac{®}{6}$ (F) $x = -\frac{®}{6}$ (G) there are no values of x

_____ 7. Let f be the function with derivative given by $f'(x) = 2x^2 - 15x + 25$. How many local extrema does f have on the interval $2 < x < 4$?

(A) Five (B) Four (C) Three (D) Two (E) One

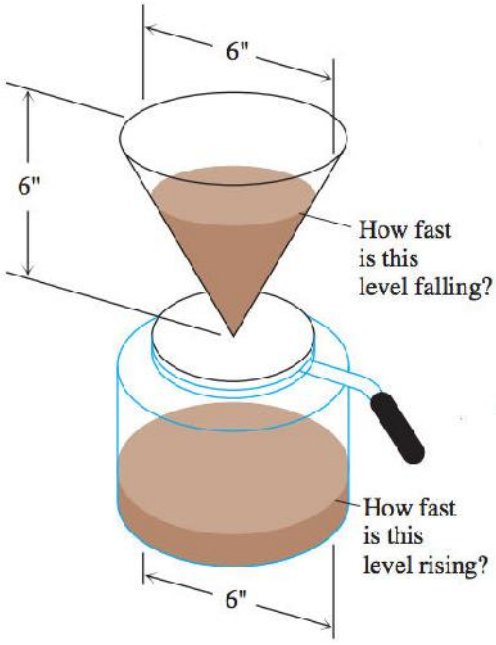
_____ 8. A right circular cylinder is inscribed in a sphere with **diameter** 4cm as shown. If the cylinder is open at both ends, find the largest possible surface area of the cylinder.



(A) $A = 8® \text{ cm}^2$ (B) $A = 8 \text{ cm}^2$ (C) $A = 16 \text{ cm}^2$

(D) $A = 16® \text{ cm}^2$ (E) $A = 2 \text{ cm}^2$

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



9. Coffee is draining from a conical filter into a cylindrical coffeepot at the rate of $8\ \text{in}^3/\text{min}$. 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 4 inches deep?
   (d) How fast is the level, ***h***, in the cone falling when the coffee in the cone is 4 inches deep?
   (e) How fast is the depth level, ***y***, in the pot rising when the coffee in the cone is 4 inches deep?
   (f) Do you prefer hot coffee or iced coffee? Precalculus or Calculus?