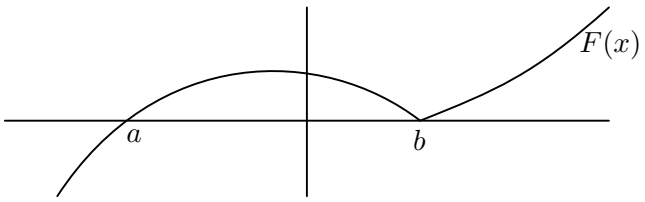


1. The function F above satisfies the conclusion of Rolle's Theorem in the interval $[a, b]$ because

I. F is continuous.
II. F is differentiable on (a, b).
III. $F(a) = F(b) = 0$.

A) I only

B) II only

C) I and III only

D) I, II, and III

E) F does not satisfy Rolle's Theorem

---

2. If $Q(x) = (3x + 2)^3$, then the third derivative of Q at $x = 0$ is

A) 0

B) 9

C) 54

D) 162

E) 224

---

3. If a function g is differentiable on the interval $[-4, 4]$, then which of the following statements is true?

A) g is not continuous on $[-5, 5]$.

B) g is not differentiable on $[-5, 5]$.

C) $g'(c) = 0$ for some c in $[-4, 4]$.

D) The conclusion of the Mean Value Theorem applies to g.

E) None of the above statements are true.

4. The value of c guaranteed to exist by the Mean Value Theorem for $f(x) = x^2$ in the interval $[0, 3]$ is

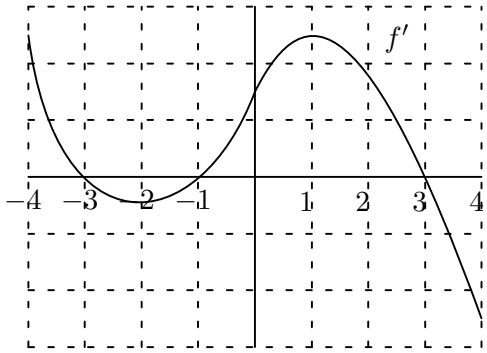
A) 1

B) 2

C) $\frac{3}{2}$

D) $\frac{1}{2}$

E) None of these



5. The graph of the derivative of a function f is shown above. Which of the following are true about the original function f ?

I. f is increasing on the interval $(-2, 1)$.
II. f is continuous at $x = 0$.
III. f has an inflection point at $x = -2$.

A) I only

B) II only

C) III only

D) II and III only

E) I, II, and III

---

6. Two particles move along the x-axis and their positions at time $0 \le t \le 2\pi$ are given by $x_1 = \cos t$ and $x_2 = e^{(t-3)/2} - 0.75$. For how many values of t do the two particles have the same velocity?

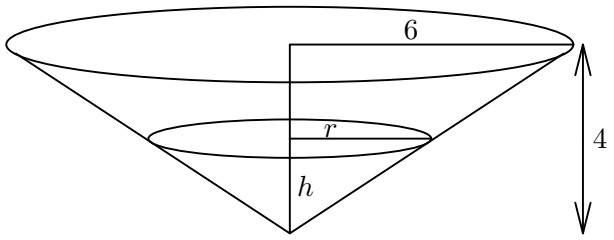
A) 0

B) 1

C) 2

D) 3

E) 4



7. The conical reservoir shown above has diameter 12 feet and height 4 feet. Water is flowing into the reservoir at the constant rate of 10 cubic feet per minute. At the instant when the surface of the water is 2 feet above the vertex, the water level is rising at the rate of

A) 0.177 ft per min

B) 0.354 ft per min

C) 0.531 ft per min

D) 0.708 ft per min

E) 0.885 ft per min

---

8. The position of a particle moving on the x-axis, starting at time $t = 0$, is given by $x(t) = (t-a)^3(t-b)$, where $0 < a < b$. Which of the following statements are true?

I. The particle is at a positive position on the x-axis at time $t = \frac{a+b}{2}$.
II. The particle is at rest at time $t = a$.
III. The particle is moving to the right at time $t = b$.

A) I only

B) II only

C) III only

D) I and II only

E) II and III only

---

9. Let the function f be differentiable on the interval $[0, 2.5]$ and define g by $g(x) = f(f(x))$. Use the table below to estimate $g'(1)$.

x	0.0	0.5	1.0	1.5	2.0	2.5
$f(x)$	1.7	1.8	2.0	2.4	3.1	4.4

A) 0.8

B) 1.2

C) 1.6

D) 2.0

E) 2.4

10. Which of the following are true about a particle that starts at $t = 0$ and moves along a number line if its position at time t is given by $s(t) = (t-2)^3(t-6)$?

I. The particle is moving to the right for $t > 5$.
II. The particle is at rest at $t = 2$ and $t = 6$.
III. The particle changes direction at $t = 2$.

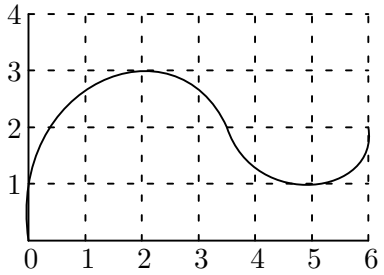
A) I only

B) II only

C) III only

D) I and III only

E) None are true.



Graph of f

11. The graph of the function f is shown above. Which of the following statements are true?

I. $\lim\limits_{h\to 0} \dfrac{f(2+h)-f(2)}{h} = f'(5)$.
II. $\dfrac{f(5)-f(2)}{5-2} = \dfrac{2}{3}$.
III. $f''(1) \le f''(5)$.

A) I and II only

B) I and III only

C) II and III only

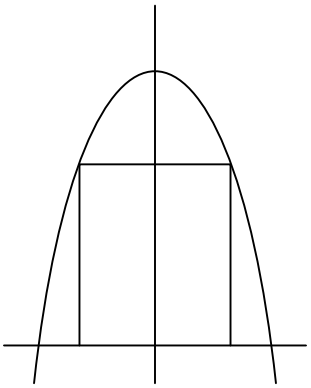
D) I, II, and III

E) None of these

---

12. If $x^2 - y^2 = 25$, then $\dfrac{d^2y}{dx^2} =$

A) $-\dfrac{x}{y}$ B) $\dfrac{5}{y^2}$ C) $-\dfrac{x^2}{y^3}$ D) $-\dfrac{25}{y^3}$ E) $\dfrac{4}{y^3}$



13. A rectangle with one side on the x-axis has its upper vertices on the graph of $y = 4 - x^2$, as shown in the figure above. What is the maximum area of the rectangle?

A) 1.155

B) 1.855

C) 3.709

D) 6.158

E) 12.316

---

14. Let f be a twice-differentiable function of x such that, when $x = c$, f is decreasing, concave up, and has an x-intercept. Which of the following is true?

A) $f(c) < f'(c) < f''(c)$

B) $f(c) < f''(c) < f'(c)$

C) $f'(c) < f(c) < f''(c)$

D) $f'(c) < f''(c) < f(c)$

E) $f''(c) < f(c) < f'(c)$

---

15. If $f'(x) = \arctan(x^3 - x)$, at how many points is the tangent line to the graph of $f(x)$ parallel to the line $y = 2x$?

A) None

B) 1

C) 2

D) 3

E) Infinitely many