

## Question Bank

### APPLICATIONS OF DERIVATIVES MCQS

#### Class 12 - Mathematics

1. If the function  $f(x) = x^3 - 9kx^2 + 27x + 30$  is increasing on  $\mathbb{R}$ , then [1]
  - a)  $0 < k < 1$
  - b)  $-1 < k < 1$
  - c)  $k < -1$  or  $k > 1$
  - d)  $-1 < k < 0$
2. The maximum value of  $\left(\frac{1}{x}\right)^x$  is: [1]
  - a)  $\left(\frac{1}{e}\right)^{\frac{1}{e}}$
  - b)  $e^e$
  - c)  $e$
  - d)  $e^{1/e}$
3. The sum of two non-zero numbers is 8, the minimum value of the sum of their reciprocals is [1]
  - a)  $\frac{1}{2}$
  - b)  $\frac{1}{8}$
  - c)  $\frac{1}{4}$
  - d) none of these
4. maximum value of  $f(x) = \sin x$  in  $[\pi, 2\pi]$  is [1]
  - a) 0
  - b)  $\frac{1}{\sqrt{2}}$
  - c) 1
  - d) none of these
5. If the function  $f(x) = \cos |x| - 2ax + b$  increases along the entire number scale, then [1]
  - a)  $a > -\frac{3}{2}$
  - b)  $a = \frac{1}{2}b$
  - c)  $a \leq -\frac{1}{2}$
  - d)  $a = b$
6. Function  $f(x) = |x| - |x - 1|$  is monotonically increasing when [1]
  - a)  $x < 1$
  - b)  $0 < x < 1$
  - c)  $x < 0$
  - d)  $x > 1$
7. When  $x$  is positive, the minimum value of  $x^x$  is [1]
  - a)  $e^{-\frac{1}{e}}$
  - b)  $e^{\frac{1}{e}}$
  - c)  $\frac{1}{e}$
  - d)  $e^e$
8. The function  $f(x) = \cos x - 2\lambda x$  is monotonic decreasing when [1]
  - a)  $\lambda > 2$
  - b)  $\lambda < 1/2$
  - c)  $\lambda > 1/2$
  - d)  $\lambda < 2$
9. The least value of  $f(x) = (e^x + e^{-x})$  is [1]
  - a) 2
  - b) -2
  - c) 0
  - d) None of these
10.  $f(x) = [x(x - 3)]^2$  is increasing in [1]

- a)  $(-\infty, 0)$  b)  $(0, \frac{3}{2}) \cup (3, \infty)$
- c)  $(1, 3)$  d)  $(0, \infty)$
11. If  $ax + \frac{b}{x} \geq c$  for all positive x where a, b, > 0, then [1]
- a)  $ab < \frac{c^2}{4}$  b)  $ab \geq \frac{c^2}{4}$
- c)  $ab \geq \frac{c}{4}$  d) none of these
12. The minimum value of  $\sin x \cdot \cos x$  is [1]
- a)  $2\sqrt{2}$  b)  $\frac{1}{2}$
- c)  $\frac{1}{4}$  d)  $\sqrt{2}$
13. The minimum value of  $f(x) = 3x^4 - 8x^3 - 48x + 25$  on  $[0, 3]$  is [1]
- a) 25 b) 16
- c) -39 d) None of these
14. At  $x = \frac{5\pi}{6}$ ,  $f(x) = 2 \sin 3x + 3 \cos 3x$  is: [1]
- a) zero b) maximum
- c) minimum d) neither maximum nor minimum
15. The function  $f(x) = \cot^{-1} x + x$  increases in the interval [1]
- a)  $0, \infty$  b)  $-\infty, \infty$
- c)  $(1, \infty)$  d)  $-1, \infty$
16. The function  $f(x) = x^2 e^{-x}$  is Monotonic increasing when [1]
- a)  $x \in \mathbb{R} - [0, 2]$  b)  $0 < X < 2$
- c)  $2 < X < \infty$  d)  $X < 0$
17. The maximum value of  $f(x) = (x - 2)(x - 3)^2$  is [1]
- a)  $\frac{7}{3}$  b) 0
- c)  $\frac{4}{27}$  d) 3
18. The function  $f(x) = |x|$  has [1]
- a) only one maxima b) only one minima
- c) no maxima or minima d) none of these
19.  $a \log x + bx^2 + x$  has its extreme values at  $x = -1$  and  $x = 2$ , then [1]
- a)  $a = 2, b = -\frac{1}{2}$  b)  $a = 2, b = -1$
- c)  $a = -2, b = -\frac{1}{2}$  d)  $a = -2, b = \frac{1}{2}$
20.  $f(x) = 2x - \tan^{-1} x - \log \{x + \sqrt{x^2 + 1}\}$  is monotonically increasing when [1]
- a)  $x \in \mathbb{R}$  b)  $x > 0$
- c)  $x \in \mathbb{R} - (0)$  d)  $x < 0$
21. The function  $f(x) = x^9 + 3x^7 + 64$  is increasing on [1]





- a)  $(1, 2) \cup (3, \infty)$       b)  $(2, 4)$   
c)  $(-\infty, 1) \cup (2, 3)$       d)  $(1, 3)$
44. If  $f(x) = x + \frac{1}{x}$ , then [1]  
a) relative maximum does not exist      b) relative maximum > relative minimum  
c) relative minimum does not exist      d) relative minimum > relative maximum
45. The maximum value of  $f(x) = \frac{x}{4+x+x^2}$  on  $[-1, 1]$  is [1]  
a)  $-\frac{1}{4}$       b)  $\frac{1}{5}$   
c)  $\frac{1}{6}$       d)  $-\frac{1}{3}$
46. The maximum value of  $\left(\frac{\log x}{x}\right)$  is [1]  
a) 1      b) e  
c)  $\frac{2}{e}$       d)  $\left(\frac{1}{e}\right)$
47. The function  $f(x) = 4 \sin^3 x - 6 \sin^2 x + 12 \sin x + 100$  is strictly [1]  
a) increasing in  $\left(\pi, \frac{3\pi}{2}\right)$       b) decreasing in  $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$   
c) decreasing in  $\left(\frac{\pi}{2}, \pi\right)$       d) decreasing in  $\left[0, \frac{\pi}{2}\right]$
48. If  $f(x) = \frac{1}{4x^2+2x+1}$ , then its maximum value is [1]  
a) 1      b)  $\frac{4}{3}$   
c)  $\frac{3}{4}$       d)  $\frac{2}{3}$
49. Let  $\phi(x) = f(x) + f(2a - x)$  and  $f(x) > 0$  for all  $x \in [0, a]$  then  $\phi(x)$  [1]  
a) decreases on  $[0, a]$       b) increases on  $[-a, 0]$   
c) increases on  $[0, a]$       d) decreases on  $[a, 2a]$
50.  $f(x) = x^x$  has a stationary point at [1]  
a)  $x = 1$       b)  $x = \sqrt{e}$   
c)  $x = e$       d)  $x = \frac{1}{e}$
51. The function  $f(x) = \frac{\lambda \sin x + 2 \cos x}{\sin x + \cos x}$  is increasing, if, [1]  
a)  $\lambda > 1$       b)  $\lambda > 2$   
c)  $\lambda < 2$       d)  $\lambda < 1$
52. The function  $f(x) = \tan x - x$  [1]  
a) always increases      b) never increases  
c) always decreases      d) sometimes increases and sometimes decreases.
53. Let  $f(x) = (x - a)^2 + (x - b)^2 + (x - c)^2$ . Then  $f(x)$  has a minimum at  $x =$  [1]  
a)  $\frac{a+b+c}{3}$       b)  $3\sqrt{abc}$   
c) none of these      d)  $\frac{3}{\frac{1}{a} + \frac{1}{b} + \frac{1}{c}}$

54. let  $f(x) = \tan^{-1}(g(x))$ , where  $g(x)$  is monotonically increasing for  $0 < x < \frac{\pi}{2}$  then,  $f(x)$  is
- a) none of these  
b) increasing on  $(0, \frac{\pi}{4})$  and decreasing on  $(\frac{\pi}{4}, \frac{\pi}{2})$   
c) increasing on  $(0, \frac{\pi}{2})$   
d) decreasing on  $(0, \frac{\pi}{2})$
55. Every invertible function is [1]
- a) not necessarily monotonic function  
b) identity function  
c) constant function  
d) monotonic function
56. The minimum value of  $x \log_e x$  is equal to [1]
- a)  $e$   
b)  $\frac{1}{e}$   
c)  $2e$   
d)  $-\frac{1}{e}$
57. If the function  $f(x) = 2x^2 - kx + 5$  is increasing on  $(1, 2)$ , then  $k$  lies in the interval [1]
- a)  $(4, \infty)$   
b)  $(-\infty, 8)$   
c)  $(8, \infty)$   
d)  $(-\infty, 4)$
58. If  $f(x) = x + \frac{1}{x}$ ,  $x > 0$ , then its greatest value is [1]
- a) -2  
b) none of these  
c) 0  
d) 3
59. The function  $f(x) = x^3 + 6x^2 + 15x - 12$  is [1]
- a) Strictly increasing on  $\mathbb{R}$   
b) Increasing in  $(-\infty, 2]$  and decreasing in  $(2, \infty)$   
c) None of these  
d) Strictly decreasing on  $\mathbb{R}$
60. The function  $f(x) = x^3 - 6x^2 + 9x + 3$  is decreasing for [1]
- a)  $-1 < x < -3$   
b)  $x > 1$   
c)  $x < 1$   
d)  $x < 1$  or  $x > 3$
61. The function  $f(x) = x^x$  decreases on the interval [1]
- a)  $(0, e)$   
b)  $(0, 1)$   
c)  $(1/e, e)$   
d)  $(0, \frac{1}{e})$
62. let  $f(x) = x^3 - 6x^2 + 15x + 3$ . Then [1]
- a)  $f(x)$  is invertible  
b)  $f(x) > f(x + 1)$  for all  $x \in \mathbb{R}$   
c)  $f(x) < 0$  for all  $x \in \mathbb{R}$   
d)  $f(x) > 0$  for all  $x \in \mathbb{R}$
63. The minimum value of  $\frac{x}{\log x}$ ,  $x > 1$ , is [1]
- a) none of these  
b)  $e$   
c)  $-e$   
d)  $\frac{1}{e}$
64.  $f(x) = \frac{x}{(x^2+1)}$  is increasing in [1]
- a) None of these  
b)  $(-1, \infty)$

- c)  $(-\infty, -1) \cup (1, \infty)$  d)  $(-1, 1)$
65. Let  $x, y$  be two variables and  $x > 0, xy = 1$  then minimum value of  $x + y$  is [1]  
 a) 2 b)  $2\frac{1}{2}$   
 c)  $3\frac{1}{3}$  d) 1
66. The function  $f(x) = \log_e (x^3 + \sqrt{x^6 + 1})$  is of the following types: [1]  
 a) even and increasing b) odd and decreasing  
 c) even and decreasing d) odd and increasing
67. Let  $f(x) = x^{25} (1 - x)^{75}$  for all  $x \in [0, 1]$ , then  $f(x)$  assumes its maximum value at [1]  
 a)  $\frac{1}{3}$  b)  $\frac{1}{2}$   
 c)  $\frac{1}{4}$  d) 0
68. The least value of  $k$  for which  $f(x) = x^2 + kx + 1$  is increasing on  $(1, 2)$ , is [1]  
 a) -2 b) 2  
 c) 1 d) -1
69. The point on the curve  $y^2 = 4x$  which is nearest to the point  $(2, 1)$  is [1]  
 a)  $(1, 2\sqrt{2})$  b)  $(-2, 1)$   
 c)  $(1, -2)$  d)  $(1, 2)$
70. Minimum value of the function  $f(x) = x^2 + x + 1$  is [1]  
 a) none of these b) 3  
 c)  $\frac{3}{4}$  d) 1
71. If the function  $f(x) = x^2 - kx + 5$  is increasing on  $[2, 4]$ , then [1]  
 a)  $k \in (-\infty, 2)$  b)  $k \in (2, \infty)$   
 c)  $k \in (4, \infty)$  d)  $k \in (-\infty, 4)$
72. The function  $f(x) = \frac{x}{1+|x|}$  is [1]  
 a) strictly increasing b) strictly decreasing  
 c) none of these d) neither increasing nor decreasing
73. The function  $f(x) = x + \frac{4}{x}$  has [1]  
 a) a local maxima at  $x = 2$  and a local minima at  $x = -2$  b) local minima at  $x = 2$  and a local maxima at  $x = -2$   
 c) No maximum and minimum d) absolute maxima at  $x = 2$  and absolute minima at  $x = -2$
74. Let the  $f : \mathbb{R} \rightarrow \mathbb{R}$  be defined by  $f(x) = 2x + \cos x$ , then  $f$  : [1]  
 a) is an increasing function b) is a decreasing function  
 c) has a minimum at  $x = \pi$  d) has a maximum, at  $x = 0$
75. Function  $f(x) = 2x^3 - 9x^2 + 12x + 29$  is monotonically decreasing when [1]

a)  $x > 2$

c)  $x < 2$

b)  $1 < x < 2$

d)  $x > 3$