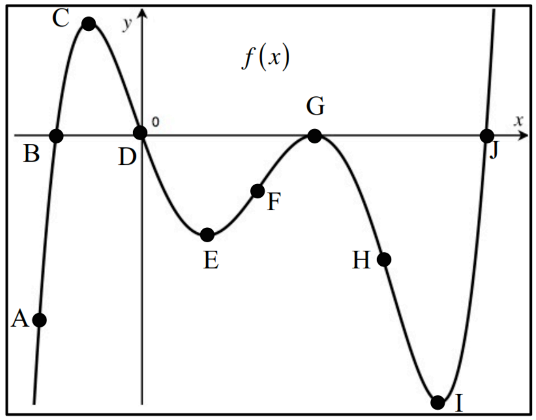
Name____Date_____________ Santa's Favorite Exercise____

AP Calculus TEST: 3.1-3.7, NO CALCULATOR

Part I: Multiple Choice—Put the CAPITAL letter of the correct response in the blank



The graph of the function $y = f(x)$ is shown above. Use the graph to answer questions 1 – 5.
*Assume all CAPITAL letters represent the *x*-values of the indicated points.

_____ 1. On the interval (F, G), which of the following is true?

I. $f(x) < 0$ II. $f'(x) > 0$ III. $f''(x) < 0$

(A) I only (B) I and II only (C) I and III only (D) I, II, and III

_____ 2. How many critical values does $y = f(x)$ have on the interval shown?

(A) 2 (B) 3 (C) 4 (D) 5

_____ 3. How many inflection values does $y = f(x)$ have on the interval shown?

(A) 1 (B) 2 (C) 3 (D) 4

_____ 4. How many values satisfy the MVT for $y = f(x)$ on the interval $[A, I]$?

(A) 0 (B) 1 (C) 2 (D) 3

_____ 5. Which of the following inequalities is correct?

(A) $f(B) < f'(B) < f''(B)$ (B) $f'(B) < f(B) < f''(B)$

(C) $f''(B) < f'(B) < f(B)$ (D) $f''(B) < f(B) < f'(B)$

_____ 6. A function $y = f(x)$ has the properties that $f'(a) = 0$ and $f''(a) = 0$. Which one of the following statements must be true?

(A) The graph of $y = f(x)$ has a horizontal tangent at $(a, f(a))$.

(B) $(a, f(a))$ is a point of inflection

(C) $(a, f(a))$ is either a local maximum or a local minimum point.

(D) f may be discontinuous at $x = a$.

____ 7. Given any given function $y = f(x)$, ***how many*** of the following statements must be true?

I. If $f''(a) < 0$, then the graph of $y = f(x)$ is concave up at $x = a$.

II. If $f'(a)$ does not exist, then $x = a$ is not in the domain of $y = f(x)$.

III. If $f'(a) = 0$ and $f''(a) > 0$, then $f(a)$ is a local max.

IV. If $f'(a) = DNE$ and $f'(x)$ changes from neg to pos at $x = a$, then $f(a)$ is a local min.

(A) 0 (B) 1 (C) 2 (D) 3

_____ 8. The function $y = f(x)$ is twice differentiable with $f(3) = -2$, $f'(3) = \frac{1}{2}$, and $f''(3) = 1$. What is the value of the approximation of $f(4)$ using the line tangent to the graph of $y = f(x)$ at $x = 3$?

(A) -1.9 (B) -1.7 (C) -1.5 (D) -1.3

_____ 9. Given L feet of fencing, what is the maximum number of square feet that can be enclosed if the fencing is used to make three sides of a rectangular pen, using an existing wall as the fourth side?

(A) $\frac{L^2}{4}$ (B) $\frac{L^2}{8}$ (C) $\frac{L^2}{9}$ (D) $\frac{L^2}{16}$

Part II: Free Response—Do the work in the space provided. Use proper notation.

10. (1981 AB3) Let f be the function defined by $f(x) = 12x^{2/3} - 4x$.

(a) Find the intervals on which f is increasing.

(b) Find the x- and y- coordinates of all relative maximum points. Justify.

(c) Find the x- and y- coordinates of all relative minimum points. Justify.

(d) Find the intervals on which f is concave downward.

(e) Using the information found in the parts above, sketch the graph of f.