Name_____ Date_____ Favorite Clown_____
AP Calculus TEST: 2.1-2.7, NO CALCULATOR

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

_____ 1. If $f(x) = \dfrac{x^3 - c^3}{x^3 + c^3}$ where c is a constant, then $f'(x) =$

(A) $\dfrac{-3c^3 x^2}{\left(x^3 + c^3\right)}$ (B) $\dfrac{-3c^3 x^2}{\left(x^3 + c^3\right)^2}$ (C) $\dfrac{3c^3 x^2}{\left(x^3 + c^3\right)^2}$ (D) $\dfrac{-6c^3 x^2}{\left(x^3 + c^3\right)^2}$ (E) $\dfrac{6c^3 x^2}{\left(x^3 + c^3\right)^2}$

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	3	-2	1	13
2	-3	5	5	$-\dfrac{1}{2}$

The table above gives the values for differentiable functions $f(x)$ and $g(x)$ & their continuous derivatives at selected values. **Use the table to answer questions 2, 3, and 4.**

_____ 2. If $k(x) = f^2\left(\dfrac{x}{2}\right) =$, use the table to find $k'(2)$.

(A) -12 (B) -3 (C) 3 (D) -6 (E) 6

_____ 3. If $J(x) = \sqrt{2f(x) + 3g(x)}$, find $J'(1)$.

(A) $\dfrac{315}{2}$ (B) $\sqrt{3}$ (C) 11 (D) $\dfrac{1}{2\sqrt{35}}$ (E) $\dfrac{35}{6}$

_____ 4. For $1 \le x \le 2$, which of the following must be true?

I. $g(c) = \dfrac{7}{2}$ for some $c \in (1, 2)$

II. $f(r) = 0$ for some $r \in (1, 2)$

III. $f(z) = 3.0001$ for some $z \in (1, 2)$

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

_____5. $\displaystyle\lim_{h\to 0}\frac{\dfrac{5}{\sqrt{(7+h)-3}}-\dfrac{5}{\sqrt{7}-3}}{h}=$

(A) $-\dfrac{5}{2}$ (B) $\dfrac{5}{2}$ (C) $-\dfrac{5}{16}$ (D) $\dfrac{5}{16}$ (E) DNE

_____ 6. If $f(x)=\cos x$ and $\dfrac{2}{y}=f(x)$, find $\dfrac{dy}{dx}\bigg|_{x=\frac{5\pi}{6}}$

(A) $\dfrac{4}{3}$ (B) $4\sqrt{3}$ (C) $-4\sqrt{3}$ (D) $\dfrac{8}{\sqrt{3}}$ (E) $\dfrac{-8}{\sqrt{3}}$

_____ 7. If $f(1)=\dfrac{\pi}{4}$ and $f'(1)=3$, find the equation of the tangent line to $h(x)=\cot\big(f(x)\big)$ at $x=1$.

(A) $6x+y=7$ (B) $6x-y=7$ (C) $6x-y=-7$ (D) $-6x+y=2$ (E) $6x-y=7$

_____ 8. $\dfrac{d^{41}}{dx^{41}}\Big[\cos 2x+22x^{30}-42x^{20}+100x^{10}-99\Big]=$

(A) $2^{41}\sin 2x$ (B) $2^{41}\cos 2x$ (C) $-2^{41}\sin 2x$ (D) $-2^{41}\cos 2x$ (E) $-82\sin 2x$

_____ 9. If $x^2+xy+y^3=0$, then in terms of x and y, $\dfrac{dy}{dx}=$

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

Part II: Free Response—Show all set ups, use correct notation, indicate your methods, and answer in complete math/English sentences (with units) when appropriate.

10. A creepy clown is walking along a sidewalk. His velocity, in ft/sec, is given as a function of time, in seconds, by the graph below for $0 \le t \le 6$.
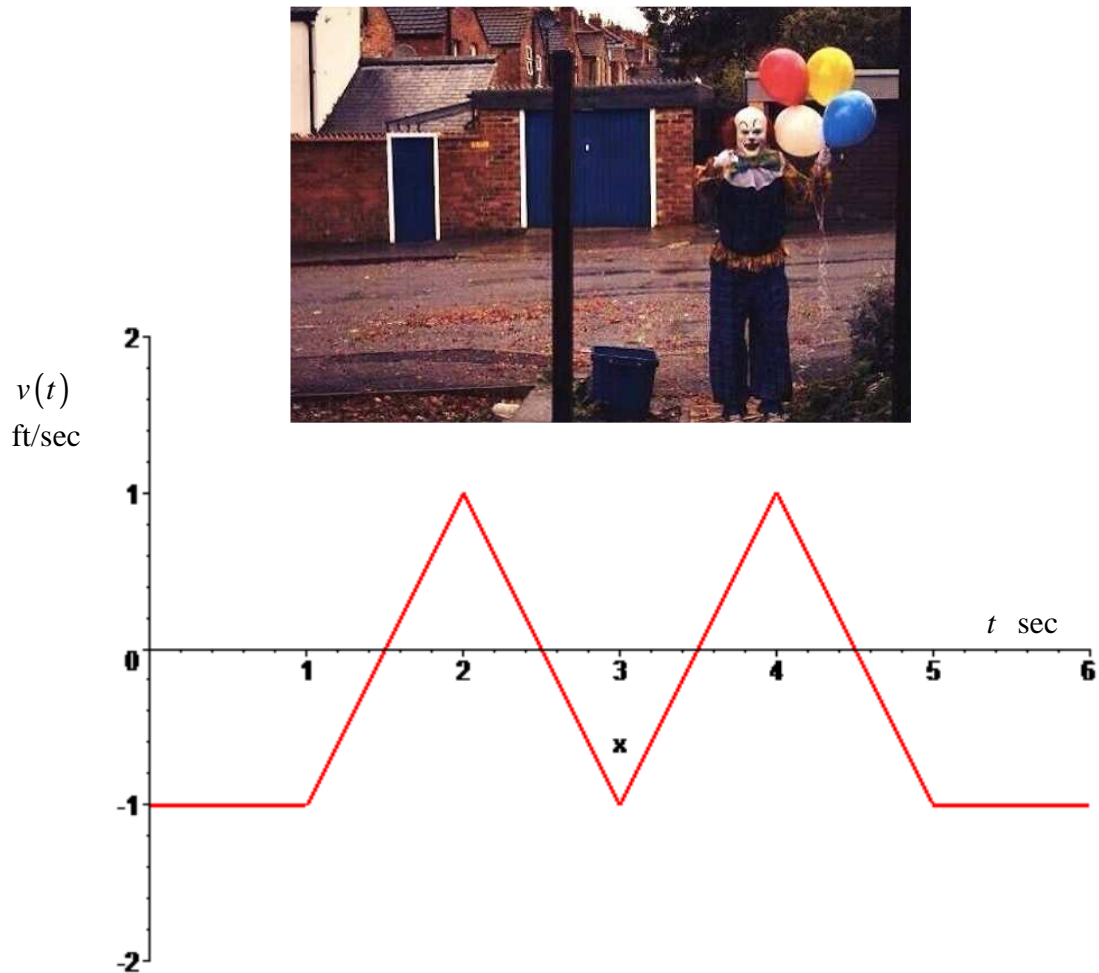
(a) At $t = 3.2$ seconds, what is the clown's acceleration? Show the work that leads to your answer and answer with correct units. Write a sentence, with units, describing what your answer means in terms of the clown's velocity.

(b) What is the clown's average acceleration for $1 \le t \le 4$ seconds. Show the work that leads to your answer. Use proper units.

(c) At $t = 3.2$ seconds, is the speed of the clown increasing or decreasing? Justify.

(d) On the interval $0 < t < 6$ seconds. How many times does the clown change direction. Explain how you know this.