1) If f is a continuous function on the closed interval $[a, b]$, which of the following must be true?

(A) There is a number c in the open interval (a, b) such that $f(c) = 0$.
(B) There is a number c in the open interval (a, b) such that $f(a) < f(c) < f(b)$.
(C) There is a number c in the closed interval $[a, b]$ such that $f(c) \geq f(x)$ for all x in $[a, b]$.
(D) There is a number c in the open interval (a, b) such that $f'(c) = 0$.
(E) There is a number c in the open interval (a, b) such that $f'(c) = \frac{f(b)-f(a)}{b-a}$

x	3	4	5	6	7
$f(x)$	20	17	12	16	20

2) The function f is continuous and differentiable on the closed interval $[3,7]$. The table above gives selected values of f on this interval. Which of the following statements must be true?

I. The minimum value of f on $[3,7]$ is 12.
II. There exists c, for $3 < c < 7$, such that $f'(c) = 0$.
III. $f'(x) > 0$ for $5 < x < 7$.

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

3) The function f is continuous for $-2 \leq x \leq 1$ and differentiable for $-2 < x < 1$. If $f(-2) = -5$ and $f(1) = 4$, which of the following statements could be false?

(A) There exists c, where $-2 < c < 1$, such that $f(c) = 0$.
(B) There exists c, where $-2 < c < 1$, such that $f'(c) = 0$.
(C) There exists c, where $-2 < c < 1$, such that $f(c) = 3$.
(D) There exists c, where $-2 < c < 1$, such that $f'(c) = 3$.
(E) There exists c, where $-2 \leq c \leq 1$, such that $f(c) \geq f(x)$ for all x on the closed interval $-2 \leq x \leq 1$.

x	0	1	2	3	4
$f(x)$	2	3	4	3	2

4) The function f is continuous and differentiable on the closed interval $[0,4]$. The table above gives selected values of f on this interval. Which of the following statements must be true?

(A) The minimum value of f on $[0,4]$ is 2 .
(B) The maximum value of f on $[0,4]$ is 4 .
(C) $f(x) > 0$ for $0 < x < 4$
(D) $f'(x) < 0$ for $2 < x < 4$
(E) There exists c, with $0 < c < 4$, for which $f'(c) = 0$.

5) Let f be a function that is differentiable on the open interval $(1,10)$. If $f(2) = -5, f(5) = 5$, and $f(9) = -5$, which of the following must be true?

I. f has at least 2 zeros.
II. The graph of f has at least one horizontal tangent.
III. For some $c, 2 < c < 5, f(c) = 3$.

(A) None
(B) I only
(C) I and II only
(D) I and III only
(E) I, II, and III

6) If f is continuous for $a \leq x \leq b$ and differentiable for $a < x < b$, which of the following could be false?

(A) $f'(c) = \frac{f(b)-f(a)}{b-a}$ for some c such that $a < c < b$.
(B) $f'(c) = 0$ for some c such that $a < c < b$.
(C) f has a minimum value on $a \leq x \leq b$.
(D) f has a maximum value on $a \leq x \leq b$.
(E) $\int_a^b f(x)dx$ exists.

7) The function f is continuous for $-2 \leq x \leq 2$ and $f(-2) = f(2) = 0$. If there is no c, where $-2 < c < 2$, for which $f'(c) = 0$, which of the following statements must be true?

(A) For $-2 < k < 2, f'(k) > 0$.
(B) For $-2 < k < 2, f'(k) < 0$.
(C) For $-2 < k < 2, f'(k)$ exists.
(D) For $-2 < k < 2, f'(k)$ exists, but f' is not continuous.
(E) For some k, where $-2 < k < 2, f'(k)$ does not exist.