Name____ Date____________ Favorite Bear_________________

BC Calculus TEST: 2.1 - 2.6,   NO CALCULATOR

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

_____1. If $f(x) = \sec x$, find $\lim\limits_{h \to 0} \dfrac{f'(\pi + h) - f'(\pi)}{h}$.

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

_____ 2. If $f(x) = \sqrt[3]{x}\cot x$, what is $f'(x)$?

(A) $\dfrac{\cot x + 3x\csc^2 x}{3\sqrt[3]{x^2}}$ (B) $\dfrac{\cot x - 3x\csc^2 x}{3\sqrt[3]{x^2}}$ (C) $\dfrac{3x\csc^2 x - \cot x}{3\sqrt[3]{x^2}}$

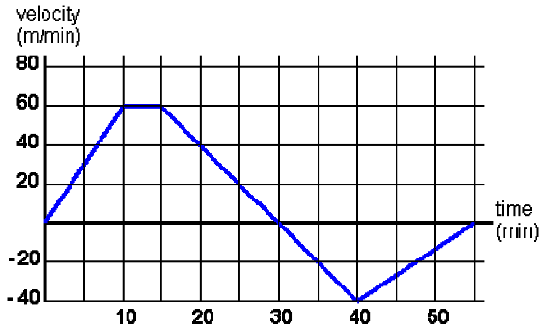
(D) $\dfrac{-\csc x \cot x}{3\sqrt[3]{x^2}}$ (E) $\dfrac{\csc x \cot x}{3\sqrt[3]{x^2}}$

_____ 3. If $f(x) = \begin{cases} 2ax^2 + x + 2, & x < -1 \\ bx + 3, & x \ge -1 \end{cases}$, what is the value of b that makes $f(x)$ differentiable at $x = -1$?

(A) -1 (B) 1   (C) -3 (D) 3   (E) $-\dfrac{1}{2}$

_____ 4. A particle (named Happy Joseph) moves along the x-axis such that at any time $t \ge 0$, his position function is given by $x(t) = t^3 - 9t^2 + 15t + 2$. On what intervals of t is Happy Joseph moving right?

(A) $[0,1) \cup (5, \infty)$ (B) $(1,5)$ (C) $(5,\infty)$ (D) $[0,1)$ (E) $(1,\infty)$



______ 5. The graph of the velocity of an indecisive tortoise (in meters per minute) is given above as it moves along a horizontal line. It's time is measured in minutes. On what intervals of t is the speed of the tortoise increasing?

I. $(0,10)$ minutes

II. $(40,50)$ minutes

III. $(30,40)$ minutes

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

______ 6. If $f(x)=\tan^4(3x)$, that is $f'\left(\frac{5\pi}{12}\right)$?

(A) -6 (B) -12 (C) -24 (D) 12 (E) 24

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	2	1	-4	8
2	-1	-3	5	-5
3	3	-3	6	5
4	-2	4	7	2
5	-4	-8	3	-1

The table above gives selected values of differentiable functions $f(x)$ and $g(x)$ and their derivatives. Use this table to answer questions 7, 8, and 9.

______ 7. If $h(x)=f(2x)\cdot g(x)$, what is $h'(2)$?

(A) 30 (B) 40 (C) 50 (D) -20 (E) -40

______ 8. If $K(x)=\left[f(g(x))\right]^3$, what is $K'(5)$?

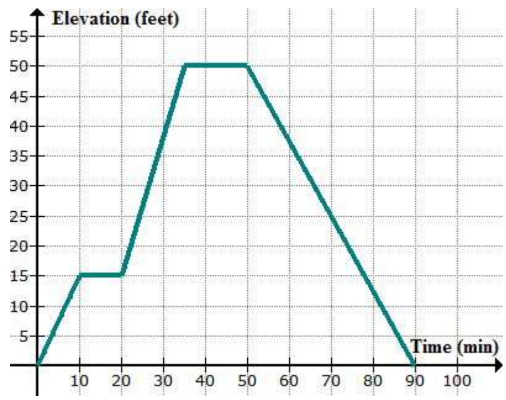
(A) 81 (B) -81 (C) 27 (D) -27 (E) -3

______ 9. If $J(x)=\dfrac{g(x)}{f(x)}$, what is $J'(1)$?

(A) 5 (B) 3 (C) 10 (D) 6 (E) 7

Part II: Free Response—show all work in a detailed, logical manner in the space provided. Include units on all final numeric answers.

10. Winnie-the-Pooh is climbing up and down on a tree. His elevation $h(t)$ above ground (in feet) at time $t \geq 0$ minutes is given in the graph below.



(a) On what open intervals is Pooh climbing up? Include units.

(b) On what open intervals is Pooh at rest? Include units.

(c) At what time does Pooh begin to descend? Include units.

(d) What is Pooh's average velocity during the first 50 minutes. Show the work that leads to your answer. Include units.

(e) What is Pooh's velocity at $t = 8$ minutes. Include units. Explain your answer in a complete sentence, with units, in terms of Pooh's elevation.

(f) On what open interval is Pooh's speed the slowest? Include units.

(g) What is the total distance Pooh travels vertically on $0 \le t \le 90$ minutes? Include units.

(h) Do you think Pooh can see Roo's House from the top of the tree? Include units.