

YOU MUST SHOW ALL COMPLETE LABELED CALCULUS 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

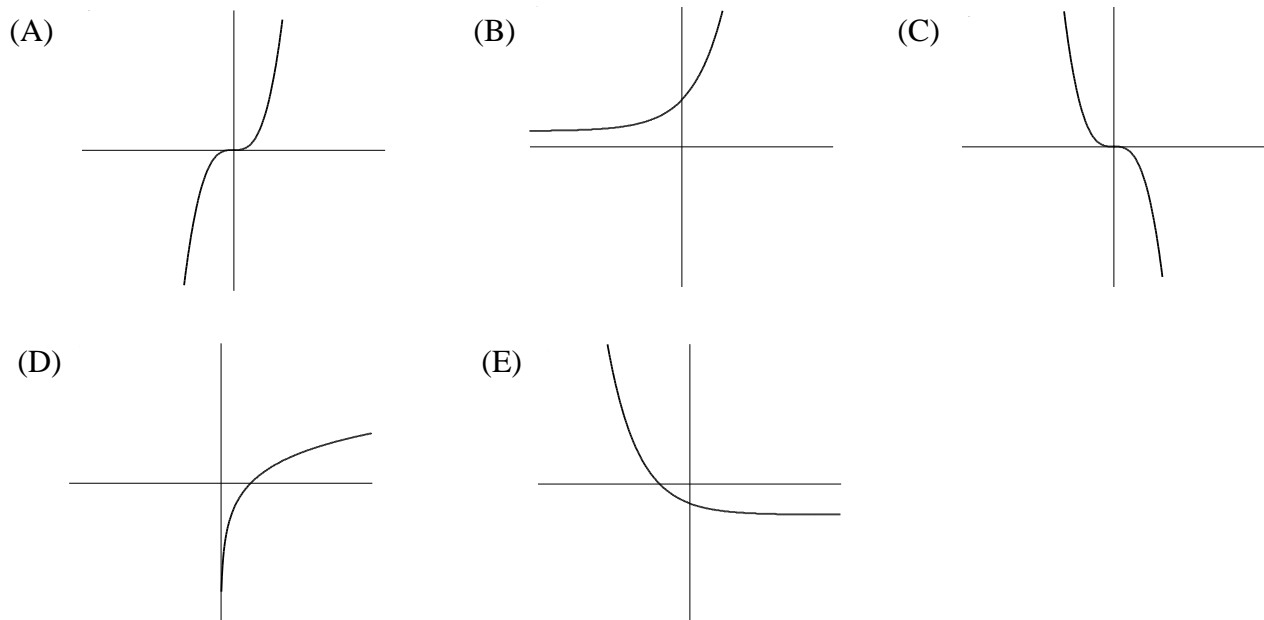
(D) -5

(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  $f(x) = x^3 + ax^2 + bx - 8$  has an inflection point at  $(2, 0)$ , what is the value of  $b$ ?

- (A) 0
- (B) 4
- (C) 8
- (D) 12
- (E) The value of  $b$  cannot be determined from the given information

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