

EXERCISE - O

SINGLE CORRECT TYPE QUESTIONS

1. If $y = \sqrt{\frac{1-x}{1+x}}$, then $\frac{dy}{dx}$ equals -

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

MDF001

2. If $x = y \ln(xy)$, then $\frac{dx}{dy}$ equals-

- (A) $\frac{y(x-y)}{x(x+y)}$ (B) $\frac{x(x+y)}{y(x-y)}$ (C) $\frac{y(x+y)}{x(x-y)}$ (D) $\frac{x(x-y)}{y(x+y)}$

MDF002

3. If $(\cos x)^y = (\sin y)^x$, then $\frac{dy}{dx}$ equals -

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

MDF003

4. $\frac{d}{dx} \left(\tan^{-1} \left(\frac{\sqrt{x-x}}{1+x^{3/2}} \right) \right)$ equals- ($x \geq 0$)

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

MDF005

5. If $\Delta_1 = \begin{vmatrix} x & b & b \\ a & x & b \\ a & a & x \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} x & b \\ a & x \end{vmatrix}$ are given, then -

- (A) $\Delta_1 = 3(\Delta_2)^2$ (B) $\frac{d}{dx} \Delta_1 = 3\Delta_2$ (C) $\frac{d}{dx} \Delta_1 = 3(\Delta_2)^2$ (D) $\Delta_1 = 3(\Delta_2)^{3/2}$

MDF008

6. Suppose the function $f(x) - f(2x)$ has the derivative 5 at $x = 1$ and derivative 7 at $x = 2$. The derivative of the function $f(x) - f(4x)$ at $x = 1$, has the value equal to

- (A) 19 (B) 9 (C) 17 (D) 14

MDF010

7. If $f(x) = \begin{cases} x \tan^{-1} x + \sec^{-1}(1/x), & x \in (-1, 1) - \{0\} \\ \pi/2, & \text{if } x = 0 \end{cases}$, then $f'(0)$ is -

- (A) equal to -1 (B) equal to 0 (C) equal to 1 (D) non existent

MDF011

8. If $x = t^3 + t + 5$ & $y = \sin t$, then $\frac{d^2y}{dx^2} =$

(A) $-\frac{(3t^2 + 1)\sin t + 6t \cos t}{(3t^2 + 1)^3}$

(B) $\frac{(3t^2 + 1)\sin t + 6t \cos t}{(3t^2 + 1)^2}$

(C) $-\frac{(3t^2 + 1)\sin t + 6t \cos t}{(3t^2 + 1)^2}$

(D) $\frac{\cos t}{3t^2 + 1}$

MDF012

9. If $y = x + e^x$ then $\frac{d^2x}{dy^2}$ is :

(A) e^x

(B) $-\frac{e^x}{(1+e^x)^3}$

(C) $-\frac{e^x}{(1+e^x)^2}$

(D) $\frac{-1}{(1+e^x)^3}$

MDF013

10. Let $f(x) = x + \sin x$. Suppose g denotes the inverse function of f . The value of $g\left(\frac{\pi}{4} + \frac{1}{\sqrt{2}}\right)$ has the value equal to

(A) $\sqrt{2} - 1$

(B) $\frac{\sqrt{2} + 1}{\sqrt{2}}$

(C) $2 - \sqrt{2}$

(D) $\sqrt{2} + 1$

MDF015

11. If $x \log_e(\log_e x) - x^2 + y^2 = 4 (y > 0)$, then dy/dx at $x = e$ is equal to :

(A) $\frac{e}{\sqrt{4 + e^2}}$

(B) $\frac{(1+2e)}{2\sqrt{4 + e^2}}$

(C) $\frac{(2e - 1)}{2\sqrt{4 + e^2}}$

(D) $\frac{(1 + 2e)}{\sqrt{4 + e^2}}$

MDF016

12. If $f(1) = 1, f'(1) = 3$, then the derivative of $f(f(f(x))) + (f(x))^2$ at $x = 1$ is :

(A) 12

(B) 33

(C) 9

(D) 15

MDF018

13. If $f(4) = g(4) = 2 ; f'(4) = 9 ; g'(4) = 6$ then $\lim_{x \rightarrow 4} \frac{\sqrt{f(x)} - \sqrt{g(x)}}{\sqrt{x} - 2}$ is equal to

(A) $3\sqrt{2}$

(B) $\frac{3}{\sqrt{2}}$

(C) 0

(D) none of these.

MDF019

14. If $8f(x) + 6f\left(\frac{1}{x}\right) = x + 5$ and $y = x^2 f(x)$, then $\frac{dy}{dx}$ at $x = -1$ is equal to

(A) 0

(B) $\frac{1}{14}$

(C) $-\frac{1}{14}$

(D) None of these

MDF057

15. If $y = \ln \left\{ \frac{x + \sqrt{a^2 + x^2}}{a} \right\}$, then the value of $\frac{dy}{dx}$ is-

(A) $\sqrt{a^2 - x^2}$

(B) $a \sqrt{a^2 + x^2}$

(C) $\frac{1}{\sqrt{a^2 + x^2}}$

(D) $x \sqrt{a^2 + x^2}$

MDF058

Methods of Differentiation

16. Suppose that $f(0) = 0$ and $f'(0) = 2$, and let $g(x) = f(-x + f(f(x)))$. The value of $g'(0)$ is equal to
 (A) 0 (B) 1 (C) 6 (D) 8

MDF060

17. If $\frac{d^2x}{dy^2} \left(\frac{dy}{dx}\right)^3 + \frac{d^2y}{dx^2} = K$, then the value of K is equal to
 (A) 1 (B) -1 (C) 2 (D) 0

MDF061

MULTIPLE CORRECT TYPE QUESTIONS

18. If $f(x) = (2x - 3\pi)^5 + \frac{4}{3}x + \cos x$ and g is the inverse function of f , then
 (A) $g'(2\pi) = \frac{7}{3}$ (B) $g'(2\pi) = \frac{3}{7}$ (C) $g''(2\pi) = \frac{7}{3}$ (D) $g''(2\pi) = 0$

MDF062

19. Let $f(x) = \frac{\sqrt{x - 2\sqrt{x - 1}}}{\sqrt{x - 1} - 1} \cdot x$, then
 (A) $f'(10) = 1$ (B) $f'(3/2) = -1$
 (C) domain of $f(x)$ is $x \geq 1$ (D) none

MDF063

20. If $y = x^{(\ln x)^{\ln(\ln x)}}$, then $\frac{dy}{dx}$ is equal to :
 (A) $\frac{y}{x} (\ln x^{\ln x - 1} + 2 \ln x \ln(\ln x))$ (B) $\frac{y}{x} (\ln x)^{\ln(\ln x)} (2 \ln(\ln x) + 1)$
 (C) $\frac{y}{x \ln x} ((\ln x)^2 + 2 \ln(\ln x))$ (D) $\frac{y \ln y}{x \ln x} (2 \ln(\ln x) + 1)$

MDF064

21. If $2^x + 2^y = 2^{x+y}$, then $\frac{dy}{dx}$ is equal to
 (A) $-\frac{2^y}{2^x}$ (B) $\frac{1}{1 - 2^x}$ (C) $1 - 2^y$ (D) $\frac{2^x (1 - 2^y)}{2^y (2^x - 1)}$

MDF065

22. If $f(x) = \begin{vmatrix} \cos(x+x^2) & \sin(x+x^2) & -\cos(x+x^2) \\ \sin(x-x^2) & \cos(x-x^2) & \sin(x-x^2) \\ \sin 2x & 0 & \sin 2x^2 \end{vmatrix}$, then
 (A) $f(-2) = 0$ (B) $f'(-1/2) = 0$ (C) $f'(-1) = -2$ (D) $f''(0) = 4$

MDF066

23. The functions $u = e^x \sin x$; $v = e^x \cos x$ satisfy the equation

(A) $v \frac{du}{dx} - u \frac{dv}{dx} = u^2 + v^2$ (B) $\frac{d^2u}{dx^2} = 2v$ (C) $\frac{d^2v}{dx^2} = -2u$ (D) $\frac{du}{dx} + \frac{dv}{dx} = 2v$

MDF067

COMPREHENSION TYPE QUESTIONS

Paragraph for Question 24 to 26

Let $a_1 > a_2 > a_3 \dots a_n > 1$; $p_1 > p_2 > p_3 \dots > p_n > 0$; such that $p_1 + p_2 + p_3 + \dots + p_n = 1$.

Also $F(x) = (p_1 a_1^x + p_2 a_2^x + \dots + p_n a_n^x)^{1/x}$ then

24. $\lim_{x \rightarrow 0^+} F(x)$ is

(A) $a_1^{p_1} \cdot a_2^{p_2} \dots a_n^{p_n}$ (B) a_1 (C) a_n (D) does not exist

MDF083

25. $\lim_{x \rightarrow \infty} F(x)$

(A) $a_1^{p_1} \cdot a_2^{p_2} \dots a_n^{p_n}$ (B) a_1 (C) a_n (D) does not exist

MDF084

26. $\lim_{x \rightarrow -\infty} F(x)$

(A) $a_1^{p_1} \cdot a_2^{p_2} \dots a_n^{p_n}$ (B) a_1 (C) a_n (D) does not exist

MDF085

Paragraph for Question 27 to 28

Consider the function defined implicitly $y^2 + y - x = 2$ on various intervals on the real line. If

$y \in \left(-\infty, -\frac{1}{2}\right)$, then equation implicitly defines a unique real valued differentiable function

$y = f(x)$. On the basis of above information's, answer the following questions.

27. The value of $f''(4)$ is -

(A) $\frac{2}{125}$ (B) $\frac{125}{2}$ (C) $\frac{1}{5}$ (D) $\frac{1}{125}$

MDF086

28. If $y = h(x)$ is mirror image of $y = f(x)$ about the line $2y + 1 = 0$, then $f''(x_0) + h''(x_0)$, where

$x_0 \in \left(-\frac{9}{4}, \infty\right)$ is -

(A) $2x_0$ (B) $\frac{2}{2f(x_0)+1}$ (C) $\frac{2}{(2f(x_0)+1)^3}$ (D) 0

MDF088

MATCHING LIST TYPE QUESTION

29. Match List-I with List-II and select the correct answer using the code given below the list.

List-I	List-II
(P) Let $f(x) = x^2 - 4x - 3, x > 2$ and let g be the inverse of f . Find the value of g' at $x = 2$. (1)	-1
(Q) Let $f: R \rightarrow R$ be defined as $f(x) = x^3 + 3x^2 + 6x - 5 + 4e^{2x}$ and $g(x) = f^{-1}(x)$, then find $g'(-1)$. (2)	$\frac{1}{6}$
(R) Suppose f^{-1} is the inverse function of a differentiable function f and let $G(x) = \frac{1}{f^{-1}(x)}$. If $f(3) = 2$ and $f'(3) = \frac{1}{9}$, find $G'(2)$. (3)	1
(S) If $y = y(x)$ and it follows the relation $e^{xy} + y \cos x = 2$, then $y'(0) + y''(0)$. (4)	$\frac{1}{14}$
(A) $P \rightarrow 4; Q \rightarrow 1; R \rightarrow 2; S \rightarrow 3$	(B) $P \rightarrow 2; Q \rightarrow 1; R \rightarrow 3; S \rightarrow 4$
(C) $P \rightarrow 2; Q \rightarrow 4; R \rightarrow 1; S \rightarrow 3$	(D) $P \rightarrow 4; Q \rightarrow 3; R \rightarrow 2; S \rightarrow 1$

MDF089

30. Match the following List-I with List-II

List-I	List-II
(P) Let $f(x) = x^2 + xg'(1) + g''(2)$ and $g(x) = x^2 + xf'(2) + f''(3)$, then $f'(1) - f'(2)$ is equal to (1)	2
(Q) If $f(x - y), f(x), f(y)$ and $f(x + y)$ are in A.P., for all x, y and $f(0) \neq 0$, then $f'(-2) + f'(2)$ is equal to (2)	1
(R) If $f(x) = x^3 + x^2$. $f'(1) + xf''(2) + f'''(3)$ for all, then $f(0) + f(3) + 1$ is equal to (3)	4
(S) Let $f(x) = x^n, n$ being a positive integer, then value of n for which the equality $f'(a + b) = f'(a) + f'(b)$ is valid for all $a, b > 0$ is (4)	0
(A) $P \rightarrow 4; Q \rightarrow 3; R \rightarrow 2; S \rightarrow 1$	(B) $P \rightarrow 2; Q \rightarrow 4; R \rightarrow 3; S \rightarrow 1$
(C) $P \rightarrow 3; Q \rightarrow 4; R \rightarrow 2; S \rightarrow 1$	(D) $P \rightarrow 1; Q \rightarrow 2; R \rightarrow 3; S \rightarrow 4$

MDF090

EXERCISE - S

1. If $y\sqrt{x^2+1} = \log\{\sqrt{x^2+1}-x\}$, then $(x^2+1)\frac{dy}{dx} + xy + 1 =$ MDF027
2. If $f(x) = x + 2$, then $f'(f(x))$ at $x = 4$ is MDF028
3. Let $3f(x) - 2f(1/x) = x$, then $4f'(2)$ is equal to MDF029
4. $\frac{d}{dx} \tan^{-1}(\sec x + \tan x) = \lambda$ then $(10\lambda) = ?$ MDF022
5. $\frac{d}{dx} \left[2 \tan^{-1} \sqrt{\frac{1-\cos x}{1+\cos x}} \right] =$ MDF023
6. If $f(2) = 4, f'(2) = 1$ then $\lim_{x \rightarrow 2} \frac{xf(2) - 2f(x)}{x-2} =$ MDF026
7. Let $y = 1 + \frac{x_1}{x-x_1} + \frac{x_2 \cdot x}{(x-x_1)(x-x_2)} + \frac{x_3 \cdot x^2}{(x-x_1)(x-x_2)(x-x_3)} + \dots$ upto $(n+1)$ terms
and if $\frac{x}{y} \frac{dy}{dx} = k \left[\frac{x_1}{x_1-x} + \frac{x_2}{x_2-x} + \frac{x_3}{x_3-x} + \dots + \frac{x_n}{x_n-x} \right]$, then k is MDF091
8. Let $x = \operatorname{cosec} \theta - \sin \theta; y = \operatorname{cosec}^6 \theta - \sin^6 \theta$ if $(x^2 + 4) \left(\frac{dy}{dx} \right)^2 - k(y^2 + 4) = 0$, then k is MDF092
9. If $x = 2\cos t - \cos 2t$ & $y = 2\sin t - \sin 2t$, find the value of $2 \left| \frac{d^2y}{dx^2} \right|$, when $t = (\pi/2)$. MDF073
10. If $x = \frac{1+t}{t^3}, y = \frac{3}{2t^2} + \frac{2}{t}$, then $x \left(\frac{dy}{dx} \right)^3 - \frac{dy}{dx}$ is equal to MDF030
11. If $y = ae^{mx} + be^{-mx}$, then $\frac{d^2y}{dx^2} - m^2y =$ MDF068
12. If $y = \tan^{-1} \frac{1}{x^2+x+1} + \tan^{-1} \frac{1}{x^2+3x+3} + \tan^{-1} \frac{1}{x^2+5x+7} + \tan^{-1} \frac{1}{x^2+7x+13} + \dots$ to 10 terms.
Find $(f'(0) + 1)^{-1}$. MDF070

13. If $y = \cot^{-1} \frac{\sqrt{1+\sin x} + \sqrt{1-\sin x}}{\sqrt{1+\sin x} - \sqrt{1-\sin x}}$, find $2 \left| \frac{dy}{dx} \right|$ if $x \in \left(0, \frac{\pi}{2}\right) \cup \left(\frac{\pi}{2}, \pi\right)$.

MDF071

14. A twice differentiable function $f(x)$ is defined for all real numbers and satisfies the following conditions

$$f(0) = 2; f'(0) = -5 \text{ and } f''(0) = 3.$$

The function $g(x)$ is defined by $g(x) = e^{ax} + f(x) \quad \forall x \in R$, where 'a' is any constant.

If $g'(0) + g''(0) = 0$, then number of possible value(s) of 'a' is

MDF072

15. Let $\sqrt{1-x^6} + \sqrt{1-y^6} = a^3 \cdot (x^3 - y^3)$ and if $\frac{dy}{dx} = \frac{x^\ell}{y^\ell} \sqrt{\frac{1-y^k}{1-x^k}}$ (where $x \neq \pm 1$), then $\frac{k}{\ell}$ is

MDF093

EXERCISE - JEE (Main) PYQ

1. If $x = 3 \tan t$ and $y = 3 \sec t$, then the value of $\frac{d^2y}{dx^2}$ at $t = \frac{\pi}{4}$, is: [JEE (Main) 2019]

- (1) $\frac{3}{2\sqrt{2}}$ (2) $\frac{1}{3\sqrt{2}}$ (3) $\frac{1}{6}$ (4) $\frac{1}{6\sqrt{2}}$

MDF035

2. Let $f(x) = \begin{cases} -1, & -2 \leq x < 0 \\ x^2 - 1, & 0 \leq x \leq 2 \end{cases}$ and $g(x) = |f(x)| + f(|x|)$. Then, in the interval $(-2, 2)$, g is :-

[JEE (Main) 2019]

- (1) differentiable at all points (2) not differentiable at two points
 (3) not continuous (4) not differentiable at one point

MDF036

3. For $x > 0$, if $(2x)^{2y} = 4e^{2x-2y}$, then $(1 + \log_e 2x)^2 \frac{dy}{dx}$ is equal to : [JEE (Main) 2019]

- (1) $\log_e 2x$ (2) $\frac{x \log_e 2x + \log_e 2}{x}$ (3) $x \log_e 2x$ (4) $\frac{x \log_e 2x - \log_e 2}{x}$

MDF037

4. If $e^y + xy = e$, the ordered pair $\left(\frac{dy}{dx}, \frac{d^2y}{dx^2}\right)$ at $x = 0$ is equal to : [JEE (Main) 2019]

- (1) $\left(-\frac{1}{e}, \frac{1}{e^2}\right)$ (2) $\left(\frac{1}{e}, \frac{1}{e^2}\right)$ (3) $\left(\frac{1}{e}, -\frac{1}{e^2}\right)$ (4) $\left(-\frac{1}{e}, -\frac{1}{e^2}\right)$

MDF038

5. The derivative of $\tan^{-1}\left(\frac{\sin x - \cos x}{\sin x + \cos x}\right)$, with respect to $\frac{x}{2}$, where $\left(x \in \left(0, \frac{\pi}{2}\right)\right)$ is :

[JEE (Main) 2019]

- (1) $\frac{1}{2}$ (2) $\frac{2}{3}$ (3) 1 (4) 2

MDF039

6. Let $y = y(x)$ be a function of x satisfying $y\sqrt{1-x^2} = k - x\sqrt{1-y^2}$ where k is a constant and $y\left(\frac{1}{2}\right) = -\frac{1}{4}$. Then $\frac{dy}{dx}$ at $x = \frac{1}{2}$, is equal to : [JEE (Main) 2020]

- (1) $\frac{\sqrt{5}}{2}$ (2) $-\frac{\sqrt{5}}{2}$ (3) $\frac{2}{\sqrt{5}}$ (4) $-\frac{\sqrt{5}}{4}$

MDF040

7. If $y(\alpha) = \sqrt{2\left(\frac{\tan \alpha + \cot \alpha}{1 + \tan^2 \alpha}\right) + \frac{1}{\sin^2 \alpha}}$, $\alpha \in \left(\frac{3\pi}{4}, \pi\right)$, then $\frac{dy}{d\alpha}$ at $\alpha = \frac{5\pi}{6}$ is : [JEE (Main) 2020]

- (1) 4 (2) $-\frac{1}{4}$ (3) $\frac{4}{3}$ (4) -4

MDF041

8. If $y = \sum_{k=1}^6 k \cos^{-1} \left\{ \frac{3}{5} \cos kx - \frac{4}{5} \sin kx \right\}$, then $\frac{dy}{dx}$ at $x = 0$ is _____. [JEE (Main) 2020]

MDF042

9. Let $x^k + y^k = a^k$, ($a, k > 0$) and $\frac{dy}{dx} + \left(\frac{y}{x}\right)^{\frac{1}{3}} = 0$, then k is : [JEE (Main) 2020]

- (1) $\frac{3}{2}$ (2) $\frac{1}{3}$ (3) $\frac{2}{3}$ (4) $\frac{4}{3}$

MDF094

10. If $(a + \sqrt{2} b \cos x)(a - \sqrt{2} b \cos y) = a^2 - b^2$, where $a > b > 0$, then $\frac{dx}{dy}$ at $\left(\frac{\pi}{4}, \frac{\pi}{4}\right)$ is :

[JEE (Main) 2020]

- (1) $\frac{a-b}{a+b}$ (2) $\frac{a+b}{a-b}$ (3) $\frac{2a+b}{2a-b}$ (4) $\frac{a-2b}{a+2b}$

MDF095

11. Consider the function $f(x) = \begin{cases} \frac{P(x)}{\sin(x-2)} & ; x \neq 2 \\ 7 & ; x = 2 \end{cases}$

Where $P(x)$ is a polynomial such that $P''(x)$ is always a constant and $P(3) = 9$. If $f(x)$ is continuous at $x = 2$, then $P(5)$ is equal to _____. [JEE (Main) 2021]

MDF043

12. Let $f(x) = \cos \left(2 \tan^{-1} \sin \left(\cot^{-1} \sqrt{\frac{1-x}{x}} \right) \right)$, $0 < x < 1$. Then : [JEE (Main) 2021]

- (1) $(1-x)^2 f'(x) - 2(f(x))^2 = 0$ (2) $(1+x)^2 f'(x) + 2(f(x))^2 = 0$
 (3) $(1-x)^2 f'(x) + 2(f(x))^2 = 0$ (4) $(1+x)^2 f'(x) - 2(f(x))^2 = 0$

MDF044

13. If $y(x) = \cot^{-1} \left(\frac{\sqrt{1+\sin x} + \sqrt{1-\sin x}}{\sqrt{1+\sin x} - \sqrt{1-\sin x}} \right)$, $x \in \left(\frac{\pi}{2}, \pi\right)$, then $\frac{dy}{dx}$ at $x = \frac{5\pi}{6}$ is : [JEE (Main) 2021]

- (1) $-\frac{1}{2}$ (2) -1 (3) $\frac{1}{2}$ (4) 0

MDF045

14. Let $f: S \rightarrow S$ where $S = (0, \infty)$ be a twice differentiable function such that $f(x+1) = xf(x)$. If $g: S \rightarrow R$ be defined as $g(x) = \log_e f(x)$, then the value of $|g''(5) - g''(1)|$ is equal to :

[JEE (Main) 2021]

- (1) $\frac{205}{144}$ (2) $\frac{197}{144}$ (3) $\frac{187}{144}$ (4) 1

MDF096

15. If $y = y(x)$ is an implicit function of x such that $\log_e(x+y) = 4xy$, then $\frac{d^2y}{dx^2}$ at $x = 0$ is equal to.

[JEE (Main) 2021]

MDF097

16. The value of $\log_e 2 \frac{d}{dx} (\log_{\cos x} \operatorname{cosec} x)$ at $x = \frac{\pi}{4}$ is [JEE (Main) 2022]
 (1) $-2\sqrt{2}$ (2) $2\sqrt{2}$ (3) -4 (4) 4

MDF046

17. Let $x(t) = 2\sqrt{2} \cos t \sqrt{\sin 2t}$ and $y(t) = 2\sqrt{2} \sin t \sqrt{\sin 2t}$, $t \in \left(0, \frac{\pi}{2}\right)$. Then $\frac{1 + \left(\frac{dy}{dx}\right)^2}{\frac{d^2y}{dx^2}}$ at $t = \frac{\pi}{4}$ is equal to [JEE (Main) 2022]
 (1) $\frac{-2\sqrt{2}}{3}$ (2) $\frac{2}{3}$ (3) $\frac{1}{3}$ (4) $\frac{-2}{3}$

MDF047

18. If $y = \tan^{-1}(\sec x^3 - \tan x^3)$, $\frac{\pi}{2} < x^3 < \frac{3\pi}{2}$, then [JEE (Main) 2022]
 (1) $xy''' + 2y' = 0$ (2) $x^2y'' - 6y + \frac{3\pi}{2} = 0$
 (3) $x^2y'' - 6y + 3\pi = 0$ (4) $xy'' - 4y' = 0$

MDF048

19. Let $f(x) = \begin{vmatrix} a & -1 & 0 \\ ax & a & -1 \\ ax^2 & ax & a \end{vmatrix}$, $a \in R$. Then the sum of the squares of all the values of a for which $2f'(10) - f'(5) + 100 = 0$ is : [JEE (Main) 2022]
 (1) 117 (2) 106 (3) 125 (4) 136

MDF049

20. If $y(x) = (x^x)^x$, $x > 0$ then $\frac{d^2x}{dy^2} + 20$ at $x = 1$ is equal to: [JEE (Main) 2022]

MDF050

21. If $y(x) = x^x$, $x > 0$, then $y''(2) - 2y'(2)$ is equal to : [JEE (Main) 2023]
 (1) $8 \log_e 2 - 2$ (2) $4 \log_e 2 + 2$ (3) $4 (\log_e 2)^2 - 2$ (4) $4 (\log_e 2)^2 + 2$

MDF051

22. Let $y = f(x) = \sin^3 \left(\frac{\pi}{3} \left(\cos \left(\frac{\pi}{3\sqrt{2}} (-4x^3 + 5x^2 + 1)^{\frac{3}{2}} \right) \right) \right)$. Then, at $x = 1$, [JEE (Main) 2023]
 (1) $2y' + \sqrt{3}\pi^2 y = 0$ (2) $2y' + 3\pi^2 y = 0$ (3) $\sqrt{2}y' - 3\pi^2 y = 0$ (4) $y' + 3\pi^2 y = 0$

MDF052

23. Let $y(x) = (1+x)(1+x^2)(1+x^4)(1+x^8)(1+x^{16})$. Then $y' - y''$ at $x = -1$ is equal to [JEE (Main) 2023]
 (1) 976 (2) 464 (3) 496 (4) 944

MDF053

24. Let $f(x) = \frac{\sin x + \cos x - \sqrt{2}}{\sin x - \cos x}$, $x \in [0, \pi] - \left\{ \frac{\pi}{4} \right\}$. Then $f\left(\frac{7\pi}{12}\right) f''\left(\frac{7\pi}{12}\right)$ is equal to

[JEE (Main) 2023]

- (1) $\frac{-2}{3}$ (2) $\frac{2}{9}$ (3) $-\frac{1}{3\sqrt{3}}$ (4) $\frac{-2}{3\sqrt{3}}$

MDF054

25. If $2x^y + 3y^x = 20$, then $\frac{dy}{dx}$ at $(2, 2)$ is equal to

[JEE (Main) 2023]

- (1) $-\left(\frac{3 + \log_e 8}{2 + \log_e 4}\right)$ (2) $-\left(\frac{2 + \log_e 8}{3 + \log_e 4}\right)$ (3) $-\left(\frac{3 + \log_e 16}{4 + \log_e 8}\right)$ (4) $-\left(\frac{3 + \log_e 4}{2 + \log_e 8}\right)$

MDF055

EXERCISE - JEE (Advanced) PYQ

1. Let $g(x) = \ln f(x)$ where $f(x)$ is a twice differentiable positive function on $(0, \infty)$ such that $f(x + 1) = xf(x)$. Then for $N = 1, 2, 3, \dots$, $g''\left(N + \frac{1}{2}\right) - g''\left(\frac{1}{2}\right) =$ **[JEE (Advanced) 2008]**

- (A) $-4 \left\{ 1 + \frac{1}{9} + \frac{1}{25} + \dots + \frac{1}{(2N-1)^2} \right\}$ (B) $4 \left\{ 1 + \frac{1}{9} + \frac{1}{25} + \dots + \frac{1}{(2N-1)^2} \right\}$
 (C) $-4 \left\{ 1 + \frac{1}{9} + \frac{1}{25} + \dots + \frac{1}{(2N+1)^2} \right\}$ (D) $4 \left\{ 1 + \frac{1}{9} + \frac{1}{25} + \dots + \frac{1}{(2N+1)^2} \right\}$

MDF074

2. Let f and g be real valued functions defined on interval $(-1, 1)$ such that $g''(x)$ is continuous, $g(0) \neq 0, g'(0) = 0, g''(0) \neq 0$, and $f(x) = g(x) \sin x$.

Statement-1 : $\lim_{x \rightarrow 0} [g(x) \cot x - g(0) \operatorname{cosec} x] = f''(0)$

and

Statement-2 : $f'(0) = g(0)$

[JEE (Advanced) 2008]

- (A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation of statement-1.
 (B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1
 (C) Statement-1 is true, statement-2 is false.
 (D) Statement-1 is false, statement-2 is true.

MDF075

3. If the function $f(x) = x^3 + e^{\frac{x}{2}}$ and $g(x) = f^{-1}(x)$, then the value of $g'(1)$ is

[JEE (Advanced) 2009]

MDF076

4. Let $f(\theta) = \sin\left(\tan^{-1}\left(\frac{\sin \theta}{\sqrt{\cos 2\theta}}\right)\right)$, where $-\frac{\pi}{4} < \theta < \frac{\pi}{4}$. Then the value of $\frac{d}{d(\tan \theta)}(f(\theta))$ is

[JEE (Advanced) 2011]

MDF077

5. Let $f : \mathbb{R} \rightarrow \mathbb{R}, g : \mathbb{R} \rightarrow \mathbb{R}$ and $h : \mathbb{R} \rightarrow \mathbb{R}$ be differentiable functions such that $f(x) = x^3 + 3x + 2$, $g(f(x)) = x$ and $h(g(g(x))) = x$ for all $x \in \mathbb{R}$. Then-

[JEE (Advanced) 2016]

- (A) $g'(2) = \frac{1}{15}$ (B) $h'(1) = 666$ (C) $h(0) = 16$ (D) $h(g(3)) = 36$

MDF079

JEE (Main) Practice Paper

This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided.

SECTION-A

- This section contains **TWENTY** questions.
- Each question has **FOUR** options (1), (2), (3) and (4). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories:
Full Marks : +4, if only the bubble corresponding to the correct option is darkened.
Zero Marks : 0, if none of the bubbles is darkened.
Negative Marks : -1 in all other cases.

1. If $f(x) = \log_{x^2}(\ln x)$ then $f'(x)$ at $x = e$ is
 (1) 0 (2) 1 (3) $\frac{1}{e}$ (4) $\frac{1}{2e}$ MDF098
2. If $f(x) = \cos x \cdot \cos 2x \cdot \cos 4x \cdot \cos 8x \cdot \cos 16x$ then $f'\left(\frac{\pi}{4}\right)$ is
 (1) $\sqrt{2}$ (2) $\frac{1}{\sqrt{2}}$ (3) 1 (4) None of these MDF099
3. If $y = \log_{10}(\sin^{-1} x^2)$ then at $x = \frac{1}{\sqrt{2}}$, $\frac{dy}{dx} =$
 (1) $\frac{2\sqrt{16} \log_{10} e}{\pi}$ (2) $\frac{4\sqrt{6} \log_{10} e}{\pi}$ (3) $\frac{2\sqrt{6} \log_e 10}{\pi}$ (4) $\frac{4\sqrt{6} \log_e 10}{\pi}$ MDF100
4. If $u = f(x^3), v = g(x^2), f'(x) = \cos x$ and $g'(x) = \sin x$ then $\frac{du}{dv}$ is
 (1) $\frac{3}{2} x \cos x^3 \cdot \cos ec x^2$ (2) $\frac{2}{3} \sin x^3 \cdot \sec x^2$ (3) $\tan x$ (4) None of these MDF101
5. If $y = \sin^n x \cos nx$, then $\frac{dy}{dx} =$
 (1) $n \sin^{n-1} x \cos(n-1)x$ (2) $n \sin^{n-1} x \cos(n+1)x$
 (3) $n \sin^{n-1} x \sin(n-1)x$ (4) $n \sin^{n-1} x \sin(n+1)x$ MDF102
6. If $x \sin(\alpha + y) = \sin y$ and $\sec^2 y \frac{dy}{dx} = \frac{m}{(n^2 x^2 + 2nx + 1)}$. Then
 (1) $m - n = 1$ (2) $m + n = 1$ (3) $m^2 + n^2 = 1$ (4) $m = n$ MDF103

7. If $y = f\left(\frac{2x-1}{x^2+1}\right)$ and $f'(x) = \sin x^2$, then $\frac{dy}{dx}$ is equal to
- (1) $\cos x^2 \cdot f'(x)$ (2) $-\cos x^2 \cdot f'(x)$
 (3) $\frac{2(1+x-x^2)}{(x^2+1)^2} \cdot \sin\left(\frac{2x-1}{x^2+1}\right)^2$ (4) None of these

MDF104

8. If $5f(x) + 3f\left(\frac{1}{x}\right) = x + 2$ and $y = xf(x)$ then $\left(\frac{dy}{dx}\right)_{x=1}$ is equal to
- (1) 14 (2) $\frac{7}{8}$ (3) 1 (4) None of these

MDF105

9. If $y = (1+x)(1+x^2)(1+x^4)\dots(1+x^{2^n})$ then $\frac{dy}{dx}$ at $x = 0$ is
- (1) 1 (2) 2 (3) 0 (4) None of these

MDF106

10. If $y = x^2 + \frac{1}{x^2 + \frac{1}{x^2 + \dots \infty}}$, then $\frac{dy}{dx} =$
- (1) $\frac{2xy^2}{y^2+1}$ (2) $\frac{2xy}{y^2+1}$ (3) $\frac{2x}{y^2+1}$ (4) $\frac{2}{y^2+1}$

MDF107

11. If $\sin y = x \sin(a+y)$, then $\frac{dy}{dx} =$
- (1) $\frac{\sin a}{\sin^2(a+y)}$ (2) $\frac{\sin^2(a+y)}{\sin a}$ (3) $\frac{\cos a}{\sin^2(a+y)}$ (4) $\frac{\sin^2(a+y)}{\cos a}$

MDF108

12. If $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \dots}}}$ then $\frac{dy}{dx} =$
- (1) $\frac{\sin x}{1-2y}$ (2) $\frac{\cos x}{1+2y}$ (3) $\frac{\cos x}{2y-1}$ (4) None

MDF109

13. If $f(x) = \sqrt{1 - \sin 2x}$, then $f'(x)$ equals
- (1) $-(\cos x + \sin x)$, for $x \in \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$ (2) $(\cos x + \sin x)$, for $x \in \left(0, \frac{\pi}{4}\right)$
 (3) $-(\cos x + \sin x)$, for $x \in \left(0, \frac{\pi}{4}\right)$ (4) $(\cos x - \sin x)$, for $x \in \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$

MDF110

14. If a differentiable function $f(x) = e^x + 2x$ is given, then $\frac{d}{dx}(f^{-1}(x))$ at $x = f(\ln 3)$ is equal to -
- (1) $\frac{1}{5}$ (2) $\frac{3}{7}$ (3) $\frac{7}{3}$ (4) 5

MDF111

15. For the curve represented implicitly as $4^x - 8^y = 4$ the value of $\lim_{x \rightarrow \infty} \left(\frac{dy}{dx} \right)$ is equal to
 (1) $\frac{1}{3}$ (2) $\frac{2}{3}$ (3) $2\ln 2$ (4) Does not exist
MDF112
16. If $y = y(x)$ and it follows the relation $e^{xy^2} + y \cos(x^2) = 5$ then $y'(0)$ is equal to
 (1) 4 (2) -16 (3) -4 (4) 16
MDF113
17. A function $f(x)$ is defined as $f(x) = \begin{cases} x^m \sin \frac{1}{x} & x > 0, m \in N \\ 0 & x = 0 \end{cases}$. The least value of m for which $f'(x)$ is continuous at $x = 0$ is
 (1) 1 (2) 2 (3) 3 (4) 4
MDF114
18. Let $f: (-3, 3) \rightarrow R$ be a differentiable function with $f(0) = -2$ and $f'(0) = -1$ and $g(x) = (f(3f(x) + 6))^3$. Then $g'(0)$ is equal to
 (1) 0 (2) 9 (3) 36 (4) -36
MDF115
19. If $y = 10^{10^x}$ and $\frac{1}{y} \frac{dy}{dx} = 10^x \cdot d$, then $d =$
 (1) $\ln 10$ (2) $(\ln 10)^2$ (3) $10^{\ln(\ln 10)^2}$ (4) $(\log_{10} e)^2$
MDF116
20. If $f(x)$ is a non constant polynomial function such that $f'(2x) = f''(3x) \cdot f'''(x)$, then leading coefficient of $f(x)$ is-
 (1) $\frac{1}{216}$ (2) $\frac{1}{36}$ (3) $\frac{1}{27}$ (4) $\frac{1}{81}$
MDF117

SECTION-B

- This section will have **TEN** questions. Candidate can choose to attempt any 5 question out of these 10 questions. In case if candidate attempts more than 5 questions, first 5 attempted questions will be considered for marking.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (Answer should be rounded off to the nearest integer).
- Answer to each question will be evaluated according to the following marking scheme:
 Full Marks : +4, if only correct answer is given.
 Zero Marks : 0, if no answer is given.
 Negative Marks : -1 for incorrect answer

1. If $x = \sec \theta - \cos \theta$ and $y = \sec^3 \theta - \cos^3 \theta$, then the value of $\left(\frac{dy}{dx} \right)^2$ at $x = 0$ is
MDF118

2. Let f and g be differentiable functions on R . If $f(6)=3, f'(6)=6, g(6)=1$ and $g'(6)=4$, then $2\left(\frac{fg}{f-g}\right)(6)$ is equal to
- MDF119**
3. Let $P(x)$ be a polynomial satisfying $P(x)-P'(x)=x^2+2x+1$, then $P(-1)$ is equal to
- MDF120**
4. Let $f(x) = 2\tan^{-1} x$ and $g(x)$ be a differentiable function satisfying $g\left(\frac{x+2y}{3}\right) = \frac{g(x)+2g(y)}{3} \forall x, y \in R$ and $g'(0)=1, g(0)=2$. Find the number of integers satisfying $f^2(g(x)) - 5f(g(x)) + 4 > 0$ where $x \in (-10,10)$
- MDF121**
5. Let $f(x) = \frac{x^2+mx+3}{x-2}$. If $f'(x) > 0 \forall x > 3$, then the range of m is $(-\infty, -a]$. Find the value of a .
- MDF122**
6. Let $f(x)$ be a twice differentiable function such that $f''(0) = 2$, then the value of $\lim_{x \rightarrow 0} \frac{f(5x)-3f(3x)+2f(2x)}{x^2}$ is
- MDF123**
7. A differentiable function f satisfies the relation $f(x+y) = f(x) + f(y) + \lambda xy(x+y) - \mu$ for all $x, y \in R$ and $\lim_{h \rightarrow 0} \frac{3f(h)-1}{2h} = 2$ also $f(2) = \frac{25}{3}$ then find the value of $\left(\lambda + \frac{1}{\mu}\right)$.
- MDF124**
8. If $\sqrt{4\cos x - 3\sin x + 5} + y \sin x = y \cos 2x$, then $y'(\pi)$ is equal to
- MDF125**
9. If $y = x^{n-1} \ln x$, satisfies $x^2 y_2 + f(n)xy_1 + g(n)y = 0$. where $f(n)$ and $g(n)$ are function of n ($n \in N$) then (y_1 and y_2 denote first order and second order derivative wrt. x) then the value of $f(4) + g(4)$ is -
- MDF126**
10. Let $f(x) = ax^3 + bx^2 + cx + 5$. If $|f(x)| \leq |e^x - e^2|$ for all $x \geq 0$ and if the maximum value of $|12a + 4b + c|$ is ℓ , then $[\ell]$ is equal to : [Note : $[y]$ denotes greatest integer less than or equal to y .]
- MDF127**

JEE (Advanced) Practice Paper

This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided.

SECTION-I

- This section contains **SIX** questions.
- Each question has FOUR options (A), (B), (C) and (D). ONLY ONE of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories:
 Full Marks : +3, if only the bubble corresponding to the correct option is darkened.
 Zero Marks : 0, if none of the bubbles is darkened.
 Negative Marks : -1, in all other cases

1. If $g(x) = f\left(x - \sqrt{1-x^2}\right)$ and $f'(x) = 1 - x^2$ then $g'(x)$ equals to -
 (A) $1 - x^2$ (B) $\sqrt{1-x^2}$ (C) $2x\left(x + \sqrt{1-x^2}\right)$ (D) $2x\left(x - \sqrt{1-x^2}\right)$
MDF128

2. If $f(x) = (2x - 3\pi)^5 + \frac{4}{3}x + \cos x$ and g is the inverse function of f , then $g'(2\pi)$ is equal to :
 (A) $\frac{7}{3}$ (B) $\frac{3}{7}$ (C) $\frac{30\pi^4 + 4}{3}$ (D) $\frac{3}{30\pi^4 + 4}$
MDF129

3. Consider $f(x) = \frac{3x-1}{x^2-1}$, $f_1(x) = \frac{d(f(x))}{dx}$, $f_2(x) = \frac{d^2(f(x))}{dx^2}$, $f_3(x) = \frac{d^3(f(x))}{dx^3}$ and so on, then value of $f_{50}(x)$ at $x = 0$ is-
 (A) $50!$ (B) $\frac{50!}{2^{50}}$ (C) $51!$ (D) $(50) 50!$
MDF130

4. If $y = \frac{\cos 6x + 6 \cos 4x + 15 \cos 2x + 10}{\cos 5x + 5 \cos 3x + 10 \cos x}$, then $\frac{dy}{dx} = \dots\dots\dots$.
 (A) $2 \sin x + \cos x$ (B) $-2 \sin x$ (C) $\cos 2x$ (D) $\sin 2x$
MDF131

5. Suppose $\begin{vmatrix} f'(x) & f(x) \\ f''(x) & f'(x) \end{vmatrix} = 0$ where $f(x)$ is continuously differentiable function with $f'(x) \neq 0$ and satisfies $f(0) = 1$ and $f'(0) = 2$ then $f(x)$ is :
 (A) $x^2 + 2x + 1$ (B) $2e^x - 1$ (C) e^{2x} (D) $4e^{x/2} - 3$
MDF132

6. If $F(x) = f(x)g(x)$ and $f'(x)g'(x) = c$, then $\frac{F'''(x)}{F(x)}$ is equal to
 (where $f'(x)$ denotes differentiation w.r.t. x and c is constant)
 (A) $\frac{f'}{f} + \frac{g'}{g}$ (B) $\frac{f''}{f} + \frac{g''}{g}$ (C) $\frac{f'''}{f} - \frac{g'''}{g}$ (D) $\frac{f'''}{f} + \frac{g'''}{g}$
MDF133

SECTION-II

- This section contains **SEVEN** questions.
- Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If only (all) the correct option(s) is (are) chosen.

Partial Marks : +3 If all the four options are correct but **ONLY** three options are chosen.

Partial Marks : +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct options.

Partial Marks : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option.

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered).

Negative Marks : -2 In all other cases.

For Example : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.

7. If $x + |y| = 2y$, then y as a function of x is
- (A) defined for all real x (B) continuous at $x = 0$
- (C) Differentiable for all x (D) Such that $\frac{dy}{dx} = \frac{1}{3}$ for $x < 0$

MDF134

8. If $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \dots \infty}}}$ then $\frac{dy}{dx}$ equals ($\sin x > 0$)
- (A) $\frac{\cos x}{2y-1}$ (B) $\frac{y}{2 \tan x + y \sec x}$ (C) $\frac{1}{\sqrt{1+4 \sin x}}$ (D) $\frac{2 \cos x}{\sin x + 2y}$

MDF135

9. If differentiate $(Ae^{-3x} \cos x + Be^{-3x} \sin x)$ w.r.t ' x ' is $e^{-3x} \cos x$ then which of the following hold good?
- (A) $A^2 + B^2 = 1$ (B) $B - 3A = 1$ (C) $A + 3B = 0$ (D) $A - 2B = 0$

MDF136

10. If $y^2 + b^2 = 2xy$, then $\frac{dy}{dx}$ equals
- (A) $\frac{1}{xy - b^2}$ (B) $\frac{y}{y - x}$ (C) $\frac{xy - b^2}{(x - y)^2}$ (D) $\frac{xy - b^2}{y}$

MDF137

Methods of Differentiation

11. For the function $y = f(x) = (x^2 + bx + c)e^x$, which of the following holds?
 (A) If $f(x) > 0$ for all real $x \Rightarrow f'(x) > 0$ (B) if $f(x) > 0$ for all real $x \Rightarrow f'(x) > 0$
 (C) if $f'(x) > 0$ for all real $x \Rightarrow f(x) > 0$ (D) if $f'(x) > 0$ for all real $x \Rightarrow f(x) > 0$

MDF138

12. If $y = \frac{x^4 + x^2 + 4}{(x^2 + \sqrt{3}x + 2)}$ and $\frac{dy}{dx} = ax + b$, then the value of $(a - b)$ is equal to
 (A) $\cot\left(\frac{\pi}{8}\right)$ (B) $\tan\left(\frac{3\pi}{8}\right)$ (C) $\cot\left(\frac{\pi}{12}\right)$ (D) $\tan\left(\frac{5\pi}{12}\right)$

MDF139

13. If f is a twice differentiable function satisfying $f(-x) = -f(x)$, $f(x) = f(4-x)$ and $f'(2+x) = f'(2-x) \forall x \in R$ then
 (A) $f(x)$ is an even function (B) $f'(1) + f'(3) + f'(5) = 0$
 (C) $f''(0) + f''(4) = 0$ (D) $\lim_{x \rightarrow 0} \frac{f(x)}{x}$ does not exist

MDF140

SECTION-III

- This section contains **TWO** paragraphs.
- Based on each paragraph, there are **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D) **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
Full Marks : +3 if only the bubble corresponding to the correct answer is darkened.
Zero Marks : 0 in all other cases.

Comprehension # 1 (Q. No. 14 & 15)

If $f(x) = x + \sin x$ and $g(x)$ denotes inverse function of $f(x)$, then

14. $g'(0)$ is -
 (A) 0 (B) 1 (C) 2 (D) $\frac{1}{2}$
15. Number of vertical tangent of $g(x)$ is -
 (A) 1 (B) 2 (C) 3 (D) more than 3

MDF141

MDF142

Comprehension # 2 (Q. No. 16 & 17)

Consider $f : [0, \infty) \rightarrow [0, \infty)$; such that $f(x)$ is bijective and satisfies $f(x)e^{f(x)} = x$.

On the basis of above information, answer the following questions :

16. The greatest integer less than or equal to the value of $f\left(f\left(e^{(e+1)}\right)\right)$, is -
 (A) 0 (B) 1 (C) 2 (D) 3

MDF143

17. The value of $\lim_{x \rightarrow \infty} \frac{f(x)}{\ln x}$, is -
 (A) 0 (B) 1 (C) e (D) non-existent

MDF144

SECTION-IV

- This section contains **THREE** questions of matching type.
- This section contains **One** table (having 3 columns and 4 rows)
- Based on table, there are **THREE** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct
- For each question, marks will be awarded in one of the following categories :

Full Marks : +3 If only correct answer is given.

Zero Marks : 0 If no answer is given.

Negative Marks : -1 For incorrect answer

Answer Q.18, Q.19 and Q.20 by appropriately matching the information given in the three columns of the following table

Column 1	Column 2	Column 3
(I) $x^3 + y^3 = 3x^2y$	(i) $\left(\frac{dy}{dx}\right) = \frac{2}{1+x^2}$	(P) $\left(\frac{d^2y}{dx^2}\right) = \frac{-4x}{(1+x^2)^2}$
(II) If $y = 7x$	(ii) $\left(\frac{dy}{dx}\right) = \frac{y}{x}$	(Q) $\left(\frac{d^2y}{dx^2}\right) = \frac{4x}{(1+x^2)^2}$
(III) If $y = \sin^{-1} \frac{2x}{1+x^2}$ where $x \in (0,1)$	(iii) $\left(\frac{dy}{dx}\right) = -\frac{2}{(1+x^2)}$	(R) $\frac{d^2y}{dx^2} = 7$
(IV) $y = \cos^{-1} \frac{(1-x^2)}{1+x^2}$ where $x \in (-1,0)$	(iv) $\left(\frac{dy}{dx}\right) = 0$	(S) $\left(\frac{d^2y}{dx^2}\right) = 0$

18. Which of the following options is the only **CORRECT** combination ?
 (A) (IV) (i) (S) (B) (III) (i) (P) (C) (II) (iv) (R) (D) (I) (iv) (R)
19. Which of the following options is the only **CORRECT** combination ?
 (A) (I) (ii) (S) (B) (I) (ii) (P) (C) (III) (iii) (R) (D) (IV) (iv) (S)
20. Which of the following options is the only **CORRECT** combination ?
 (A) (IV) (iii) (Q) (B) (IV) (iv) (Q) (C) (I) (ii) (P) (D) (II) (i) (Q)

MDF145

MDF146

MDF147

ANSWER KEY

EXERCISE - O

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	B	B	B	A	B	A	A	A	B	C
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	C	B	A	C	C	C	D	B,D	A,B	B,D
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	A,B,C,D	B,C,D	A,B,C,D	A	B	C	A	D	C	C

EXERCISE - S

1.	0	2.	1	3.	2	4.	5	5.	1
6.	2	7.	1.00	8.	36.00	9.	3.00	10.	1
11.	0	12.	101	13.	1.00	14.	2	15.	3.00

EXERCISE - JEE (Main) PYQ

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	4	4	4	1	4	2	1	91	3	2
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	39	3	1	1	40	4	4	2	3	16
Que.	21	22	23	24	25					
Ans.	3	2	3	2	2					

EXERCISE - JEE (Advanced) PYQ

Que.	1	2	3	4	5					
Ans.	A	A	2	1	B,C					

JEE (Main) Practice Paper

Section-A	Q.	1	2	3	4	5	6	7	8	9	10
	A.	4	1	2	1	2	3	3	2	1	1
Section-B	Q.	11	12	13	14	15	16	17	18	19	20
	A.	2	3	3	1	2	2	3	3	2	4
Section-B	Q.	1	2	3	4	5	6	7	8	9	10
	A.	9	15	2	8	3	8	5	1	4	7

JEE (Advanced) Practice Paper

Section-I	Q.	1	2	3	4	5	6		
	A.	C	B	A	B	C	D		
Section-II	Q.	7	8	9	10	11	12	13	
	A.	A,B,D	B,C	B,C	B,C	A,C	C,D	A,B,C	
Section-III	Q.	14	15	16	17				
	A.	D	D	B	B				
Section-IV	Q.	18	19	20					
	A.	B	A	A					