

DIFFERENTIATION (2020-21)

MCQs & VSA QUESTIONS

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- 1 Find $\frac{dy}{dx}$, if $x^2 + y^2 = 5$
 A) $-\frac{x}{y}$ B) $\frac{x}{y}$ C) $\frac{y}{x}$ D) $2x + 2y = 0$ ANS: A)
- 2 Differentiate $\sin^{-1}x^2$ with respect to x .
 A) $\frac{x}{\sqrt{1-x^4}}$ B) $\frac{2x}{\sqrt{1-x^2}}$ C) $\frac{-x}{\sqrt{1-x^4}}$ D) $\frac{2x}{\sqrt{1-x^4}}$ ANS: D)
- 3 Differentiate $\log_e(\sin x)$ with respect to x .
 A) $\sin x$ B) $\tan x$ C) $\cot x$ D) $\log \sin x$ ANS: C)
- 4 If $y = e^{-3\log x}$ then find $\frac{dy}{dx}$
 A) $\frac{3}{x^4}$ B) $\frac{3}{x^3}$ C) $-\frac{3}{x^4}$ D) $\frac{4}{x^4}$ ANS: C)
- 5 Differentiate $\log(\log x)$, w.r.t. x .
 A) $\frac{1}{x \log x}$ B) $\frac{1}{\log x}$ C) $\frac{x}{\log x}$ D) $\frac{-1}{x \log x}$ ANS: A)
- 6 Find the value of k , so that the function $f(x) = \begin{cases} kx^2, & x \geq 1 \\ 4, & x < 1 \end{cases}$ is continuous at $x = 1$.
 A) $k = 4$ B) $k = -4$ C) $k = 8$ D) $k = 2$ ANS: A)
- 7 Find the value of k so that the function f defined by
 $f(x) = \begin{cases} kx, & x \leq \pi \\ \cos x, & x > \pi \end{cases}$ is continuous at $x = \pi$.
 A) $\frac{2}{\pi}$ B) $\frac{\pi}{2}$ C) $-\frac{\pi}{2}$ D) $-\frac{2}{\pi}$ ANS: D)
- 8 Find $\frac{d^2y}{dx^2}$, if $y = \log x$
 A) $\frac{1}{x^2}$ B) $-\frac{1}{x^2}$ C) x^2 D) $\frac{1}{x}$ ANS: B)
- 9 For what value of k is the function defined by
 $f(x) = \begin{cases} \frac{\sin x + x \cos x}{x}, & x \neq 0 \\ k, & x = 0 \end{cases}$ continuous at $x = 0$?
 A) -2 B) 2 C) $\frac{1}{2}$ D) 1 ANS: B)
- 10 The function $f(x) = \begin{cases} \frac{\sin 3x}{x}, & x \neq 0 \\ \frac{k}{2}, & x = 0 \end{cases}$ is continuous at $x = 0$, then find the value of k .
 A) -6 B) 3 C) 4 D) 6 ANS: D)
- 11 Find k , so that the function $f(x) = \begin{cases} \frac{x^2-25}{x-5}, & x \neq 5 \\ k, & x = 5 \end{cases}$ is continuous at $x = 5$
 A) 10 B) 5 C) 25 D) 6 ANS: A)

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12. Find $\frac{dy}{dx}$ at (4,9) if $\sqrt{x} + \sqrt{y} = 5$.

ANS: $-\frac{3}{2}$

13. Differentiate $y = e^x + e^{x^2} + e^{x^3} + e^{x^4} + e^{x^5}$ with respect to x .

14. Differentiate following with respect to x : $\sin(m \sin^{-1} x)$

15 * If $f(x) = \sqrt{\frac{\sec x - 1}{\sec x + 1}}$, find $f'(\frac{\pi}{3})$

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16 * Find the value of k so that the function f defined by

$$f(x) = \begin{cases} kx^2 + 5, & x \leq 1 \\ 2, & x > 1 \end{cases} \text{ is continuous at } x = 1.$$

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17 If $(\cos x)^y = (\cos y)^x$ find $\frac{dy}{dx}$.

18 If the function $f(x)$ defined by

$$f(x) = \begin{cases} a \sin \frac{\pi}{2}(x+1), & x \leq 0 \\ \frac{\tan x - \sin x}{x^3}, & x > 0 \end{cases} \text{ is continuous at } x = 0, \text{ find } a.$$

19 If $\frac{x}{a} + \frac{y}{b} = 1$ find $\frac{dy}{dx}$

20 If $x = ae^\theta(\sin \theta - \cos \theta)$ and $y = ae^\theta(\sin \theta + \cos \theta)$ find $\frac{dy}{dx}$ at $\theta = \frac{\pi}{4}$

21 If $\sin^{-1}\left(\frac{2^{x+1} \cdot 3^x}{1 + (36)^x}\right)$, find $\frac{dy}{dx}$

22 If $y = \tan^{-1}\left(\frac{5ax}{a^2 - 6x^2}\right)$, show that $\frac{dy}{dx} = \frac{3a}{a^2 + 9x^2} + \frac{2a}{a^2 + 4x^2}$

23 Differentiate $\sin^2 x$ with respect to $e^{\cos x}$.

24 Differentiate the function $\sin^{-1}\left(\frac{2^{x+1}}{1 + 4^x}\right)$ with respect to x .

25 If $y = \tan^{-1}\left(\frac{5ax}{a^2 - 6x^2}\right)$, show that $\frac{dy}{dx} = \frac{3a}{a^2 + 9x^2} + \frac{2a}{a^2 + 4x^2}$

26 If $f(x) = \begin{cases} \frac{x-4}{|x-4|} + a, & x < 4 \\ a + b, & x = 4 \\ \frac{x-4}{|x-4|} + b, & x > 4 \end{cases}$ is continuous at $x = 4$, find a and b .

27 If $y = \tan^{-1}\left(\frac{4x}{1-4x^2}\right)$ then prove that $\frac{dy}{dx} = \frac{4}{(1+4x^2)}$

28 Differentiate the following w.r.t x : $\tan^{-1} \sqrt{\frac{1-\cos x}{1+\cos x}}$

29 Differentiate the following w.r.t x : $\tan^{-1}\left(\frac{\cos x + \sin x}{\cos x - \sin x}\right)$

30 Differentiate the following w.r.t x : $\tan^{-1}(\sec x + \tan x)$

- 31 Differentiate the following w.r.t x $\tan^{-1}\left(\frac{\sqrt{x}-x}{1+x^{3/2}}\right)$
- 32 If $y = \log \tan\left(\frac{\pi}{4} + \frac{x}{2}\right)$, then show that $\frac{dy}{dx} - \sec x = 0$.
- 33 If $y = \sqrt{x + \sqrt{x + \sqrt{x + \dots \dots \dots \text{to } \infty}}}$, prove that $\frac{dy}{dx} = \frac{1}{(2y-1)}$.
- 34 Give an example of a function which is continuous but not differentiable at exactly two points.
35. if $y = \log x$, find $\frac{d^2y}{dx^2}$
36. If $y = \sin 3x$, find y_2
37. if $y = e^{-3x}$ find $\frac{d^2y}{dx^2}$
38. If $y = x \cos x$, find y_2 .
39. If $y = e^x + e^{-x}$ prove that $y'' = y$.
40. If $y = \sin 5x$ find $\frac{d^2y}{dx^2}$
41. If $y = 500e^{7x} + 600e^{-7x}$, show that $\frac{d^2y}{dx^2} = 49y$.
42. If the derivative of $\tan^{-1}(a + bx)$ takes the value 1 at $x = 0$, prove that $b = 1 + a^2$.
43. Differentiate $\cos x$ with respect to e^x
44. Given $f(0) = -2$, $f'(0) = 3$. Find $h'(0)$, where $h(x) = x f(x)$.
45. Given functions $f(x) = \frac{x^2-4}{x-2}$ and $g(x) = x + 2$, $x \in R$. Then which of the following is correct?
- a) f is continuous at $x = 2$, g is continuous at $x = 2$
 - (b) f is continuous at $x = 2$, g is not continuous at $x = 2$
 - (c) f is not continuous at $x = 2$, g is continuous at $x = 2$
 - (d) f is not continuous at $x = 2$, g is not continuous at $x = 2$

46. A function f is said to be continuous for $x \in R$, if
- (a) it is continuous at $x = 0$
 - (b) differentiable at $x = 0$
 - (c) continuous at two points
 - (d) differentiable for $x \in R$
47. A function $f(x) = \sin x + \cos x$ is continuous function. State true or false.
48. The derivative of $\sin x$ with respect to $\log x$ is
49. If $y = Ae^{5x} + Be^{-5x}$ then $\frac{d^2y}{dx^2}$ is equal to
50. $y = x^x$, $\frac{dy}{dx}$ is equal to _____.
51. If $y = a \sin^3 t$, $x = a \cos^3 t$, then $\frac{dy}{dx} = 1$ at $t = \frac{3\pi}{4}$. State true or false.
52. State which of the following is continuous as well as differentiable for $x \in R$
- (a) $|x|$
 - (b) $[x]$
 - (c) polynomial function
 - (d) $\operatorname{sgn}(x)$
53. Derivative of $\sin x$ with respect to $\log x$, is
54. State the function which is continuous for all $x \in R$.
- (a) $\sin x$
 - (b) $\frac{x^2-25}{x-5}$
 - (c) $[x]$
 - (d) $\operatorname{sgn}(x)$
55. If $x = at^2$, $y = 2at$, then $\frac{d^2y}{dx^2}$ is