

YOU MUST SHOW ALL WORK TO RECEIVE CREDIT!!

1. The graph of $y = 3x^2 - x^3$ has a relative maximum at

- (A) (0, 0) only
- (B) (1, 2) only
- (C) (2, 4) only
- (D) (4, -16) only
- (E) (0, 0) and (2, 4)

2. If $f(x) = \frac{x^2 - 9}{x + 3}$ is continuous at $x = -3$, then $f(-3) =$

- (A) 3
- (B) -3
- (C) 0
- (D) 6
- (E) -6

3. $\lim_{x \rightarrow \infty} \frac{10^8 x^5 + 10^6 x^4 + 10^4 x^2}{10^9 x^6 + 10^7 x^5 + 10^5 x^3} =$

- (A) 0
- (B) 1
- (C) -1
- (D) $\frac{1}{10}$
- (E) $-\frac{1}{10}$

4. The equation of the tangent line to the curve $x^2 + y^2 = 169$ at the point $(5, -12)$ is

(A) $5y - 12x = -120$

(B) $5x - 12y = 119$

(C) $5x - 12y = 169$

(D) $12x + 5y = 0$

(E) $12x + 5y = 169$

5. If $e^y = x$, then $\frac{dy}{dx} =$

(A) 1

(B) $\frac{1}{x}$

(C) $\frac{1}{y}$

(D) $\ln x$

(E) $\ln y$

6. If $f(x) = \frac{(\ln x)^2}{2}$, then $f'(e) =$

(A) e^2

(B) $\frac{1}{e}$

(C) $\frac{1}{e^2}$

(D) e

(F) 0

7. If the graph of $f(x) = 2x^2 + \frac{k}{x}$ has a point of inflection at $x = -1$, then the value of k is

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

8. If $f(x) = 3x^2 - 8x^{-2}$, then $\lim_{h \rightarrow 0} \frac{f(2+h) - f(2)}{h} =$

- (A) 10
- (B) 14
- (C) 20
- (D) -14
- (E) -20

9. For what values of x is the graph of $y = \frac{2}{4-x}$ concave downward?

- (A) No values of x
- (B) $x < 4$
- (C) $x > -4$
- (D) $x < -4$
- (E) $x > 4$

10. $\frac{d}{dx}(e^{3\ln x}) =$

(A) $e^{3\ln x}$

(B) $\frac{e^{3\ln x}}{x}$

(C) x^3

(D) $3x^2$

(F) 3

11. A particle moves along the x -axis in such a way that its position at time t is given by $x(t) = \frac{1-t}{1+t}$.

What is the acceleration of the particle at time $t = 0$?

(A) $-\frac{3}{5}$

(B) -4

(C) 4

(D) 2

(E) -2

12. Let f and g be differentiable functions such that

$$f(1) = 4, g(1) = 3, f'(3) = -5, f'(1) = -4, g'(1) = -3, g'(3) = 2$$

If $h(x) = f(g(x))$, then $h'(1) =$

(A) -9

(B) 15

(C) 0

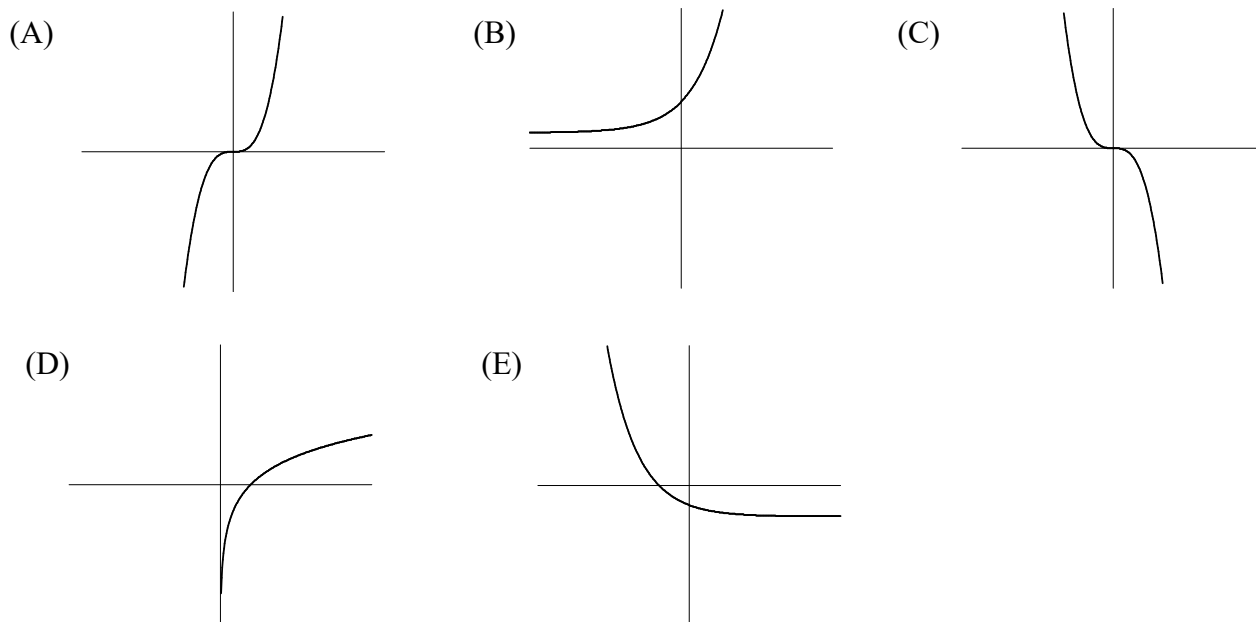
(D) -5

(E) -12

13. A point moves along the curve $y = x^2 + 1$ in such a way that when $x = 4$, the x -coordinate is increasing at the rate of 5 ft/sec. At what rate is the y -coordinate changing at that time?

- (A) 80 ft/sec
- (B) 45 ft/sec
- (C) 32 ft/sec
- (D) 85 ft/sec
- (E) 40 ft/sec

14. If, for all values of x , $f'(x) < 0$ and $f''(x) > 0$, which of the following curves could be part of the graph of f ?



15. If the graph of $f(x) = Ax^2 + Bx + C$ where A , B , and C are constants, passes through the point $(-1, -15)$ and attains a relative maximum at the point $(2, 3)$, then the values of A , B , and C must be

- (A) $A = 2, B = 8, C = -5$
- (B) $A = -2, B = 8, C = 5$
- (C) $A = -2, B = 8, C = -5$
- (D) $A = -2, B = -5, C = 8$
- (E) $A = 2, B = -5, C = 8$

16. If $y = x^{(x^3)}$ for $x > 0$, then $\frac{dy}{dx} =$

(A) $x^3 \cdot x^{(x^3-1)}$

(B) $4x^3$

(C) $x^2 + 3x^2 \ln x$

(D) $x^{(x^3+2)}(1+3 \ln x)$

(E) $3x^{(x^3+2)} \ln x$

17. The maximum value of $f(x) = 2x^3 - 9x^2 + 12x - 1$ on $[-1, 2]$ is

(A) 0

(B) 1

(C) 2

(D) 3

(E) 4

18. The shortest distance from the curve $xy = 4$ to the origin is

(A) 2

(B) 4

(C) $\sqrt{2}$

(D) $2\sqrt{2}$

(E) $\frac{1}{2}\sqrt{2}$