

Maxprap. Chapter wise Series Class 12th - Derivatives and Higher order

Class : 12th

Subject: Mathematics

Max. Marks :

Duration :

NCERT Based Questions

	Derivative Examples	
1	Check the continuity of the function f given by $f(x) = 2x + 3$ at $x = 1$.	[2]
2	Examine whether the function f given by $f(x) = x^2$ is continuous at $x = 0$.	[2]
3	Discuss the continuity of the function f given by $f(x) = x $ at $x = 0$.	[2]
4	Show that the function f given by $f(x) = \begin{cases} x^3 + 3, & \text{if } x \neq 0 \\ 1, & \text{if } x = 0 \end{cases}$ is not continuous at $x = 0$.	[2]
5	Is the function defined by $f(x) = x $, a continuous function?	[2]
6	Discuss the continuity of the function 'f' given by $f(x) = x^3 + x^2 - 1$.	[1]
7	Discuss the continuity of the function f defined by $f(x) = \frac{1}{x}, x \neq 0$	[1]
8	Discuss the continuity of the function f defined by $f(x) = \begin{cases} x + 2, & \text{if } x \leq 1 \\ x - 2, & \text{if } x > 1 \end{cases}$	[3]
9	Discuss the continuity of the function f given by $f(x) = \begin{cases} x, & \text{if } x \geq 0 \\ x^2, & \text{if } x < 0 \end{cases}$	[2]
10	Discuss the continuity of sine function.	[2]
11	Find all the points of discontinuity of the greatest integer function defined by $f(x) = [x]$, where $[x]$ denotes the greatest integer less than or equal to x.	[2]
12	Show that the function defined by $f(x) = \sin(x^2)$ is a continuous function.	[1]
13	Show that the function f defined by $f(x) = 1 - x + x $, where x is any real number, is a continuous function.	[2]
14	Find the derivative of the function given by $f(x) = \sin(x^2)$.	[2]
15	Find $\frac{dy}{dx}$, if $y + \sin y = \cos x$.	[2]
16	Find the derivative of f given by $f(x) = \sin^{-1} x$ assuming it exists.	[2]

17	Differentiate the e^{-x} w.r.t. x .	[1]
18	Differentiate the $\sin(\log x)$, $x > 0$ w.r.t. x .	[1]
19	Differentiate $e^{\cos x}$ w.r.t. x .	[1]
20	Differentiate $\sqrt{\frac{(x-3)(x^2+4)}{3x^2+4x+5}}$ w.r.t. x .	[2]
21	Differentiate $x^{\sin x}$, $x > 0$ w.r.t. x .	[2]
22	Find $\frac{dy}{dx}$ if $y^x + x^y + x^x = a^b$	[3]
23	Find $\frac{dy}{dx}$, if $x = a \cos \theta$, $y = a \sin \theta$.	[1]
24	Find $\frac{dy}{dx}$, if $x = at^2$, $y = 2at$.	[1]
25	Find $\frac{dy}{dx}$, if $x = a(\theta + \sin \theta)$, $y = a(1 - \cos \theta)$.	[2]
26	Find $\frac{dy}{dx}$, if $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$.	[2]
27	Find $\frac{d^2y}{dx^2}$, if $y = x^3 + \tan x$.	[1]
28	If $y = A \sin x + B \cos x$, then prove that $\frac{d^2y}{dx^2} + y = 0$	[2]
29	If $y = 3e^{2x} + 2e^{3x}$, prove that $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$.	[2]
30	If $y = \sin^{-1} x$, show that $(1 - x^2) \frac{d^2y}{dx^2} - x \frac{dy}{dx} = 0$.	[2]
31	Differentiate w.r.t. x , the function, $\log_7(\log x)$	[2]
32	Differentiate w.r.t. x , the function, $\sqrt{3x+2} + \frac{1}{\sqrt{2x^2+4}}$	[2]
33	Differentiate the $\cos^{-1}(\sin x)$ w.r.t. x .	[1]
34	Differentiate the $\tan^{-1}\left(\frac{\sin x}{1+\cos x}\right)$ w.r.t. x .	[2]
35	Differentiate the $\sin^{-1}\left(\frac{2^{x+1}}{1+4^x}\right)$ w.r.t. x .	[2]
36	Find $f'(x)$ if $f(x) = (\sin x)^{\sin x}$ for all $0 < x < \pi$.	[2]
37	For a positive constant a find $\frac{dy}{dx}$, where $y = a^{\left(t+\frac{1}{t}\right)}$ and $x = \left(t + \frac{1}{t}\right)^a$.	[3]

38	Differentiate $\sin^2 x$ w.r.t. $e^{\cos x}$.	[2]
Continuity Exercise 5.1		
39	Prove that the function $f(x) = 5x - 3$ is continuous at $x = 0$, at $x = -3$ and at $x = 5$	[2]
40	Examine the continuity of the function $f(x) = 2x^2 - 1$ at $x = 3$.	[2]
41	Examine the function for continuity. $f(x) = \frac{1}{x-5}, x \neq 5$	[1]
42	Examine the function for continuity. $f(x) = \frac{x^2 - 25}{x + 5}, x \neq 5$	[2]
43	Examine the function for continuity. $f(x) = x - 5 $	[3]
44	Find all points of discontinuity of f , where f is defined by: $f(x) = \begin{cases} 2x + 3, & x \leq 2 \\ 2x - 3, & x > 2 \end{cases}$	[2]
45	Find all points of discontinuity of f , where f is defined by: $f(x) = \begin{cases} \frac{ x }{x}, & \text{if } x \neq 0 \\ 0, & \text{if } x = 0 \end{cases}$	[2]
46	Find all points of discontinuity of f , where f is defined by: $f(x) = \begin{cases} x + 1, & \text{if } x \geq 1 \\ x^2 + 1, & \text{if } x < 1 \end{cases}$	[2]
47	Find the relationship between a and b , so that the function f defined by $f(x) = \begin{cases} ax + 1, & \text{if } x \leq 3 \\ bx + 3, & \text{if } x > 3 \end{cases}$ is continuous at $x = 3$.	[3]
48	For what value of λ is the function defined by $f(x) = \begin{cases} \lambda(x^2 - 2x), & \text{if } x \leq 0 \\ 4x + 1, & \text{if } x > 0 \end{cases}$ continuous at $x = 0$? What about continuity at $x = 1$?	[2]
49	Show that the function defined by $g(x) = x - [x]$ is discontinuous at all integral points. Here $[x]$ denotes the greatest integer less than or equal to x .	[2]
50	Is the function defined by $f(x) = x^2 - \sin x + 5$ continuous at $x = \pi$?	[2]
51	Discuss the continuity of the function : $f(x) = \sin x + \cos x$	[3]

52	Discuss the continuity of the function: $f(x) = \sin x \cdot \cos x$	[1]
53	Find all points of discontinuity of f, where $f(x) = \begin{cases} \frac{\sin x}{x}, & \text{if } x < 0 \\ x + 1, & \text{if } x \geq 0 \end{cases}$.	[2]
54	Determine if f defined by $f(x) = \begin{cases} x^2 \sin \frac{1}{x}, & \text{if } x \neq 0 \\ 0, & \text{if } x = 0 \end{cases}$ is a continuous function?	[2]
55	Examine the continuity of f, where f is defined by $f(x) = \begin{cases} \sin x - \cos x, & \text{if } x \neq 0 \\ -1, & \text{if } x = 0 \end{cases}$	[2]
56	Find the values of k so that the function f is continuous at the indicated point: $f(x) = \begin{cases} \frac{k \cos x}{\pi - 2x}, & \text{if } x \neq \frac{\pi}{2} \\ 3, & \text{if } x = \frac{\pi}{2} \end{cases}$ at $x = \frac{\pi}{2}$	[3]
57	Find the value of k so that the function f is continuous at the indicated point: $f(x) = \begin{cases} kx^2, & \text{if } x \leq 2 \\ 3, & \text{if } x > 2 \end{cases}$ at $x = 2$.	[2]
58	Find the value of k so that the function f is continuous at the indicated point: $f(x) = \begin{cases} kx + 1, & \text{if } x \leq 5 \\ 3x - 5, & \text{if } x > 5 \end{cases}$ at $x = 5$.	[2]
59	Find the values of a and b such that the function defined by $f(x) = \begin{cases} 5, & \text{if } x \leq 2 \\ ax + b, & \text{if } 2 < x < 10 \\ 21, & \text{if } x \geq 10 \end{cases}$ is a continuous function.	[3]
60	Show that the function defined by $f(x) = \cos x $ is a continuous function.	[2]
61	Examine that $\sin x $ is a continuous function.	[2]
Derivative Chain Rule 5.2		
62	Differentiate the function with respect to x : $\sin(x^2 + 5)$	[1]
63	Differentiate the function with respect to x : $\cos(\sin x)$.	[1]
64	Differentiate the function with respect to x : $\sin(ax + b)$	[1]

65	Differentiate the function with respect to x : $\sec(\tan\sqrt{x})$	[2]
66	Differentiate the function with respect to x : $\frac{\sin(ax+b)}{\cos(cx+d)}$	[2]
67	Differentiate the function with respect to x : $2\sqrt{\cot(x^2)}$	[2]
68	Differentiate the function with respect to x : $\cos(\sqrt{x})$	[2]
69	Prove that the function f given by $f(x) = x - 1 $, $x \in \mathbb{R}$ is not differentiable at $x = 1$.	[3]

	Implicit Function 5.3	
1	Find $\frac{dy}{dx}$ if $2x + 3y = \sin x$	[1]
2	Find $\frac{dy}{dx}$ if $2x + 3y = \sin y$	[2]
3	Find $\frac{dy}{dx}$ if $ax + by^2 = \cos y$	[1]
4	Find $\frac{dy}{dx}$ if $xy + y^2 = \tan x + y$	[2]
5	Find $\frac{dy}{dx}$ if $x^2 + xy + y^2 = 100$	[2]
6	Find $\frac{dy}{dx}$ if $x^3 + x^2y + xy^2 + y^3 = 81$.	[2]
7	Find $\frac{dy}{dx}$ if $\sin^2 y + \cos xy = k$	[2]
8	Find $\frac{dy}{dx}$ if $\sin^2 x + \cos^2 y = 1$	[2]
9	Find $\frac{dy}{dx}$ if $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$	[1]
10	Find $\frac{dy}{dx}$, if $y = \tan^{-1}\left(\frac{3x-x^3}{1-3x^2}\right)$, $-\frac{1}{\sqrt{3}} < x < \frac{1}{\sqrt{3}}$	[2]
11	Find $\frac{dy}{dx}$ if $y = \cos^{-1}\left(\frac{2x}{1+x^2}\right)$, $-1 < x < 1$	[1]
12	Find $\frac{dy}{dx}$ if $y = \sec^{-1}\left(\frac{1}{2x^2-1}\right)$, $0 < x < \frac{1}{\sqrt{2}}$	[2]
	Chain Rule 5.4	
13	Differentiate the $\frac{e^x}{\sin x}$ w.r.t.x.	[1]

14	Differentiate $e^{\sin^{-1}x}$ w.r.t. x.	[1]
15	Differentiate e^{x^3} w.r.t. x.	[1]
16	Differentiate the $\sin(\tan^{-1}e^{-x})$ w.r.t.x.	[2]
17	Differentiate the $\log(\cos e^x)$ w.r.t.x.	[2]
18	Differentiate the $\sqrt{e^{\sqrt{x}}}, x > 0$ w.r.t. x.	[1]
19	Differentiate the $\log(\log x), x > 1$ w.r.t. x.	[1]
20	Differentiate the $\frac{\cos x}{\log x}, x > 0$ w.r.t. x.	[2]
21	Differentiate the $\cos(\log x + e^x), x > 0$ w.r.t. x.	[1]
Log Function 5.5		
22	Differentiate the function $\cos x \cdot \cos 2x \cdot \cos 3x$ w.r.t. x.	[2]
23	Differentiate the function $\sqrt{\frac{(x-1)(x-2)}{(x-3)(x-4)(x-5)}}$ w.r.t. x.	[2]
24	Differentiate the function $(\log x)^{\cos x}$ w.r.t. x.	[3]
25	Differentiate the function $x^x - 2^{\sin x}$ w.r.t. x.	[3]
26	Differentiate the function $(x+3)^2 \cdot (x+4)^3 \cdot (x+5)^4$ w.r.t. x.	[3]
27	Differentiate the function $\left(x + \frac{1}{x}\right)^x + x^{\left(1 + \frac{1}{x}\right)}$ w.r.t. x.	[5]
28	Differentiate the function $(\log x)^x + x^{\log x}$ w.r.t. x.	[5]
29	Differentiate the function $(\sin x)^x + \sin^{-1} \sqrt{x}$ w.r.t. x.	[3]
30	Differentiate the function $x^{\sin x} + (\sin x)^{\cos x}$ w.r.t. x.	[3]
31	Differentiate the function $(x \cos x)^x + (x \sin x)^{\frac{1}{x}}$ w.r.t.x.	[5]
32	Find $\frac{dy}{dx}$, of the function $y^x = x^y$	[2]
33	Find $\frac{dy}{dx}$ of the function $x^y + y^x = 1$	[5]
34	Find $\frac{dy}{dx}$ of the function $(\cos x)^y = (\cos y)^x$.	[3]
35	Find $\frac{dy}{dx}$ of the function $xy = e^{(x-y)}$	[2]

36	Find the derivative of the function given by $f(x) = (1 + x)(1 + x^2)(1 + x^4)(1 + x^8)$ and hence find $f'(1)$.	[3]
Parametric Function 5.6		
37	If x and y are connected parametrically by the equation $x = 2at^2$, $y = at^4$, without eliminating the parameter, Find $\frac{dy}{dx}$.	[2]
38	If x and y are connected parametrically by the equation $x = a\cos\theta$, $y = b\cos\theta$, without eliminating the parameter, Find $\frac{dy}{dx}$.	[2]
39	If x and y are connected parametrically by the equation $x = \cos\theta - \cos 2\theta$, $y = \sin\theta - \sin 2\theta$, without eliminating the parameter, find $\frac{dy}{dx}$.	[2]
40	If x and y are connected parametrically by the equation $x = a(\theta - \sin\theta)$, $y = a(1 + \cos\theta)$ without eliminating the parameter. Find $\frac{dy}{dx}$.	[2]
41	If x and y are connected parametrically by the equation $x = \frac{\sin^3 t}{\sqrt{\cos 2t}}$, $y = \frac{\cos^3 t}{\sqrt{\cos 2t}}$, without eliminating the parameter, Find $\frac{dy}{dx}$.	[3]
42	If x and y are connected parametrically by the equation $x = a\left(\cos t + \log \tan \frac{t}{2}\right)$, $y = a \sin t$, without eliminating the parameter, find $\frac{dy}{dx}$.	[2]
43	If x and y are connected parametrically by the equation $x = a \sec\theta$, $y = b \tan\theta$, without eliminating the parameter, find $\frac{dy}{dx}$.	[2]
44	If x and y are connected parametrically by the equation $x = a(\cos\theta + \theta \sin\theta)$, $y = a(\sin\theta - \theta \cos\theta)$, without eliminating the parameter, find $\frac{dy}{dx}$.	[2]
45	If $x = \sqrt{a^{\sin^{-1}t}}$, $y = \sqrt{a^{\cos^{-1}t}}$, show that $\frac{dy}{dx} = -\frac{y}{x}$.	[3]
Higher Order 5.7		
46	Find the second - order derivatives of the function $x^2 + 3x + 2$	[1]
47	Find the second - order derivative of the function $x \cdot \cos x$	[2]
48	Find the second - order derivative of the function $\log x$	[1]
49	Find the second - order derivative of the function $x^3 \log x$	[2]
50	Find the second - order derivative of the function $e^x \sin 5x$	[2]

51	Find the second - order derivatives of the function $\tan^{-1} x$	[2]
52	Find the second - order derivative of the function $\log(\log x)$	[2]
53	Find the second - order derivative of the function $\sin(\log x)$	[2]
54	If $y = 5 \cos x - 3 \sin x$, prove that $\frac{d^2y}{dx^2} + y = 0$	[2]
55	If $y = \cos^{-1} x$. Find $\frac{d^2y}{dx^2}$ in terms of y alone.	[2]
56	If $y = 3 \cos (\log x) + 4 \sin (\log x)$. Show that $x^2 y_2 + xy_1 + y = 0$	[3]
57	If $y = Ae^{mx} + Be^{nx}$, show that $\frac{d^2y}{dx^2} - (m + n) \frac{dy}{dx} + mny = 0$	[3]
58	If $y = 500e^{7x} + 600e^{-7x}$ show that $\frac{d^2y}{dx^2} = 49y$.	[2]
59	If $e^y (x + 1) = 1$, show that $\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^2$	[3]
60	If $y = (\tan^{-1} x)^2$ show that $(x^2 + 1)^2 y_2 + 2x(x^2 + 1)y_1 = 2$	[2]
Misc. Exercise		
61	Differentiate the function $(3x^2 - 9x + 5)^9$ w.r.t to x .	[2]
62	Differentiate the function $(5x)^{3\cos 2x}$ w.r.t to x .	[2]
63	Differentiate the function $\sin^{-1}(x\sqrt{x})$, $0 \leq x \leq 1$ w.r.t.to x .	[2]
64	Differentiate the function $\cot^{-1} \left[\frac{\sqrt{1+\sin x} + \sqrt{1-\sin x}}{\sqrt{1+\sin x} - \sqrt{1-\sin x}} \right]$, $0 < x < \frac{\pi}{2}$ w.r.t. x .	[3]
65	Differentiate the function $(\log x)^{\log x}$, $x > 1$, w.r.t to x .	[2]
66	Differentiate the function $(\sin x - \cos x)^{(\sin x - \cos x)}$, $\frac{\pi}{4} < x < \frac{3\pi}{4}$ w.r.t to x .	[3]
67	Differentiate w.r.t. x the function in $x^x + x^a + a^x + a^a$, for some fixed $a > 0$ and $x > 0$.	[3]
68	Find $\frac{dy}{dx}$, if $y = 12(1 - \cos t)$, $x = 10(t - \sin t)$, $-\frac{\pi}{2} < t < \frac{\pi}{2}$	[2]
69	Find $\frac{dy}{dx}$, if $y = \sin^{-1} x + \sin^{-1} \sqrt{1 - x^2}$, $0 < x < 1$	[3]
70	If $x\sqrt{1+y} + y\sqrt{1+x} = 0$ for $-1 < x < 1$ prove that $\frac{dy}{dx} = -\frac{1}{(1+x)^2}$	[2]

71	If $\cos y = x \cos(a + y)$ with $\cos a \neq \pm 1$ prove that $\frac{dy}{dx} = \frac{\cos^2(a+y)}{\sin a}$	[3]
72	If $x = a (\cos t + t \sin t)$ and $y = a (\sin t - t \cos t)$, find $\frac{d^2y}{dx^2}$	[3]
73	Does there exist a function which is continuous everywhere but not differentiable at exactly two points? Justify your answer.	[1]
74	If $y = \begin{vmatrix} f(x) & g(x) & h(x) \\ l & m & n \\ a & b & c \end{vmatrix}$, Prove that $\frac{dy}{dx} = \begin{vmatrix} f'(x) & g'(x) & h'(x) \\ l & m & n \\ a & b & c \end{vmatrix}$	[3]
75	If $y = e^{a \cos^{-1} x}$, $-1 \leq x \leq 1$, show that $(1 - x^2) \frac{d^2y}{dx^2} - x \frac{dy}{dx} - a^2 y = 0$.	[2]