Chapter 3 – Mean Value Theorem WKST

Name:_____

Understanding IVT, MVT, and Rolle's Theorem

A Graphing Calculator is allowed for these problems.

For problems #1 and #2, find the value of *c* guaranteed by the Mean Value Theorem on the indicated interval such that $f'(c) = \dfrac{f(b) - f(a)}{b - a}$.

1. $f(x) = x^2$ on [1 , 3]

2. $f(x) = x^3 + 1$ on [-1 , 1]

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3. Which of the following satisfy the hypotheses of Mean Value Theorem on the interval [0 , 2] ?

   I. $f(x) = \sin \pi x + \cos 2x$

   II. $f(x) = \sqrt[3]{x - 2}$

   III. $f(x) = \left| x^2 - 2x \right|$

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

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4. Which of the following satisfy the hypotheses of Mean Value Theorem on the interval [0 , 3] ?
   Note: this is the same as #3, except the interval is different.

   I. $f(x) = \sin \pi x + \cos 2x$

   II. $f(x) = \sqrt[3]{x - 2}$

   III. $f(x) = \left| x^2 - 2x \right|$

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

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5. Which of the following satisfy the hypotheses of Rolle's Theorem on the interval [0 , 2] ?

I. $f(x) = \frac{1}{|x-1|}$

II. $f(x) = |x-1|$

III. $f(x) = x^2 - 2x$

IV. $f(x) = \sin 2x$

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

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6. Let f be continuous for $0 \le x \le 5$ where (0 , 13) and (5 , 3) are the endpoints of f. The Intermediate Value Theorem guarantees which of the following?

(A) $f(c) = 2$ for some c such that $0 < c < 5$.

(B) $f'(c) = 2$ for some c such that $0 < c < 5$.

(C) $f'(c) = 0$ for some c such that $0 < c < 5$.

(D) $f(c) = 4$ for some c such that $0 < c < 5$.

(E) $\lim_{x \to c} f(x) = f(c)$ for all values c on $0 < c < 5$.

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7. How many values of c are guaranteed by Rolle's Theorem for $f(x)$ below on the interval [-10 , 10] ?

$$\text{If } f(x) = \begin{cases} \frac{\sin x}{x} & , \text{ for } x \neq 0 \\ 1 & , \text{ for } x = 0 \end{cases}$$

(A) 4 (B) 5 (C) 6 (D) 7 (E) the theorem does not apply

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8. Suppose f is continuous for $0 \le x \le 6$ and differentiable for $0 < x < 6$. If $f(0) = 1$ and $f(6) = 7$, then which of the following could be false?

(A) f has a no vertical asymptotes on $0 \le x \le 6$.

(B) There exists a value c on $0 < c < 6$ such that the slope of the tangent line at $x = c$ is 1.

(C) $f(c) = 2$ for some c such that $0 < c < 6$.

(D) $f(c) = 0$ for some c such that $0 < c < 6$.

(E) $\lim_{x \to c} f(x)$ exists for all values c on $0 < c < 6$.

ANSWERS:

1) 2
2) $\pm \frac{\sqrt{3}}{3}$
3) E
4) A
5) C
6) D
7) B
8) D