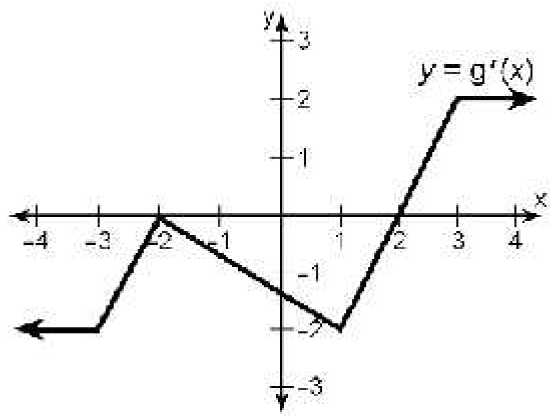
Name____________________________________ Date________________ Brand of Facial Tissues__________

TEST: 3.1-3.6, NO CALCULATOR

Part I: Multiple Choice: Put the letter in the letter place.

_____ 1. The graph of the derivative, $g'(x)$, of a function $g(x)$ is shown below



Which of the following must be true about the function $g(x)$ on the interval $[-4,4]$?

I. $g(x)$ is increasing for $x > 2$ **only**

II. $g(x)$ is not differentiable at four points

III. $g(x)$ is concave down for $-2 < x < 1$

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

_____ 2. On what open intervals is $f(x) = \dfrac{2x-3}{x^2}$ increasing?

(A) $(3,\infty)$ (B) $(0,\infty)$ (C) $(-\infty,3)$ (D) $(0,3)$ (E) $(-\infty,-3)$

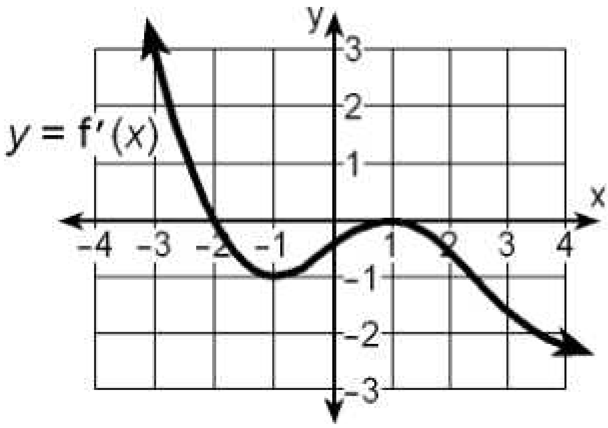
_____ 3. If $\lim\limits_{h\to 0} \dfrac{f(-3+h)-f(-3)}{h} = 2.718$, then the graph of $f(x)$ at $x=-3$ is

(A) increasing (B) concave up (C) decreasing (D) stationary (E) concave down

_____ 4. On the interval $[0,®]$, the graph of $f(x) = \dfrac{1}{2}x + \sin x$ has a critical value at $x =$

(A) ® (B) $\dfrac{2®}{3}$ (C) $\dfrac{5®}{6}$ (D) 0 (E) $\dfrac{®}{3}$

_____ 5. The graph of the derivative, $f'(x)$, of a function $f(x)$ is shown below



At what value of x does $f(x)$ have a local maximum?

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

_____ 6. Selected values for the derivative, $f'(x)$, of a differentiable function $f(x)$ are shown in the table below.

x	1	2	3	4	5	6
$f'(x)$	8	4	0	-4	-8	-12

If $f'(x)$ is strictly decreasing, which of the following statements **must** be true?

(A) The graph of $f(x)$ is symmetric with respect to the line $x=3$

(B) $f(x)$ is concave up for for all x

(C) $f(x)$ changes concavity at $x=3$

(D) $f(x)$ has a relative maximum at $x=3$

(E) $f(x)$ has a relative minimum at $x=3$

_____ 7. The function g is defined by the equation $g(x)=6x^5-10x^3$. On what open intervals is the graph of $g(x)$ **concave up**? HINT: $\frac{\sqrt{2}}{2}\approx 0.707$

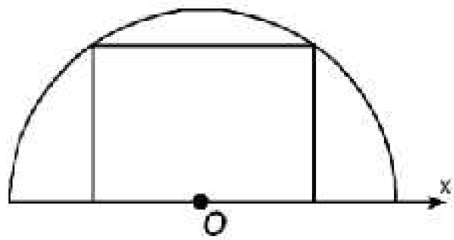
(A) $\left(-\infty,-\frac{\sqrt{2}}{2}\right)\cup\left(0,\frac{\sqrt{2}}{2}\right)$ (B) $\left(-\frac{\sqrt{2}}{2},\frac{\sqrt{2}}{2}\right)$ (C) $\left(-\frac{\sqrt{2}}{2},0\right)\cup\left(\frac{\sqrt{2}}{2},\infty\right)$

(D) $\left(-\frac{\sqrt{2}}{2},\infty\right)$ (D) $\left(-\infty,\frac{\sqrt{2}}{2}\right)$

______ 8. The shortest distance from the curve $y=\sqrt{x}$ and the point $(4,0)$ is

(A) $\sqrt{15}$ (B) $\frac{\sqrt{14}}{2}$ (C) $\frac{\sqrt{15}}{2}$ (D) $\frac{7}{2}$ (E) $\sqrt{14}$

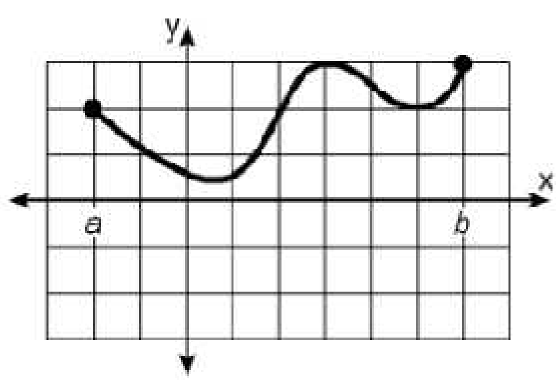
______ 9. The diagram below shows a rectangle inscribed in a semicircle.



If the radius of the semicircle is 2 meters, what is the maximum area, in square meters, of the rectangle?

(A) $4\sqrt{2}$ (B) $2\sqrt{2}$ (C) 4 (D) 8 (E) 2

______ 10. The graph of a function is shown below.



On the closed interval $[a,b]$, at how many points is the Mean Value Theorem satisfied?

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

Part II: Free Response

11. Let f be the function defined by $f(x) = 36x^{1/3} - 9x^{4/3}$

(a) What is the domain of $f(x)$?

(b) Show that $f'(x) = \dfrac{-12(x-1)}{\sqrt[3]{x^2}}$. Show the work that leads to your answer.

(c) Find the intervals on which f is decreasing.

(d) At each critical value, determine if $f(x)$ has a local maximum, a local minimum, or neither. Justify.