Name_____ Date_____ Pasta Shape_____

AP Calculus TEST: 2.1-2.3, NO CALCULATOR

Part I: 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 $6x+y=2$, where *k* is a constant, is tangent to the graph of $y=2k+x^2$. What is the value of *k* ?

(A) -3 (B) 3 (C) $-\frac{2}{11}$ (D) 2 (E) $\frac{11}{2}$

_____ 2. Which of the following is/are true regarding the function $f(x)=3-|6x+12|$?

I. $f'(-2)=DNE$

II. $f'(0)=6$

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

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

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

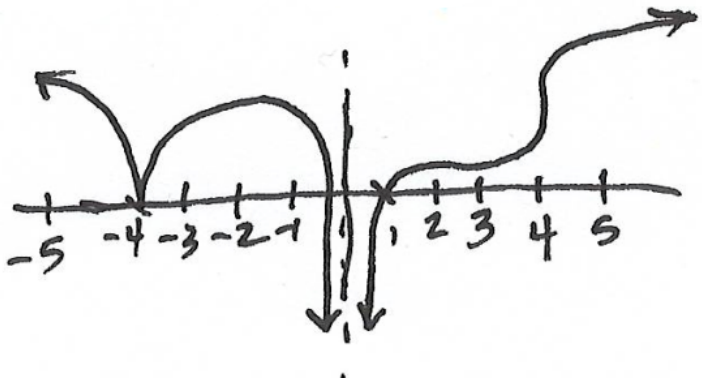
_____ 3. Let *f* be the function defined above, where a and b are constants. If f is differentible at $x=-2$, what is the value of $a\div b$?

(A) -3 (B) $\frac{1}{6}$ (C) 1 (D) 6 (E) No such values exist

_____ 4. If $y=3x^2(x+2)^2$, then $\frac{dy}{dx}=$

(A) $12x^3+18x^2+24x$ (B) $12x^3+36x^2+24x$ (C) $12x^3+24x$ (D) $12x^3+12x$ (E) $9x^2+12x$

_____ 5. $\lim_{h\to 0}\frac{2\cos\left(\frac{4\pi}{3}+h\right)-2\cos\frac{4\pi}{3}}{h}=$ (A) $\sqrt{3}$ (B) 1 (C) $-\sqrt{3}$ (D) -1 (E) $\sqrt{2}$



_____ 6. The graph of a function $f(x)$ is given above. The graph of $f(x)$ has a vertical asymptote at $x=0$, a vertical tangent line at $x=4$, and x-intercepts at $x=-4$, $x=-0.5$, and $x=1$. For what values of x is the function $f(x)$ is **not** differentiable?

I. $x=-4$
II. $x=0$
III. $x=3$
IV. $x=4$

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

$$g(x)=\begin{cases}6x-2, & x<-1\\ -3x^2-5, & x\geq -1\end{cases}$$

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

I. $\lim_{x\to -1} g(x)$ exists
II. g is continuous at $x=-1$
III. g is differentiable at $x=-1$

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

$$\lim_{x\to 1}\frac{\sqrt{x+3}-2}{x-1}$$

_____ 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) $f(x)=\sqrt{x+3},\ c=1$ (B) $f(x)=\sqrt{x+3}-2,\ c=1$ (C) $f(x)=\sqrt{x+3},\ c=2$
(D) $f(x)=\sqrt{x},\ c=3$ (E) $f(x)=\sqrt{x+2},\ c=1$

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

(A) $\dfrac{-10x^2-1}{3\sqrt[3]{x^4}}$ (B) $\dfrac{10x^2+1}{3\sqrt[4]{x^3}}$ (C) $\dfrac{10x^2-1}{3\sqrt[4]{x^3}}$ (D) $\dfrac{10x^2-1}{3\sqrt[3]{x^4}}$ (E) $\dfrac{10x^2+1}{3\sqrt[3]{x^4}}$

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

10. If $f(x) = x^3 + 2x^2 + 4x + 3$

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

(b) Find $P(1)$ and $P'(1)$.

(c) Find the equation of the tangent line, in Taylor Form, of $P(x)$ at $x = 1$.

(d) Find the equation of the normal line, in Taylor Form, of $P(x)$ at $x=1$.

(e) The equation of the normal line to $P(x)$ at $x=1$ intersects the graph of $P(x)$ at another x-value. Find this x-value. Show the work that leads to your answer.