Name______________________________________ Date_________________ Famous Horse____________

AP Calculus TEST: 2.1-2.5

NO CALCULATOR

Part Uno: Polychoices—Put the correct CAPITAL letter in the space to the left of each question.

_____ 1. If $f(x)=(x-1)^2\sin x$, then $f'(0)=$

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

_____ 2. If $f(x)=3x^{1/3}(2x+1)$, then the domain of $f'(x)$ is

(A) $\{x|x\neq 0\}$ (B) $\{x|x>0\}$ (C) $\left\{x\middle|-\frac{1}{2}<x<0\right\}$ (D) $\left\{x\middle|x\neq-\frac{1}{2}\text{ and }x\neq 0\right\}$ (E) all real numbers

_____ 3. If $f(x)=e+\pi x$, then $f'\left(\sqrt{2}\right)=$

(A) e (B) π (C) $\sqrt{2}$ (D) 1 (E) undefined

_____ 4. $\lim\limits_{h\to 0}\dfrac{7\sqrt{9+h}-21}{h}=$

(A) undefined (B) 63 (C) $\frac{63}{2}$ (D) $\frac{21}{3}$ (E) $\frac{7}{6}$

_____ 5. If $f(x)=\sqrt[3]{3x}$, then $f'\left(\sqrt{3}\right)=$

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{\sqrt{3}}$ (D) $\frac{1}{\sqrt[3]{3}}$ (E) $\frac{1}{\sqrt{2}}$

_____ 6. Find the values of *a* and *b* such that $f(x)=\begin{cases}3x-7, & x<1\\ ax^2+bx, & x\geq 1\end{cases}$ is differentiable for all *x*.

(A) $a=1,\ b=-5$ (B) $a=-4,\ b=0$ (C) $a=7,\ b=-11$

(D) $a=\frac{3}{2},\ b=-\frac{11}{2}$ (E) no such values exist

_____ 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

_____ 8. If $f(x)=(2x-1)\left(\dfrac{x^2-2}{5x-7}\right)$, then $f'(0)=$

(A) $\frac{18}{49}$ (B) $\frac{15}{72}$ (C) 0 (D) $-\frac{16}{15}$ (E) $\frac{2}{7}$

Part Zwei: Tell me what you know in the most perfect, poet, mathematical way you possibly can.
Oh, and work everything below the line, labeling each part. I won't even bother looking above the line, even if you beg me.

1. Let $f(x)=\begin{cases}-4x+5, & x<-1\\ 3x^2+6, & x\geq -1\end{cases}$

   a. Use the alternate form definition to find the left-hand derivative of f at $x=-1$ if it exists.
   b. Use the alternate form definition to find the right-hand derivative of f at $x=-1$ if it exists.
   c. Is $f(x)$ differentiable at $x=-1$? Explain.
   d. Determine if $f(x)$ is continuous at $x=-1$. Give conclusion based on the 3-step definition.
   e. Sketch a graph of $f(x)$. Be sure to label it.
   f. Prove that there exists a $c\in(0,2)$ such that $f(c)=7$.

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2. A particle moves along a vertical line and has a position equation $s(t)=(3t-1)(t-3)$ with $s(t)$ measured in furlongs (about 210 meters) and t measured in heleks (about 3.3 seconds) and $t \geq 0$. Be sure to include units in your final answer(s), lest you lose valuable points and class rank slots.

   g. What is the initial position of the particle? Include units.
   h. When is the first time the particle is at zero? Include units.
   i. What is the particle's displacement on the interval from $t=0$ to $t=2$ heleks? Include units. Explain what that number means in terms of the particle's starting position.
   j. What is the particle's average velocity on the interval from $t=0$ to $t=2$ heleks? Include units.
   k. What is the particle's speed at $t=2$ heleks? In which direction is it heading? Include units.
   l. What is the particle's acceleration at $t=2$ heleks? Include units.
   m. At what time (in heleks) does the particle turn around? Justify.
   n. At $t=1$ heleks, is the speed of the particle increasing or decreasing? Justify.
