Name_____ Date_____ Common Injury_____

AP Calculus TEST: 2.1-2.4 , NO CALCULATOR

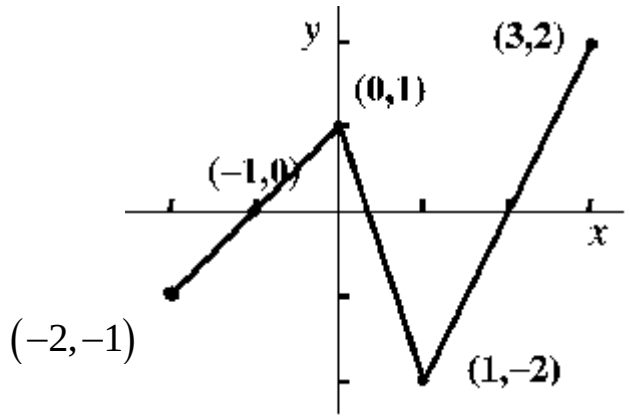
Part I: Multiple Choice—Put the correct CAPITAL letter in the space to the left of each question.

_____ 1. If $y = \sec x$, then $\frac{d^2y}{dx^2} =$

(A) $\sec^3 x \tan x$ (B) $\sec x \tan x$ (C) $\sec x\left(2\sec^2 x + 1\right)$ (D) $\sec x\left(2\sec^2 x - 1\right)$

_____ 2. If $g(x) = \frac{x+2}{x-2}$, then $g'(-2) =$

(A) $-\frac{1}{4}$ (B) -1 (C) 1 (D) $\frac{1}{4}$



_____ 3. The function $K(x)$, whose graph is composed of straight line segments is shown above. Which of the following is true for $K(x)$ on the open interval $(-2,3)$?

I. $\lim_{x\to 0} K(x)$ exists

II. $K(x)$ is differentiable for all $x \in (-2,3)$

III. The derivative of $K(x)$ is positive on the interval $(1,3)$

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

_____ 4. If $f(x) = -x^5 + \frac{1}{x} - \sqrt[3]{x} + \frac{1}{\sqrt{x^5}}$, then $f'(1) =$

(A) $-\frac{53}{6}$ (B) $-\frac{58}{15}$ (C) $\frac{58}{15}$ (D) $\frac{53}{6}$

_____ 5. If the line $7x - 4y = 3$ is tangent in the first quadrant to the curve $y = x^3 + x + c$, then $c =$

(A) $-\frac{1}{2}$ (B) $-\frac{1}{4}$ (C) $\frac{1}{4}$ (D) $\frac{1}{2}$

_____ 6. The function $f(x) = x^4 + 3x^3 + 2x + 4$ must have a zero/root between which of the following values of x?

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

$$g(x) = \begin{cases} x + 2, & x \le 3 \\ 4x - 7, & x > 3 \end{cases}$$

_____ 7. Let f be the function given above. Which of the following statements are true about g?

I. $\lim_{x \to 3} g(x)$ exists

II. g is continuous at $x = 3$

III. g is differentiable at $x = 3$

(A) None (B) I only (C) II only (D) I and II only (E) I, II, and III

_____ 8. What are all the horizontal asymptotes for the graph of $f(x) = \frac{5x}{\sqrt{x^2 + 1}}$?

(A) $y = 0$ only (B) $y = 5$ only (C) $y = -5$ only (D) $y = 5$ and $y = -5$

_____ 9. $\lim_{h \to 0} \frac{9\left(\frac{1}{3}(x+h)\right)^3 - 9\left(\frac{1}{3}x\right)^3}{h} =$

(A) $\frac{x^2}{3}$ (B) 0 (C) $9x^2$ (D) x^2

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

10. If $f(x)=\frac{5}{3}x^3+2x^2-3x+11$

(a) Let $Q(x)=f'(x)$. Find $Q(x)$ and $Q'(x)$.

(b) Find $\lim_{x\to\infty}\frac{Q(x)}{\left[Q'(x)\right]^2}=$

(c) Find $Q(-2)$ and $Q'(-2)$.

(d) Find the equation of the tangent line, in Taylor Form, of $Q(x)$ at $x=-2$.

(e) Find the equation of the normal line, in Taylor Form, of $Q(x)$ at $x = -2$.

(f) The equation of the normal line to $Q(x)$ at $x = -2$ intersects the graph of $Q(x)$ at another x-value. Find this x-value. Show the work that leads to your answer.