

BASHEWAM SCHOOL
2020/2012 E.C Mathematics Questions for grade 12
Unit 3: Introduction to derivatives

1. Which of the following statement is **NOT** true about derivative of a function?
 - A. If a function is differentiable at a point, then it is continuous at that point.
 - B. The derivative of a function is a function.
 - C. If the derivative of a function exists at a point, then its second derivative exists at that point.
 - D. If a function is differentiable at the number a, then a is in the domain of the function.
2. Which of the following is the derivative of $x^2 \sin x + e^x \cos x$?
 - A. $2x \sin x - e^x \sin x$
 - B. $2x \sin x + x^2 \cos x - e^x \sin x$
 - C. $2x \sin x - e^x \sin x + e^x \cos x$
 - D. $2x \sin x + x^2 \cos x + e^x \cos x - e^x \sin x$
3. If $g(x) = \frac{\ln(x^2+1)}{x^2+1}$, then which of the following is the value of $g'(1)$?
 - A. $\frac{1}{2} \ln 2$
 - B. $-\frac{1}{2} \ln 2$
 - C. $2(1-\ln 2)$
 - D. $\frac{1}{2}(1-2 \ln 2)$
4. What is the derivative of the function $f(x) = \sqrt{1-2x}$?
 - A. $\frac{1}{\sqrt{1-2x}}$
 - B. $\frac{-1}{2\sqrt{1-2x}}$
 - C. $\frac{2}{\sqrt{1-2x}}$
 - D. $\frac{-1}{\sqrt{1-2x}}$
5. Let $f(x) = |x-4|$. Which of the following is true?
 - A. $f(x)$ is differentiable $\forall x \in \mathbb{R}$
 - B. $f(x)$ is differentiable in $[4, \infty)$
 - C. $f(x)$ is discontinuous at 4.
 - D. None of the above.
6. Which of the following statement is true?
 - A. If a function is continuous at a, then it is differentiable.
 - B. If a function is not differentiable at some point in its domain then it is not continuous.
 - C. If a function is differentiable in its domain, then it is continuous at every point of its domain.
 - D. If the derivative of a function at some point is zero, the function is a constant function.
7. The equation of the line tangent to the graph of $f(x) = \frac{3x}{x-2}$ at $(1, f(1))$
 - A. $y = -3x$
 - B. $y = 3x - 6$
 - C. $y = -6x + 3$
 - D. $y = 6x - 9$
8. Let $G(x) = f(x^2 + 1)$. If $f'(2) = -1 = f''(2)$, then $G''(1) =$ _____.
 - A. -6
 - B. -4
 - C. -2
 - D. -1
9. What is the derivative of the function $f(x) = \sin(x - \cos(2x))$?
 - A. $\cos(x - \cos(2x))$
 - B. $2 \sin 2x \cos(1 + \sin(2x))$
 - C. $\sin(x - \cos(2x)) - 2 \cos(x - \cos(2x))$
 - D. $\cos(x - \cos(2x)) + 2 \sin 2x \cos(x - \cos(2x))$

10. Let $g(x) = x^5 + 8x^2 - 3$. What is $(g^{-1})'(6)$, if $g(1) = 6$?

- A. $\frac{1}{6556}$ B. $\frac{1}{96}$ C. $\frac{1}{21}$ D. $\frac{21}{6556}$

11. What is the equation of the straight line having slope - 4 that is tangent to the curve $y = 3x^2 + 2x + 1$?

- A. $y = 4x$ B. $y - 1 = 4x$ C. $y = -4x - 2$
D. $y = -4x + 6$

12. Let $f(x) = e^{-2x}$. For each positive integer n , $f^{(n)}(0) = \underline{\hspace{2cm}}$.

- A. $(2)^n$ B. $-(2)^n$ C. $(-2)^n$ D. $(-1)^{n+1}2^n$

13. The equation of the line tangent to the graph of $g(x) = 2x \sin(1-x)$ at $(1, g(1))$ is:

- A. $y = 3x - 5$ B. $y = 3x - 1$ C. $y = x + 1$ D. $y = x - 3$

14. Let $G(x) = f\left(\frac{3x^2+1}{x-1}\right)$ where f is a differentiable function on $\mathbb{R} \setminus \{1\}$. If $f'(0) = 0$, $f'(-1) = 2$ and

$f'(3) = -3$, then what is $G'(0)$?

- A. -2 B. -1 C. 0 D. 3

15. Suppose that at time $t \geq 0$ the position of a particle moving along the x -axis is $x(t) = (t-1)(t+4)^4$.

During what time interval does the particle move to the left?

- A. $[0, 3]$ B. $[4, \infty)$ C. $\left[0, \frac{8}{5}\right]$ D. $\left[\frac{8}{5}, 4\right]$

16. Let $f(x) = e^{3x} - \cos^2 x$. Then $f'(x) = \underline{\hspace{2cm}}$.

- A. $3e^{3x} + \sin 2x$ B. $3e^{3x} - \sin 2x$ C. $e^{3x} + 2 \sin x \cos x$ D. $\frac{1}{3}e^{3x} - 2 \sin x \cos x$

17. Which one of the following statements is true?

- A. If a function is continuous everywhere in its domain, then it is differentiable.
B. If $f(x)$ is continuous in the open interval (a, b) , then f attains both its maximum and minimum values in $[a, b]$.
C. A derivative of a continuous function is also continuous.
D. Every continuous function is integrable.

18. If $F(x) = f(2g(x))$, where $f(x) = x^4 + x^3 + 1$ for $0 \leq x \leq 3$, and $g(x) = f^{-1}(x)$, then the value of the

derivative $F'(3)$ is :

- A. $\frac{88}{7}$ B. $\frac{270}{109}$ C. $\frac{1}{218}$ D. It does not exist

19. If $G(x) = f(x^2 + x)$, $f'(2) = -2$ and $f''(2) = 3$, then $G''(1) = \underline{\hspace{2cm}}$.

- A. -18 B. 9 C. 23 D. 27

20. Let $f(x) = \begin{cases} 3x-1, & x \leq 2 \\ \dots \end{cases}$. What is the derivative of f at $a = 2$?
 A. 3 B. 4 C. 5 D. Does not exist
21. If $h(x) = 5^{\pi x}$, then $h'''(0)$ is equal to:
 A. π^3 B. $(\pi \ln 5)^3$ C. $(\ln 5)^3$ D. $\pi(\ln 5)^3$
22. If $f(2) = -3$, $f'(2) = 4$, $g(1) = 1$, $g'(1) = -5$, and $F(x) = f(2x+2)g(1-x^2)$, then what is the value of $F'(0)$?
 A. 4 B. 8 C. -11 D. -22
23. At what point does the equation of the line tangent to the graph of $f(x) = e^{2x}$ at $x = 0$, intersect the x -axis?
 A. $\left(-\frac{1}{2}, 0\right)$ B. $(-2, 0)$ C. $\left(\frac{1}{2}, 0\right)$ D. $(-\sqrt{e}, 0)$
24. Let $f(x) = \ln(x^2 - 3x)$. Then $f'(-1) = \underline{\hspace{2cm}}$.
 A. $\frac{17}{16}$ B. $\frac{7}{16}$ C. $-\frac{5}{16}$ D. $\frac{19}{16}$
25. If $g(x) = xf(3x+1)$, $f(4) = 1$ and $f'(4) = 2$, then $g'(1)$ is equal to:
 A. 7 B. 6 C. 4 D. 3
26. Let $f(x) = \cos x + 5^x$. Then, what is $f'(x)$?
 A. $\sin x + 5^x \ln x$ B. $-\sin x + 5^x \log 5$ C. $-\sin x + 5^x \ln 5$ D. $\sin x + \log 5$
27. Which of the following is the equation of the tangent line to the graph of $f(x) = \frac{3x}{x-1}$ at $(2, f(2))$?
 A. $3y + x = 20$ B. $3y - x = 16$ C. $y - 3x = 0$ D. $y + 3x = 12$
28. What is the simplified form of the derivative of $f(x) = \frac{\sin x}{1+\cos x}$?
 A. $1 + \sec x$ B. $\frac{1}{1+\cos x}$ C. $\frac{\cos x}{(1+\cos x)^2}$ D. $\tan x + \cot x$
29. For $f(x) = x^2\sqrt{2x+12}$, what is the equation of the tangent line to the graph of f at $x = 2$?
 A. $y - 4 = 16(x-2)$ B. $y = 17(x-2)+16$ C. $y = \frac{1}{\sqrt{12}}(x-2) - 16$ D. $y = 8(x-2) + 32$
30. If $f(2) = -3$, $f'(2) = 4$, $g(1) = -5$, $g'(1) = 1$ and $F(x) = f(2x+2)g(1-x^2)$, then what is the value of $F'(0)$?
 A. 19 B. 0 C. -20 D. -40

31. Let $f(x) = \begin{cases} 3x-1, & x \leq 2 \\ \dots \end{cases}$, which of the following is true?
 A. $f'(2) = 1$ B. $f'(2) = 3$ C. $f'(2) = 5$ D. f has no derivative at 2

32. If $f(x) = xe^{3x}$, then which of the following is equal to $f''(x)$?
 A. $(1+3x)e^{3x}$ B. $(6+3x)e^{3x}$ C. $(3+9x)e^{3x}$ D. $(6+9x)e^{3x}$

33. Which of the following is the equation of the line tangent to the graph of $f(x)$

$= \begin{cases} x-\pi, & x \leq 0 \\ \dots \end{cases}$,
 at $(\pi, f(\pi))$?
 A. $y = 2x - 2\pi + 1$ B. $y = 2x - 2\pi - 1$ C. $y = -2x + 2\pi + 1$ D. $y = -2x + 2\pi - 1$

34. Let $h(x) = x+3^x$ and $F(x) = (f \circ h)(x)$ such that $f'(4) = -1$. Then, $F'(1)$ is equal to:
 A. $+1+3\ln 3$ B. $-1-3\ln 3$ C. $4+12\ln 3$ D. $-4-12\ln 3$

35. If $f(x) = \ln(2 + \sec x)$, then $f'(x)$ is equal to:
 A. $\frac{\tan x}{2+\sec x}$ B. $\frac{\tan x}{2+\cos x}$ C. $\frac{\cos x}{1+2\cos x}$ D. $\frac{\tan x}{1+2\cos x}$

36. Let $f(x) = e^{3x-1}$ and $g(x) = \tan x$. If $F(x) = xf(x) + f(g(x))$, which of the following is equal to $F'(0)$?
 A. $3e^{-1}$ B. $4e^{-1}$ C. $\frac{1}{e}\left(1+\frac{1}{e}\right)$ D. $\frac{1}{e}\left(1+\frac{3}{e}\right)$

37. Let $f(x) = g(\sqrt{4x+1})$. If $g'(3) = \frac{1}{2}$, then $f'(2)$ is equal to:
 A. $\frac{2}{3}$ B. $\frac{1}{3}$ C. $\frac{1}{2}\sqrt{5}$ D. $\frac{1}{2}\sqrt{13}$

38. Which of the following is the second derivative of $f(x) = \ln(x^2 + 1)$?

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

39. Let $f(x) = x|x|$, for all $x \in (-\infty, \infty)$. Which of the following is true?

- A. f is not differentiable at $x = 0$. B. $f'(x) = 2|x|$ at each $x \in (-\infty, \infty)$.
 C. f is differentiable only on $(0, \infty)$. D. $f'(x) = 2x$ at each $x \in (-\infty, \infty)$
40. If $f(x) = e^{2x} + x - 3 \cos x$, then what is $f''(x)$?
 A. $e^{2x} + 1 - 3 \sin x$ B. $e^{2x} + 1 + 3 \sin x$ C. $4e^{2x} - 3 \cos x$ D. $4e^{2x} + 3 \cos x$
41. If $g(x) = xf(x) - \sqrt{f(x)}$ and $f(2) = f'(2) = 4$, then which of the following is equal to $g'(2)$?
 A. 11 B. 8 C. 2 D. 0
42. Which one of the following is true about the derivative of $f(x) = x|x|$?
 A. f is not differentiable at $x = 0$. B. $f'(x) = 2|x|$ for every $x \in (-\infty, \infty)$.
 C. $f'(x) = 2x$, for every $x \in (-\infty, \infty)$. D. $f'(x) = |x| + x$, for every $x \in (-\infty, \infty)$.
43. Which one of the following is the equation of the line tangent to the graph of $f(x) = \frac{1}{x+1} + \cos x$ at $(0, f(0))$?
 A. $x + y = 1$ B. $x - y = -2$ C. $x + y = 2$ D. $x + 4y = 2$
44. If $f(x) = \frac{x^2}{1+xg(x)}$, $g(2) = 1$ and $g'(2) = 10$, then which of the following is equal to $f'(2)$?
 A. -8 B. $-\frac{8}{9}$ C. $\frac{4}{3}$ D. $\frac{8}{9}$
45. The simplified form of the derivative of $f(x) = \frac{1+\sin x}{\cos x}$ is:
 A. $\sec x + \tan x$ B. $\frac{1+\sin x}{\cos^2 x}$ C. $\frac{1}{1+\tan x}$ D. $\frac{\cos x}{\sin^2 x}$
46. If $y = \sin(3x^2)$, then the simplified form of $\frac{d^2 y}{dx^2}$ is:
 A. $-6 \sin(3x^2)$ B. $\cos(6x) - 6 \sin(3x^2)$ C. $6 \cos(3x^2) - 36 x^2 \sin(3x^2)$ D. $x^2 \cos(3x^2) + 6 \sin(3x^2)$

47. If $e^{2x}\sin x$, then $f''(x)$ is equal to :

- A. $3e^{2x}\sin x - 4e^{2x}\cos x$ B. $4e^{2x}\sin x + 2e^{2x}\cos x$ C. $e^{2x}(3\sin x + 4\cos x)$ D. $e^{2x}(4\sin x - 3\cos x)$

48. If $f(x) = x^2\sqrt{2x+12}$, what is the slope of the tangent line to the graph of f at $x = 2$?

- A. -4 B. 2 C. 18 D. 17
49. If $F(x) = f(2x+2) \cdot g(1-x^2)$, with $f(2) = -3$, $f'(2) = 4$, $g(1) = -5$, and $g'(1) = 1$, then what is the actual value of $F'(0)$?

- A. -40 B. -20 C. 0 D. 19
50. If $f(x) = \ln(\sqrt{x^2+1})$, which of the following is equal to $f'(x)$?

- A. $\frac{x}{\sqrt{x^2+1}}$ B. $\frac{x}{x^2+1}$ C. $\frac{2x}{\sqrt{x^2+1}}$ D. $\frac{2x}{x^2+1}$

51. For what values of a and b is the function $f(x) = \begin{cases} 1-3x^2, & \text{for } x \leq 1 \\ ax+b, & \text{for } x > 1 \end{cases}$ differentiable at $x = 1$?

- A. $a = 6, b = 0$ B. $a = -3, b = 1$ C. $a = 0, b = -2$ D. $a = -6, b = 4$

52. If $f(2) = -3$, $f'(2) = 4$, $g(1) = -5$, $g'(1) = 1$ and $F(x) = f(2x+2) \cdot g(1-x^2)$, then what is the value of $F'(0)$?

- A. 19 B. 0 C. -20 D. -40

53. Suppose that a function f has the property that $f(x+y) = f(x)f(y)$ for all values of x and y and that

$f(0) = 2$, $f'(0) = 1$. Then which one of the following represents the formula for the derivative $f'(x)$?

- A. $f'(x) = 2f'(x) + 1$ B. $f'(x) = f(x) + 2f'(x)$ C. $f'(x) = f(x) + 2$ D. $f'(x) = 2f(x) - 1$

54. If $f(x) = e^{3x}\cos x - \frac{x+\pi}{x^2+2}$. Then $f'(0)$ is equal to _____.

- A. $3 - \frac{\pi}{2}$ B. $\frac{3}{2}$ C. $\frac{7}{4}$ D. $\frac{5}{2}$

55. If $f(x) = \ln(\sqrt{x^2-5})$, which one of the following is equal to $f'(x)$?

- A. $\frac{x}{x^2-5}$ B. $\frac{-x}{\sqrt{x^2-5}}$ C. $\frac{2x}{\sqrt{x^2-5}}$ D. $\frac{-x}{x^2-5}$

56. $\frac{d}{dx}(\ln e^{2x})$ is equal to:

A. $\frac{1}{e^{2x}}$

B. $\frac{2}{e^{2x}}$

C. $2x$

D. 2

57. If $f(x) = 2 + |x-3|$ for all x , then the value of the derivative $f'(x)$ at $x = 3$ is _____.

A. -1

B. does not exist

C. 1

D.

2

58. Let $f(x) = \sqrt{e^x} + e^{\sqrt{x}}$ then $f'(4)$ is _____?

A. $\frac{1}{2}(e + \sqrt{e})$

B. $\frac{3}{4}e^2$

C. e^2

D. none

59. Let $G(x+1) = f(x^2+x-1)$ with $f'(1) = -4$ and $f''(1) = 2$ then which of the following is equal

to $G''(2)$?

A. -8

B. 10

C. -6

D. -12

60. Let $f(x) = e^{(1/5)^x}$, then $f'(-1)$ is equal to

A. $-e^{1/5} \ln 5$

B. $-5(\ln 5)e^5$

C. $\frac{-1}{5}e^5 \ln 5$

D.

$-5(\ln 5)e^{1/5}$