Name KEY ______________________ Date______________ Famous Symbol________

AP Calculus TEST: 4.1-4.4 , NO CALCULATOR

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

$y=-x+k$ $\quad y'=-1,\ y'=2x+3$

A 1. In the *xy*-plane, the line $x+y=k$, where k is a constant, is tangent to the graph of $y=x^2+3x+1$. What is the value of k?

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

$-x+k=x^2+3x+1$
$2+k=4-6+1$
$k=-1-2$
$k=-3$

$2x+3=-1$
$2x=-4$
$x=-2$

$$f(x)=\begin{cases} cx+d & \text{for } x\le 2 \\ x^2-cx & \text{for } x>2 \end{cases}$$

cont: $2c+d=4-2c$ $\quad$ so $4+d=4-4$, $\boxed{d=-4}$

$f'=\begin{cases} c \\ 2x-c \end{cases} \rightarrow$ slopes: $c=4-c$, $2c=4$, $\boxed{c=2}$

B 2. Let f be the function defined above, where c and d are constants. If f is differentiable at $x=2$, what is the value of $c+d$?

(A) -4 (B) -2 (C) (D) 2 (E) 4

$\frac{2(3x+2)-3(2x+3)}{(3x+2)^2}=\frac{6x+4-6x-9}{(3x+2)^2}=\frac{-5}{(3x+2)^2}$

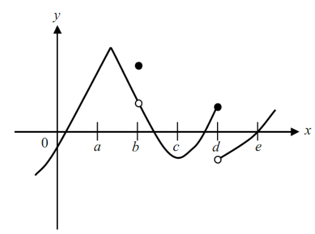
D 3. If $y=\dfrac{2x+3}{3x+2}$, then $\dfrac{dy}{dx}=$ (A) $\dfrac{12x+13}{(3x+2)^2}$ (B) $\dfrac{12x-13}{(3x+2)^2}$ (C) $\dfrac{5}{(3x+2)^2}$ (D) $\dfrac{-5}{(3x+2)^2}$ (E) $\dfrac{2}{3}$

$3\sec x\tan x$

B 4. $\displaystyle\lim_{h\to 0}\frac{3\sec(\pi+h)-3\sec\pi}{h}=$ (A) -1 (B) 0 (C) -3 (D) π (E) DNE

A 5. The graph of a function f is shown at right. At which value of x is f continuous, but not differentiable?

(A) a (B) b (C) c (D) d (E) e



Graph of f

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

D 6. Let g be the function given above. Which of the following statements are true about g?

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

E 7. The function f is continuous on $[-3,2]$ and has values given in the table below. If the equation $f(x)=2$ has at least 2 solutions in the interval $(-3,2)$ if $k=$

x	-3	0	2
$f(x)$	5	k	3.2

(A) 5 (B) 3.2 (C) 2 (D) 10 (E) -3

B 8. If $f(x)=(x-1)\sin x$, then $f'(0)=$ (A) -2 (B) -1 (C) 0 (D) 1 (E) 2

$\sin x+(x-1)\cos x \rightarrow 0-1(1)$

E 9. If $f(x)=3-4|x+5|$ for all x, then the value of the derivative $f'(x)$ at $x=-5$ is

(A) -4 (B) 0 (C) 4 (D) 3 (E) DNE

17 checks Total

① A
② B
③ D
④ B
⑤ A
⑥ D
⑦ E
⑧ B
⑨ E

Part Dos: Free Response—Do all work below the line.

10. If $f(x)=\frac{1}{3}x^3-\frac{1}{2}x^2-6x+4$

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

(b) Find $k(-1)$ and $k'(-1)$.

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

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

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

(a) $k(x)=f'(x)=x^2-x-6$ ✓

$k'(x)=2x-1$ ✓

(b) $k(-1)=(-1)^2-(-1)-6=1+1-6=\boxed{-4}$ ✓

$k'(-1)=2(-1)-1=-2-1=\boxed{-3}$ ✓

(c) $(-1,-4)$, $m=-3$

$\boxed{y=-4-3(x+1)}$ ✓

(d) $(-1,-4)$, $m=\frac{1}{3}$

$\boxed{y=-4+\frac{1}{3}(x+1)}$ ✓

8 checks

(e) $\boxed{x^2-x-6=-4+\frac{1}{3}(x+1)}$ ✓

$3x^2-3x-18=-12+x+1$

$3x^2-4x-7=0$

$(x+1)(3x-7)=0$

$x=-1$, $x=\frac{7}{3}$

So $\boxed{x=\frac{7}{3}}$ ✓