For #1-5, find $\frac{dy}{dx}$.

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

(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) $\frac{7-6x}{(3x+1)^2}$

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

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

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

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

4. $y = \ln\frac{e^x}{e^x-1}$

(A) $x - \frac{e^x}{e^x-1}$ (B) $\frac{1}{e^x-1}$ (C) $-\frac{1}{e^x-1}$ (D) 0 (E) $\frac{e^x-2}{e^x-1}$

5. $y = \tan^{-1}\frac{x}{2}$

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

In questions #6-11, 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 $B = f \bullet g$, 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 $M(x) = f(g(x))$, then $M'(1)$=?

(A) -12 (B) -6 (C) 4 (D) 6 (E) 12

11. If $S(x) = f^{-1}(x)$, then $S'(3)$=?

(A) -2 (B) $-\frac{1}{25}$ (C) $\frac{1}{4}$ (D) $\frac{1}{2}$ (E) 2

12. A differentiable function f has 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

13. $y = x^2 \sin\frac{1}{x}$ $(x \neq 0)$, then $y' = ?$

(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) $-\cos\frac{1}{x}$

14. $y = \sec^2\sqrt{x}$, then $y' = ?$

(A) $\frac{\sec\sqrt{x}\tan\sqrt{x}}{\sqrt{x}}$ (B) $\frac{\tan\sqrt{x}}{\sqrt{x}}$ (C) $2\sec\sqrt{x}\tan^2\sqrt{x}$

(D) $\frac{\sec^2\sqrt{x}\tan\sqrt{x}}{\sqrt{x}}$ (E) $2\sec^2\sqrt{x}\tan\sqrt{x}$

15. $x^3 - xy + y^3 = 1$ $\frac{dy}{dx} = ?$

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

16. $\sin x - \cos y - 2 = 0$ $\frac{dy}{dx} = ?$

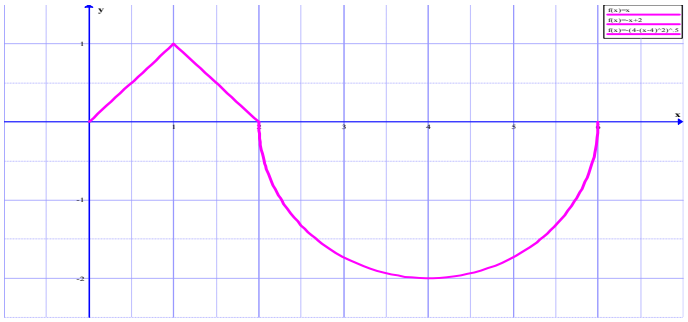
(A) $-\cot x$ (B) $-\cot y$ (C) $\frac{\cos x}{\sin y}$

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

17. 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

Use the graph to answer Questions #18-20. It consists of two line segments and a semicircle.



18. $f'(x)=0$ for $x=?$

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

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

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

20. $f'(5)=?$

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

21. At how many points on the interval [-5,5] is a tangent to $y=x+\cos x$ parallel to the secant line?

(A) none (B) 1 (C) 2 (D) 3 (E) more than 3

22. If $f(x)=\frac{x}{(x-1)^2}$, then the set of all x's for which $f'(x)$ exists is

(A) all reals
(B) all reals except $x=1$ and $x=-1$
(C) all reals except $x=-1$
(D) all reals except $x=\frac{1}{3}$ and $x=-1$
(E) all reals except $x=1$

23. $\lim_{h\to 0}\frac{(1+h)^6-1}{h}$

(A) 0 (B) 1 (C) 6 (D) ∞ (E) nonexistent

24. The function $f(x)=x^{\frac{2}{3}}$ on [-8,8] does not satisfy the conditions of the mean-value theorem because

(A) $f(0)$ is not defined.
(B) $f(x)$ is not continuous on [-8,8].
(C) $f'(-1)$ does not exist.
(D) $f(x)$ is not defined for $x<0$.
(E) $f'(0)$ does not exist.

25. If $f(a)=f(b)=0$ and $f(x)$ is continuous on [a,b], then

(A) $f(x)$ must be identically zero.
(B) $f'(x)$ may be different from zero for all x on [a,b].
(C) there exists at least one number c, $a<c<b$, such that $f'(c)=0$.
(D) $f'(x)$ must exist for every x on (a,b).

26. If $f(x)=2x^3-6x$, at what point on the interval $0\le x\le\sqrt{3}$, if any, is the tangent to the curve parallel to the secant line?

(A) 1 (B) -1 (C) $\sqrt{2}$ (D) 0 (E) nowhere

27. $\lim\limits_{x\to 0}\dfrac{\sin 3x}{\sin 4x}$ is

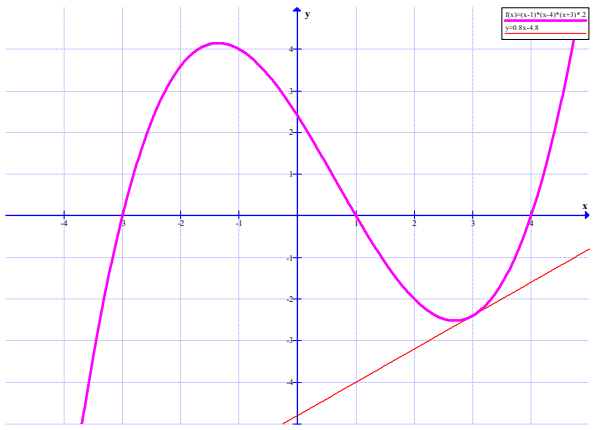
(A) 1 (B) $\dfrac{4}{3}$ (C) $\dfrac{3}{4}$ (D) 0 (E) nonexistent

28. Let $f(x)=3^x-x^3$. The tangent to the curve is parallel to the secant through (0,1) and (3,0) for x equal

(A) only to 0.984 (B) only to 1.244 (C) only to 2.727

(D) to 0.984 and 2.804 (E) to 1.244 and 2.727

Use this graph of $y=f(x)$ for Questions #29-30.



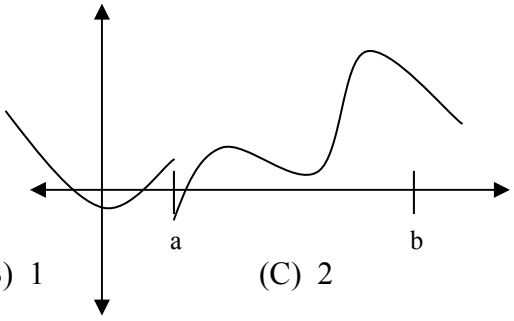
29. $f'(3)$ is most closely approximated by

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

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

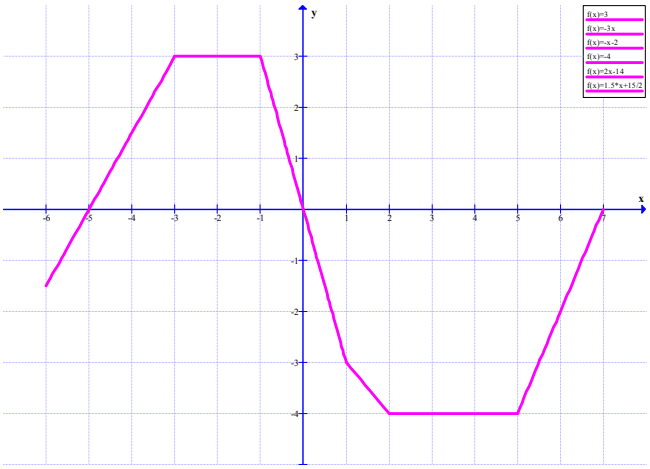
(A) -3 (B) -1.3 (C) 0 (D) 0.7 (E) 2.7

31. At how many points on the interval [a,b] does the function graphed satisfy the Mean Value Theorem?



(A) none (B) 1 (C) 2 (D) 3 (E) 4

Questions #32-36 are based on the following graph of $f(x)$, sketched on [-6,7].
Assume the horizontal and vertical grid lines are equally spaced at unit intervals.



32. On the interval $1 < x < 2$, $f(x)$ =?

(A) $-x-2$ (B) $-x-3$ (C) $-x-4$ (D) $-x+2$ (E) $x-2$

33. Over which of the following intervals does $f'(x)$ equal zero?

I. (-6,3) II. (-3,-1) III. (2,5)

(A) I only (B) II only (C) I & II only (D) I & III only (E) II & III only

34. How many points of discontinuity does $f'(x)$ have on the interval $-6 < x < 7$?

(A) none (B) 2 (C) 3 (D) 4 (E) 5

35. For $-6 < x < -3$, $f'(x)$ equals ?

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

36. Which of the following statements about the graph of $f'(x)$ is false?

(A) It consists of 6 horizontal segments.
(B) It has 4 jump discontinuities.
(C) $f'(x)$ is discontinuous at each x in the set {-3,-1,1,2,5}.
(D) $f'(x)$ ranges from -3 to 2.
(E) On the interval $-1 < x < 1, f'(x) = -3$.

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37. $y = \dfrac{e^x - e^{-x}}{e^x + e^{-x}} \quad y' = ?$

(A) 0 (B) 1 (C) $\dfrac{2}{(e^x + e^{-x})^2}$ (D) $\dfrac{4}{(e^x + e^{-x})^2}$ (E) $\dfrac{1}{e^{2x} + e^{-2x}}$

38. From the values of f shown, estimate $f'(2)$.

x	1.92	1.94	1.96	1.98	2.00
$f(x)$	6.00	5.00	4.40	4.10	4.00

(A) -0.10 (B) -0.20 (C) -5 (D) -10 (E) -25

39. Suppose $y = f(x) = 2x^3 - 3x$. If $h(x)$ is the inverse function of $f(x)$, then $h'(-1)$=?

(A) -1 (B) $\frac{1}{5}$ (C) $\frac{1}{3}$ (D) 1 (E) 3

For #40-43, find $\frac{dy}{dx}$.

40. $x = t - \sin t$ and $y = 1 - \cos t$

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

41. $x = \cos^3\theta$ and $y = \sin^3\theta$

(A) $\tan^3\theta$ (B) $-\cot\theta$ (C) $\cot\theta$ (D) $-\tan\theta$ (E) $-\tan^2\theta$

42. $x = 1 - e^{-t}$ and $y = t + e^{-t}$

(A) $\frac{e^{-t}}{1-e^{-t}}$ (B) $e^{-t} - 1$ (C) $e^t + 1$ (D) $e^t - e^{-2t}$ (E) $e^t - 1$

43. $x = \frac{1}{1-t}$ and $y = 1 - \ln(1-t)$ $(t < 1)$

(A) $\frac{1}{1-t}$ (B) $t - 1$ (C) $\frac{1}{x}$ (D) $\frac{(1-t)^2}{t}$ (E) $1 + \ln x$