

# Set 3: Multiple-Choice Questions on Differentiation

(Answers at the Bottom)

In each of Questions 1–5 a function is given. Choose the alternative that is the derivative,  $\frac{dy}{dx}$ , of the function.

1.  $y = (4x + 1)(1 - x)^3$

- (A)  $-12(1 - x)^2$     (B)  $(1 - x)^2(1 + 8x)$     (C)  $(1 - x)^2(1 - 16x)$   
(D)  $3(1 - x)^2(4x + 1)$     (E)  $(1 - x)^2(16x + 7)$

2.  $y = \frac{2 - x}{3x + 1}$

Text

- (A)  $-\frac{7}{(3x + 1)^2}$     (B)  $\frac{6x - 5}{(3x + 1)^2}$     (C)  $-\frac{9}{(3x + 1)^2}$   
(D)  $\frac{7}{(3x + 1)^2}$     (E)  $\frac{7 - 6x}{(3x + 1)^2}$

3.  $y = \sqrt{3 - 2x}$

- (A)  $\frac{1}{2\sqrt{3 - 2x}}$     (B)  $-\frac{1}{\sqrt{3 - 2x}}$     (C)  $-\frac{(3 - 2x)^{3/2}}{3}$   
(D)  $-\frac{1}{3 - 2x}$     (E)  $\frac{2}{3}(3 - 2x)^{3/2}$

4.  $y = \frac{2}{(5x + 1)^3}$

- (A)  $-\frac{30}{(5x + 1)^2}$     (B)  $-30(5x + 1)^{-4}$     (C)  $\frac{-6}{(5x + 1)^4}$   
(D)  $-\frac{10}{3}(5x + 1)^{-4/3}$     (E)  $\frac{30}{(5x + 1)^4}$

5.  $y = 3x^{2/3} - 4x^{1/2} - 2$

- (A)  $2x^{1/3} - 2x^{-1/2}$     (B)  $3x^{-1/3} - 2x^{-1/2}$     (C)  $\frac{9}{5}x^{5/3} - 8x^{3/2}$   
(D)  $\frac{2}{x^{1/3}} - \frac{2}{x^{1/2}} - 2$     (E)  $2x^{-1/3} - 2x^{-1/2}$

In Questions 6–13, differentiable functions  $f$  and  $g$  have the values shown in the table.

$x$	$f$	$f'$	$g$	$g'$
0	2	1	5	-4
1	3	2	3	-3
2	5	3	1	-2
3	10	4	0	-1

6. If  $A = f + 2g$ , then  $A'(3) =$   
(A) -2    (B) 2    (C) 7    (D) 8    (E) 10
7. If  $B = f \cdot g$ , then  $B'(2) =$   
(A) -20    (B) -7    (C) -6    (D) -1    (E) 13
8. If  $D = \frac{1}{g}$ , then  $D'(1) =$   
(A)  $-\frac{1}{2}$     (B)  $-\frac{1}{3}$     (C)  $-\frac{1}{9}$     (D)  $\frac{1}{9}$     (E)  $\frac{1}{3}$
9. If  $H(x) = \sqrt{f(x)}$ , then  $H'(3) =$   
(A)  $\frac{1}{4}$     (B)  $\frac{1}{2\sqrt{10}}$     (C) 2    (D)  $\frac{2}{\sqrt{10}}$     (E)  $4\sqrt{10}$
10. If  $K(x) = \left(\frac{f}{g}\right)(x)$ , then  $K'(0) =$   
(A)  $\frac{-13}{25}$     (B)  $-\frac{1}{4}$     (C)  $\frac{13}{25}$     (D)  $\frac{13}{16}$     (E)  $\frac{22}{25}$
11. If  $M(x) = f(g(x))$ , then  $M'(1) =$   
(A) -12    (B) -6    (C) 4    (D) 6    (E) 12
12. If  $P(x) = f(x^3)$ , then  $P'(1) =$   
(A) 2    (B) 6    (C) 8    (D) 12    (E) 54

In Questions 14–21 find  $y'$ .

14.  $y = 2\sqrt{x} - \frac{1}{2\sqrt{x}}$

(A)  $x + \frac{1}{x\sqrt{x}}$       (B)  $x^{-1/2} + x^{-3/2}$       (C)  $\frac{4x-1}{4x\sqrt{x}}$

(D)  $\frac{1}{\sqrt{x}} + \frac{1}{4x\sqrt{x}}$       (E)  $\frac{4}{\sqrt{x}} + \frac{1}{x\sqrt{x}}$

15.  $y = \sqrt{x^2 + 2x - 1}$

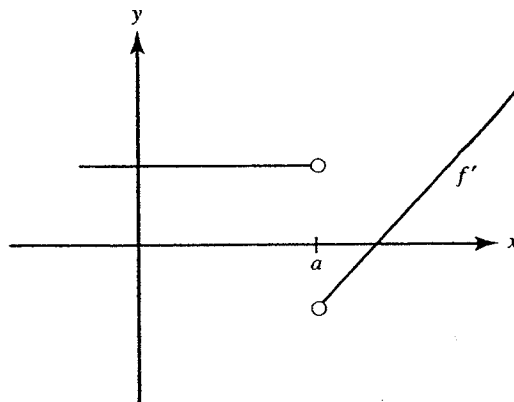
(A)  $\frac{x+1}{y}$       (B)  $4y(x+1)$       (C)  $\frac{1}{2\sqrt{x^2 + 2x - 1}}$

(D)  $-\frac{x+1}{(x^2 + 2x - 1)^{3/2}}$       (E) none of these

23. A function  $f$  has the derivative shown.

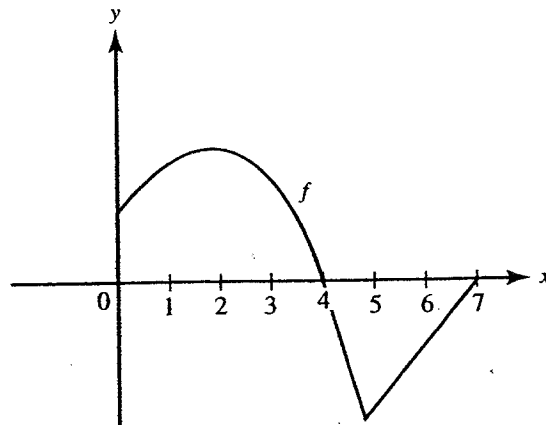
Which of the following statements must be false?

- (A)  $f$  is continuous at  $x = a$ .
- (B)  $f(a) = 0$ .
- (C)  $f$  has a vertical asymptote at  $x = a$ .
- (D)  $f$  has a jump discontinuity at  $x = a$ .
- (E)  $f$  has a removable discontinuity at  $x = a$ .



24. The function  $f$  whose graph is shown has  $f' = 0$  at  $x =$

- (A) 2 only
- (B) 2 and 5
- (C) 4 and 7
- (D) 2, 4, and 7
- (E) 2, 4, 5, and 7



25. A differentiable function  $f$  has the values shown. Estimate  $f'(1.5)$ .

$x$	1.0	1.2	1.4	1.6
$f(x)$	8	10	14	22

- (A) 8    (B) 12    (C) 18    (D) 40    (E) 80

In Questions 27–33, find  $\frac{dy}{dx}$ .

27.  $y = x^2 \sin \frac{1}{x}$     ( $x \neq 0$ )

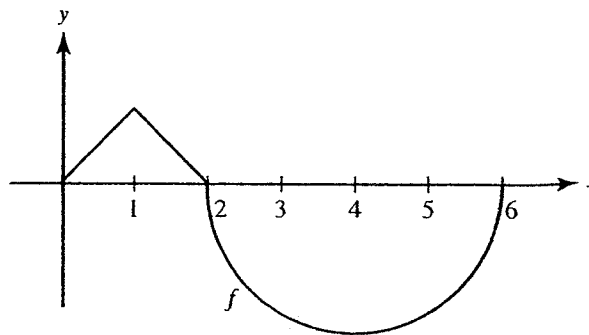
- (A)  $2x \sin \frac{1}{x} - x^2 \cos \frac{1}{x}$     (B)  $-\frac{2}{x} \cos \frac{1}{x}$     (C)  $2x \cos \frac{1}{x}$   
 (D)  $2x \sin \frac{1}{x} - \cos \frac{1}{x}$     (E)  $-\cos \frac{1}{x}$

32.  $y = \frac{1+x^2}{1-x^2}$

- (A)  $-\frac{4x}{(1-x^2)^2}$     (B)  $\frac{4x}{(1-x^2)^2}$     (C)  $\frac{-4x^3}{(1-x^2)^2}$   
 (D)  $\frac{2x}{1-x^2}$     (E)  $\frac{4}{1-x^2}$

Use the graph to answer Questions

34–36. It consists of two line segments and a semicircle.



34.  $f'(x) = 0$  for  $x =$

- (A) 1 only  
 (B) 2 only  
 (C) 4 only  
 (D) 1 and 4  
 (E) 2 and 6

35.  $f'(x)$  does not exist for  $x =$

- (A) 1 only    (B) 2 only    (C) 1 and 2  
 (D) 2 and 6    (E) 1, 2, and 6

36.  $f'(5) =$

- (A)  $\frac{1}{2}$     (B)  $\frac{1}{\sqrt{3}}$     (C) 1    (D) 2    (E)  $\sqrt{3}$

In each of Questions 43–46,  $y$  is a differentiable function of  $x$ . Choose the alternative that is the derivative  $\frac{dy}{dx}$ .

43.  $x^3 - xy + y^3 = 1$

(A)  $\frac{3x^2}{x-3y^2}$  (B)  $\frac{3x^2-1}{1-3y^2}$  (C)  $\frac{y-3x^2}{3y^2-x}$

(D)  $\frac{3x^2+3y^2-y}{x}$  (E)  $\frac{3x^2+3y^2}{x}$

44.  $x + \cos(x+y) = 0$

(A)  $\csc(x+y) - 1$  (B)  $\csc(x+y)$  (C)  $\frac{x}{\sin(x+y)}$

(D)  $\frac{1}{\sqrt{1-x^2}}$  (E)  $\frac{1-\sin x}{\sin y}$

45.  $\sin x - \cos y - 2 = 0$

(A)  $-\cot x$  (B)  $-\cot y$  (C)  $\frac{\cos x}{\sin y}$

(D)  $-\csc y \cos x$  (E)  $\frac{2-\cos x}{\sin y}$

46.  $3x^2 - 2xy + 5y^2 = 1$

(A)  $\frac{3x+y}{x-5y}$  (B)  $\frac{y-3x}{5y-x}$  (C)  $3x+5y$

(D)  $\frac{3x+4y}{x}$  (E) none of these

49. If  $f(x) = 16\sqrt{x}$ , then  $f''(4)$  is equal to

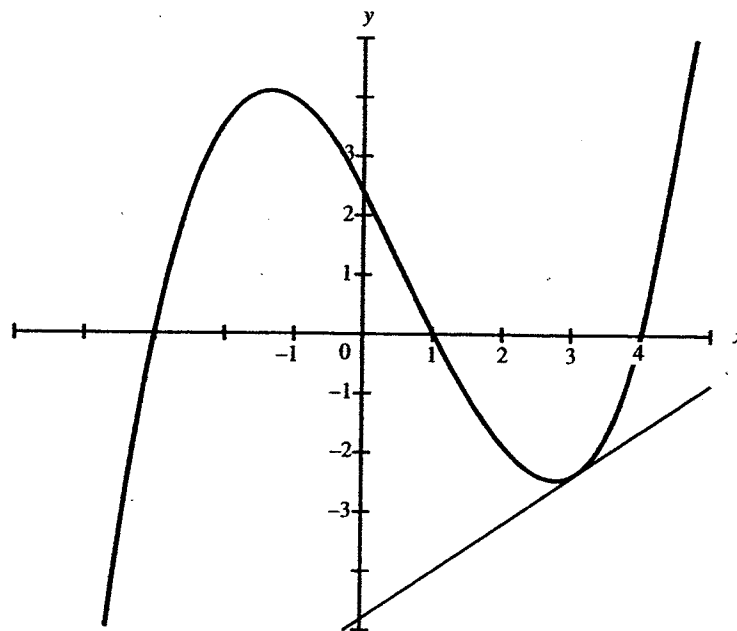
(A)  $-32$  (B)  $-16$  (C)  $-4$  (D)  $-2$  (E)  $-\frac{1}{2}$

51. If a point moves on the curve  $x^2 + y^2 = 25$ , then, at  $(0, 5)$ ,  $\frac{d^2y}{dx^2}$  is

(A)  $0$  (B)  $\frac{1}{5}$  (C)  $-5$  (D)  $-\frac{1}{5}$  (E) nonexistent

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Use this graph of  $y = f(x)$  for Questions 76 and 77.



76.  $f'(3)$  is most closely approximated by

- (A) 0.3    (B) 0.8    (C) 1.5    (D) 1.8    (E) 2

77. The rate of change of  $f(x)$  is least at  $x \approx$

- (A) -3    (B) -1.3    (C) 0    (D) 0.7    (E) 2.7