Name____ Date___________ Notable Curmudgeon____________

AP Calculus TEST: 2.1-2.3, NO CALCULATOR

Part WON: Multiple Choice—Put the correct CAPITAL letter in the space to the left of each question. Attach any scratch work to the back of this test upon completion.

_____ 1. In the *xy*-plane, the line $2x - y = 1$, where k is a constant, is tangent to the graph of $y = k - x^2$. What is the value of k?

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

_____ 2. Which of the following is/are true regarding the function $f(x) = 5|x+3| - 2$?

I. $f'(3) = DNE$

II. $f'(-4) = -5$

III. $f(x)$ is continuous for all x

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

$$f(x) = \begin{cases} ax^2 + bx + 1 & \text{for } x \le -1 \\ -3ax + 2b & \text{for } x > -1 \end{cases}$$

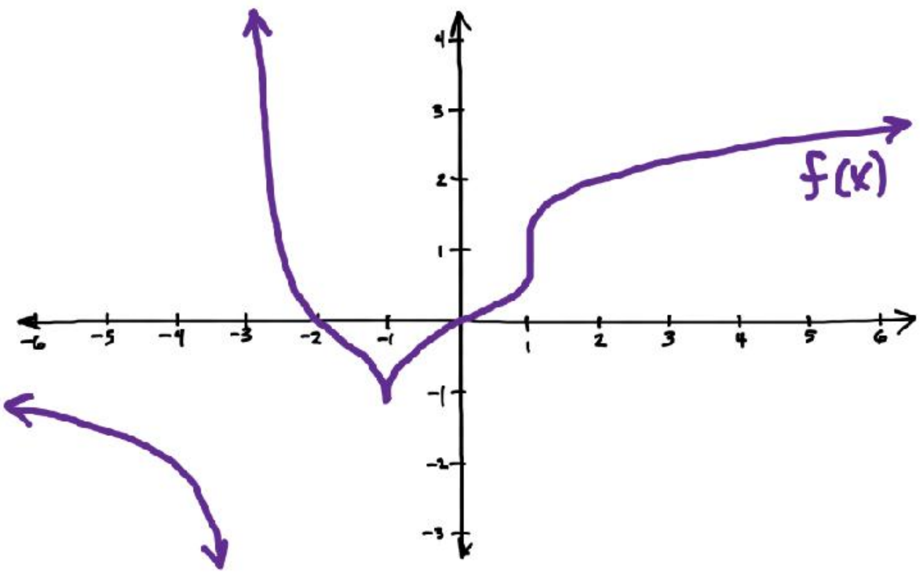
_____ 3. Let f be the function defined above, where a and b are constants. If f is differentiable at $x = -1$, what is the value of $a + b$?

(A) -2 (B) 5 (C) 0 (D) -3 (E) No such values exist

_____ 4. If $y = 2x(x-5)^2$, then $\frac{dy}{dx} =$

(A) $6x^2 - 40x + 50$ (B) $16x^3 - 120x^2 + 200x$ (C) $6x^2 - 20x + 50$ (D) $4x - 20$ (E) $6x^2 + 50$

_____ 5. $\lim_{h \to 0} \frac{6\cos\left(\frac{\text{®}}{6} + h\right) - 6\cos\frac{\text{®}}{6}}{h} =$ (A) 0 (B) -6 (C) 6 (D) -3 (E) 3



_____ 6. The graph of a function $f(x)$ is given above. The graph of $f(x)$ has a vertical asymptote at $x=-3$, a vertical tangent line at $x=1$, and x-intercepts at $x=-2$ and $x=0$. For what values of x is the function $f(x)$ is **not** differentiable?

(A) $-3, -1, 1$ only (B) $-3, -1$ only (C) $-3, 1$ only (D) -3 only (E) $-1, 1$ only

$$g(x)=\begin{cases} 7x^2-2, & x<2 \\ 26, & x=2 \\ 14x-2, & x>2 \end{cases}$$

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

I. $\lim_{x\to 2} g(x)$ exists

II. g is continuous at $x=2$

III. g is differentiable at $x=2$

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

$$\lim_{x\to 0}\frac{\left(3e^x-x\right)-3}{x}$$

_____ 8. The above limit represents $f'(c)$, the derivative of some function $f(x)$ at some $x=c$. What are $f(x)$ and $x=c$?

(A) $f(x)=e^x-x$, $c=3$ (B) $f(x)=3e^x$, $c=0$ (C) $f(x)=3e^x-x-3$, $c=0$

(D) $f(x)=3e^x-x$, $c=0$ (E) $f(x)=3e^x-x$, $c=3$

_____ 9. $\dfrac{d}{dx}\left[\dfrac{3x^3-2\sqrt{x}+1}{\sqrt{x}}\right]=$

(A) $\dfrac{15\sqrt{x^3}}{2}-\dfrac{\sqrt{x}}{2}$ (B) $\dfrac{15\sqrt{x^3}}{2}-\dfrac{1}{2\sqrt{x^3}}$ (C) $\dfrac{18\sqrt{x^5}-2}{x}$ (D) $3\sqrt{x^5}-2+\dfrac{1}{\sqrt{x}}$ (E) $18x^2$

Part TOO: Free Response—Do all work below in the space provided.

10. If $f(x)=5-3x-2x^2+x^3$

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

(b) Find $P(2)$ and $P'(2)$.

(c) Find the equation of the tangent line, in Taylor Form, of $P(x)$ at $x=2$.

(d) Find the equation of the normal line, in Taylor Form, of $P(x)$ at $x = 2$.

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