EXERCISE - O

SINGLE CORRECT TYPE QUESTIONS

1. Domain of the function $f(x) = \log_e\cos^{-1}\{\sqrt{x}\}$ is, where {.} represents fractional part function –

(A) $x \in \mathbb{R}$ (B) $x \in [0, \infty)$ (C) $x \in (0, \infty)$ (D) $x \in \mathbb{R} - \{x \mid x \in I\}$

MIT002

2. The range of the function $f(x) = \sin^{-1}(\log_2(-x^2 + 2x + 3))$ is –

(A) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ (B) $\left[-\frac{\pi}{2}, 0\right]$ (C) $\left[0, \frac{\pi}{2}\right]$ (D) [–1, 1]

MIT003

3. Range of $f(x) = \cot^{-1}(\log_e(1 - x^2))$ is -

(A) $(0,\pi)$ (B) $\left(0,\frac{\pi}{2}\right)$ (C) $\left[\frac{\pi}{2},\pi\right)$ (D) $\left(0,\frac{\pi}{2}\right]$

MIT004

4. The function $f(x) = \cot^{-1}\sqrt{(x+3)x} + \cos^{-1}\sqrt{x^2+3x+1}$ is defined on the set S, where S is equal to:

(A) {0, 3} (B) (0, 3) (C) {0, –3} (D) [–3, 0]

MIT005

5. The value of $\cot^{-1}\left\{\frac{\sqrt{1-\sin x}+\sqrt{1+\sin x}}{\sqrt{1-\sin x}-\sqrt{1+\sin x}}\right\}$, where $\frac{\pi}{2} < x < \pi$, is:

(A) $\pi - \frac{x}{2}$ (B) $\frac{\pi}{2} + \frac{x}{2}$ (C) $\frac{x}{2}$ (D) $2\pi - \frac{x}{2}$

MIT008

6. The inequality $\sin^{-1}(\sin 5) > x^2 - 4x$ holds for

(A) $x \in \left(2-\sqrt{9-2\pi}, 2+\sqrt{9-2\pi}\right)$ (B) $x > 2 + \sqrt{9-2\pi}$

(C) $x < 2 - \sqrt{9-2\pi}$ (D) $x \in \phi$

MIT009

7. Show that the roots r, s and t of the cubic $x(x - 2)(3x - 7) = 2$, are real and positive. Also compute the value of $\tan^{-1}(r) + \tan^{-1}(s) + \tan^{-1}(t)$.

(A) $\frac{\pi}{2}$ (B) $\frac{3\pi}{4}$ (C) $\frac{5\pi}{4}$ (D) 2π

MIT010

8. The complete solution set of the inequality $[\cot^{-1}x]^2 - 6[\cot^{-1}x] + 9 \le 0$, where [.] denotes greatest integer function, is

(A) $(-\infty, \cot 3]$ (B) [cot 3, cot 2] (C) [cot 3, ∞) (D) $(-\infty, \cot 2]$

MIT011

9. If $\cos^{-1}(2x^2 - 1) = 2\pi - 2\cos^{-1}x$, then -

(A) $x \in [-1, 0]$ (B) $x \in [0, 1]$ (C) $x \in \left[0, \frac{1}{\sqrt{2}}\right]$ (D) $x \in \left[-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right]$

MIT014

10. If $\cos^{-1}x - \cos^{-1}\frac{y}{2} = \alpha$, then $4x^2 - 4xy\cos\alpha + y^2$ is equal to-

(A) $2\sin 2\alpha$ (B) 4 (C) $4\sin^2\alpha$ (D) $-4\sin^2\alpha$

MIT015

11. $\tan\left(\frac{\pi}{4}+\frac{1}{2}\cos^{-1}x\right)+\tan\left(\frac{\pi}{4}-\frac{1}{2}\cos^{-1}x\right)$, $x \neq 0$ is equal to

(A) x (B) $2x$ (C) $\frac{2}{x}$ (D) $\frac{x}{2}$

MIT016

12. If $\alpha = 2\text{ arc tan}\left(\frac{1+x}{1-x}\right)$ & $\beta = \text{arc sin}\left(\frac{1-x^2}{1+x^2}\right)$, what is the value of $\alpha + \beta$ if $x > 1$.

(A) $-\pi$ (B) π (C) $\frac{\pi}{2}$ (D) 2π

MIT017

13. The numerical value of $\tan\left(2\tan^{-1}\frac{1}{5}-\frac{\pi}{4}\right)$ is

(A) $\frac{-7}{17}$ (B) $\frac{7}{17}$ (C) $\frac{17}{7}$ (D) $-\frac{2}{3}$

MIT018

14. $\sum_{r=0}^{\infty}\tan^{-1}\left(\frac{r((r+1)!)}{(r+1)+((r+1)!)^2}\right)$ is equal to -

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{4}$ (C) $\cot^{-1}3$ (D) $\tan^{-1}2$

MIT019

15. $\lim_{n\to\infty}\sum_{r=1}^{n}\tan^{-1}\frac{2r+1}{r^4+2r^3+r^2+1}$ is equal to -

(A) $\frac{\pi}{4}$ (B) $\frac{3\pi}{4}$ (C) $\frac{\pi}{2}$ (D) $-\frac{\pi}{8}$

MIT020

MULTIPLE CORRECT TYPE QUESTIONS

16. Consider the function $f(x) = e^x$ and $g(x) = \sin^{-1}x$, then which of the following is/are necessarily true.

(A) Domain of gof = Domain of f (B) Range of $gof \subset$ Range of g

(C) Domain of gof is $(-\infty, 0]$ (D) Range of gof is $\left[-\frac{\pi}{2}, 0\right)$

MIT048

17. Let $f(x) = \sin^{-1}(tanx) + \cos^{-1}(cotx)$ then

(A) $f(x) = \frac{\pi}{2}$ wherever defined (B) domain of $f(x)$ is $x = n\pi \pm \frac{\pi}{4}$, $n \in I$

(C) period of $f(x)$is $\frac{\pi}{2}$ (D) $f(x)$ is many one function

MIT049

18. If $\sin\left(2\cos^{-1}\left(\frac{1}{\sqrt{5}}\right)\right)+\cos\left(2\tan^{-1}\left(\frac{1}{3}\right)\right)=\frac{p}{q}$, where p & q are relatively prime then digit at units place of $(p-q)^{2k+1}$, $k\in N$, can be -

(A) 1 (B) 3 (C) 7 (D) 9

MIT051

19. Value of $3\tan^{-1}\left(\frac{1}{3}\right)+\tan^{-1}\left(\frac{1}{2}\right)+\sin^{-1}\left(\frac{1}{\sqrt{5}}\right)+\cos^{-1}\left(\frac{2}{\sqrt{5}}\right)$ is greater than

(A) $\frac{\pi}{2}$ (B) $\frac{2\pi}{3}$ (C) $\frac{3\pi}{4}$ (D) $\frac{5\pi}{6}$

MIT052

20. If $\alpha=2\tan^{-1}(\sqrt{3-2\sqrt{2}})+\sin^{-1}\left(\frac{1}{\sqrt{6}-\sqrt{2}}\right)$, $\beta=\cot^{-1}\left(\sqrt{3}-2\right)+\frac{1}{8}\sec^{-1}(-2)$ & $\gamma=\tan^{-1}\frac{1}{\sqrt{2}}+\cos^{-1}\frac{1}{\sqrt{3}}$, then

(A) $\alpha=\beta$ (B) $\alpha+\beta=3\gamma$

(C) $4(\beta-\gamma)=\alpha$ (D) $\beta=\gamma$

MIT053

21. If $\sin^{-1}\left(\frac{\sqrt{x}}{2}\right)+\sin^{-1}\left(\sqrt{1-\frac{x}{4}}\right)+\tan^{-1}y=\frac{2\pi}{3}$, then :

(A) maximum value of x^2+y^2 is $\frac{49}{3}$ (B) maximum value of x^2+y^2 is 4

(C) minimum value of x^2+y^2 is $\frac{1}{3}$ (D) minimum value of x^2+y^2 is 3

MIT054

COMPREHENSION TYPE QUESTIONS

Paragraph for Question 22 to 24

Consider a continuous function such that each image has atmost three preimage & atleast one image has exactly three preimages. This type of function is to be called as three-one function.

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

22. Which of the following function is a three-one function ?

(A) $|\ell n|x||$ (B) $e^{|x|}$

(C) x^3+3x^2-7x+6 (D) $\cos(\cos^{-1}x)$

MIT055

23. If $f(x)=\sin^{-1}(\sin x)$ is a three-one function, then possible interval of x is -

(A) $[-\pi,\pi]$ (B) $\left[-\frac{\pi}{2},\frac{3\pi}{2}\right]$

(C) $(-2\pi,0]$ (D) $\left[\frac{-3\pi}{2},\frac{\pi}{2}\right]$

MIT056

24. If $f(x)$ is a three-one function such that $f(a)=f(b)$ (where $a\neq b$), then number of maximum possible values of b is -

(A) 1 (B) 2

(C) 3 (D) 4

MIT057

Paragraph for Question 25 to 26

If $\alpha = 2\tan^{-1}\frac{1}{2} + \sin^{-1}\frac{3}{5}$, $\beta = \sin^{-1}\frac{12}{13} + \cos^{-1}\frac{4}{5} + \cot^{-1}\frac{16}{63}$.

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

25. If $2\sin\alpha$, $\cos\beta$ are roots of $x^2 - ax + b = 0$, then -

(A) $a = 1$ (B) $a = -1$

(C) $b = -2$ (D) $\frac{b}{a} = -2$

MIT058

26. The range of $cot^{-1}(x^2 - 2x)$ is $(c, d]$, then

(A) $c = 0$ (B) $d = \frac{3\pi}{4}$

(C) $c = \frac{\pi}{4}$ (D) $c + d = \frac{3\pi}{4}$

MIT059

MATCHING LIST TYPE QUESTION

Match List-I with List-II and select the correct answer.

	List-I		**List-II**
(P)	The number of integral values of k for which the equation $\sin^{-1}x^2 + \tan^{-1}x^2 = 2k + 1$ has a solution	(1)	1
(Q)	Let $\sum_{k=1}^{\infty}\cot^{-1}\left(\frac{k^2}{8}\right) = \frac{p}{q}\pi$ where $\frac{p}{q}$ is rational in its lowest form, then find $\lvert q - p\rvert$	(2)	2
(R)	If $\tan^{-1}\left(\sin^2\theta - 2\sin\theta + 3\right) + \cot^{-1}\left(5\sec^2 y + 1\right) = \frac{\pi}{2}$, then the value of $\cos^2 y - \sin\theta$	(3)	3
(S)	Minimum positive integral value of x such that $f(x)$ is defined, $f(x) = \sqrt{\sec^{-1}\left(\frac{1-\lvert x\rvert}{2}\right)}$	(4)	0

27. Which of the following is the only **CORRECT** combination ?

(A) (P), (3) (B) (S), (2)

(C) (R), (2) (D) (Q), (1)

MIT062

28. Which of the following is the only **CORRECT** combination ?

(A) (P), (1) (B) (Q), (1)

(C) (R), (4) (D) (S), (2)

MIT063

29. Match the column

Column-I		**Column-II**
(A) Let a, b, c be three positive real numbers $\theta = \tan^{-1}\sqrt{\frac{a(a+b+c)}{bc}} + \tan^{-1}\sqrt{\frac{b(a+b+c)}{ca}} + \tan^{-1}\sqrt{\frac{c(a+b+c)}{ab}}$, then θ is equal to	(p)	π
(B) The value of the expression $\tan^{-1}\left(\frac{1}{2}\tan 2A\right) + \tan^{-1}(\cot A) + \tan^{-1}(\cot^3 A)$ for $0 < A < (\pi/4)$ is equal to	(q)	$-\frac{\pi}{2}$
(C) If $x < 0$, then $\frac{1}{2}\{\cos^{-1}(2x^2 - 1) + 2\cos^{-1} x\}$ is equal to	(r)	$-\pi$
(D) The value of $\sin^{-1}\left(\frac{3}{5}\right) - \cos^{-1}\left(\frac{12}{13}\right) + \cos^{-1}\left(\frac{16}{65}\right)$ is equal to	(s)	$\frac{\pi}{2}$

MIT064 **MIT065** **MIT066** **MIT067**

30. Solve for x :

Column – I		**Column – II**	
(P)	$\sin^{-1} x + \sin^{-1} 2x = \frac{\pi}{3}$	(1)	$x = 3$
(Q)	$\tan^{-1}\frac{1}{1+2x} + \tan^{-1}\frac{1}{1+4x} = \tan^{-1}\frac{2}{x^2}$	(2)	$x = \frac{1}{2}\sqrt{\frac{3}{7}}$
(R)	$\tan^{-1}(x-1) + \tan^{-1}(x) + \tan^{-1}(x+1) = \tan^{-1}(3x)$	(3)	$\left[\frac{\sqrt{3}}{2}, 1\right]$
(S)	$3\cos^{-1} x = \sin^{-1}\left(\sqrt{1-x^2}(4x^2-1)\right)$	(4)	$x = 0, \frac{1}{2}, -\frac{1}{2}$

MIT088

EXERCISE - S

1. Let $f(x)=\sin^{-1}\left(\frac{2x}{1+x^2}\right)+\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$, then the value of $f(1) + f(2)$ is $k\pi$ where k is equal to

MIT021

2. If $x > 0$ $\cos^{-1}\left(\frac{12}{x}\right)=\frac{\pi}{2}-\cos^{-1}\left(\frac{16}{x}\right)$ then x is -

MIT023

3. Number of integral ordered pairs (a, b) for which

$\sin^{-1}(1 + b + b^2 + \ldots \infty) + \cos^{-1}\left(a-\frac{a^2}{3}+\frac{a^3}{9}-\ldots..\infty\right)=\frac{\pi}{2}$ is –

MIT024

4. Number of solution(s) of the equation $\cos^{-1}\sqrt{x}-\sin^{-1}\sqrt{x-1}+\cos^{-1}\sqrt{1-x}-\sin^{-1}\frac{1}{\sqrt{x}}=\frac{\pi}{2}$ is -

MIT026

5. The number of solution(s) of the equation, $\sin^{-1}x + \cos^{-1}(1 - x) = \sin^{-1}(- x)$, is

MIT027

6. If $\sin^{-1}\left(x-\frac{x^2}{2}+\frac{x^3}{4}-.....\right)+\cos^{-1}\left(x^2-\frac{x^4}{2}+\frac{x^6}{4}-.....\right)=\frac{\pi}{2}$ for $0 < |x| < \sqrt{2}$, then x equals

MIT028

7. Let $y = \sin^{-1}(\sin 8) - \tan^{-1}(\tan 10) + \cos^{-1}(\cos 12) - \sec^{-1}(\sec 9) + \cot^{-1}(\cot 6) - \operatorname{cosec}^{-1}(\operatorname{cosec} 7)$. If y simplifies to $a\pi + b$, then find $(a - b)$.

MIT029

8. If $\sin^{-1}\sin\left(\frac{10\pi}{3}\right)+\cos^{-1}\cos\frac{22\pi}{3}+\tan^{-1}\tan 10=a\pi+b$, then $\left|\frac{3ab}{80}\right|$ is equal to

MIT030

9. If the domain of definition of the function $f(x)=\sqrt{\sin^{-1}(2x)+\frac{\pi}{6}}$ for real valued 'x' is $[\alpha, \beta]$, then the value of $4(\alpha + \beta)$ is equal to:

MIT068

10. Number of solutions of equation $\tan^{-1}(e^{-x}) + \cot^{-1}(|\ell nx|) = \pi/2$ is :

MIT069

11. If $\tan^{-1} x + \cot^{-1} \frac{1}{y} + 2\tan^{-1} z = \pi$, then $x + y + \mu z = xz^2 + yz^2 + \lambda xyz$. Find $\lambda + \mu$

MIT089

12. If the value of $\cot\left(\operatorname{cosec}^{-1}\frac{5}{3}+\tan^{-1}\frac{2}{3}\right)$ is equal to $\frac{a}{b}$, where a and b are coprime, then the value of $a + b$ is

MIT091

EXERCISE - JEE (Main) PYQ

1. If $\cos^{-1}\left(\frac{2}{3x}\right)+\cos^{-1}\left(\frac{3}{4x}\right)=\frac{\pi}{2}, \left(x>\frac{3}{4}\right)$, then x is equal to : **[JEE (Main) 2019]**

(1) $\frac{\sqrt{145}}{12}$ (2) $\frac{\sqrt{145}}{10}$ (3) $\frac{\sqrt{146}}{12}$ (4) $\frac{\sqrt{145}}{11}$

MIT031

2. If $x = \sin^{-1}(\sin 10)$ and $y = \cos^{-1}(\cos 10)$, then $y - x$ is equal to: **[JEE (Main) 2019]**

(1) π (2) 7π (3) 0 (4) 10

MIT032

3. The value of $\cot\left(\sum_{n=1}^{19}\cot^{-1}\left(1+\sum_{p=1}^{n}2p\right)\right)$ is : **[JEE (Main) 2019]**

(1) $\frac{22}{23}$ (2) $\frac{23}{22}$ (3) $\frac{21}{19}$ (4) $\frac{19}{21}$

MIT033

4. Considering only the principal values of inverse functions, the set

$A=\left\{x\geq 0:\tan^{-1}(2x)+\tan^{-1}(3x)=\frac{\pi}{4}\right\}$ **[JEE (Main) 2019]**

(1) is an empty set
(2) Contains more than two elements
(3) Contains two elements
(4) is a singleton

MIT034

5. The value of $\sin^{-1}\left(\frac{12}{13}\right)-\sin^{-1}\left(\frac{3}{5}\right)$ is equal to : **[JEE (Main) 2019]**

(1) $\pi-\sin^{-1}\left(\frac{63}{65}\right)$ (2) $\pi-\cos^{-1}\left(\frac{33}{65}\right)$ (3) $\frac{\pi}{2}-\sin^{-1}\left(\frac{56}{65}\right)$ (4) $\frac{\pi}{2}-\cos^{-1}\left(\frac{9}{65}\right)$

MIT037

6. If S is the sum of the first 10 terms of the series $\tan^{-1}\left(\frac{1}{3}\right)+\tan^{-1}\left(\frac{1}{7}\right)+\tan^{-1}\left(\frac{1}{13}\right)+\tan^{-1}\left(\frac{1}{21}\right)+\ldots$,

then $\tan(S)$ is equal to : **[JEE (Main) 2020]**

(1) $\frac{5}{11}$ (2) $-\frac{6}{5}$ (3) $\frac{10}{11}$ (4) $\frac{5}{6}$

MIT038

7. The domain of the function $f(x)=\sin^{-1}\left(\frac{|x|+5}{x^2+1}\right)$ is $(-\infty, -a]\cup[a, \infty)$. Then a is equal to :

[JEE (Main) 2020]

(1) $\frac{1+\sqrt{17}}{2}$ (2) $\frac{\sqrt{17}-1}{2}$ (3) $\frac{\sqrt{17}}{2}+1$ (4) $\frac{\sqrt{17}}{2}$

MIT092

8. $2\pi-\left(\sin^{-1}\frac{4}{5}+\sin^{-1}\frac{5}{13}+\sin^{-1}\frac{16}{65}\right)$ is equal to: **[JEE (Main) 2020]**

(1) $\frac{7\pi}{4}$ (2) $\frac{5\pi}{4}$ (3) $\frac{3\pi}{2}$ (4) $\frac{\pi}{2}$

MIT093

9. Let M and m respectively be the maximum and minimum values of the function $f(x) = \tan^{-1}(\sin x + \cos x)$ in $\left[0,\frac{\pi}{2}\right]$. Then the value of $\tan(M-m)$ is equal to: **[JEE (Main) 2021]**

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

MIT039

10. If $\sum_{r=1}^{50}\tan^{-1}\frac{1}{2r^2}=p$, then the value of $\tan p$ is : **[JEE (Main) 2021]**

(1) $\frac{101}{102}$ (2) $\frac{50}{51}$ (3) 100 (4) $\frac{51}{50}$

MIT040

11. If $0 < a, b < 1$, and $\tan^{-1}a + \tan^{-1}b = \frac{\pi}{4}$, then the value of $(a+b)-\left(\frac{a^2+b^2}{2}\right)+\left(\frac{a^3+b^3}{3}\right)-\left(\frac{a^4+b^4}{4}\right)+\ldots$ is : **[JEE (Main) 2021]**

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

MIT041

12. The domain of the function $f(x)=\sin^{-1}\left(\frac{3x^2+x-1}{(x-1)^2}\right)+\cos^{-1}\left(\frac{x-1}{x+1}\right)$ is : **[JEE (Main) 2021]**

(1) $\left[0,\frac{1}{4}\right]$ (2) $[-2,0]\cup\left[\frac{1}{4},\frac{1}{2}\right]$ (3) $\left[\frac{1}{4},\frac{1}{2}\right]\cup\{0\}$ (4) $\left[0,\frac{1}{2}\right]$

MIT094

13. $\text{cosec}\left[2\cot^{-1}(5)+\cos^{-1}\left(\frac{4}{5}\right)\right]$ is equal to : **[JEE (Main) 2021]**

(1) $\frac{56}{33}$ (2) $\frac{65}{56}$ (3) $\frac{65}{33}$ (4) $\frac{75}{56}$

MIT095

14. The domain of the function $\cos^{-1}\left(\frac{2\sin^{-1}\left(\frac{1}{4x^2-1}\right)}{\pi}\right)$ is : **[JEE (Main) 2022]**

(1) $R-\left\{-\frac{1}{2},\frac{1}{2}\right\}$ (2) $(-\infty,-1]\cup[1,\infty)\cup\{0\}$

(3) $\left(-\infty,\frac{-1}{2}\right)\cup\left(\frac{1}{2},\infty\right)\cup\{0\}$ (4) $\left(-\infty,\frac{-1}{\sqrt{2}}\right]\cup\left[\frac{1}{\sqrt{2}},\infty\right)\cup\{0\}$

MIT042

15. The set of all values of k for which $(tan^{-1}x)^3 + (cot^{-1}x)^3 = k\pi^3, x \in R$, is the interval : **[JEE (Main) 2022]**

(1) $\left[\frac{1}{32},\frac{7}{8}\right)$ (2) $\left(\frac{1}{24},\frac{13}{16}\right)$ (3) $\left[\frac{1}{48},\frac{13}{16}\right]$ (4) $\left[\frac{1}{32},\frac{9}{8}\right)$

MIT043

16. If the inverse trigonometric functions take principal values, then $\cos^{-1}\left(\frac{3}{10}\cos\left(\tan^{-1}\left(\frac{4}{3}\right)\right)+\frac{2}{5}\sin\left(\tan^{-1}\left(\frac{4}{3}\right)\right)\right)$ is equal to : **[JEE (Main) 2022]**

(1) 0 (2) $\frac{\pi}{4}$ (3) $\frac{\pi}{3}$ (4) $\frac{\pi}{6}$

MIT045

17. The domain of the function $f(x)=\frac{\cos^{-1}\left(\frac{x^2-5x+6}{x^2-9}\right)}{\log_e(x^2-3x+2)}$ is **[JEE (Main) 2022]**

(1) $(-\infty,1)\cup(2,\infty)$ (2) $(2,\infty)$

(3) $\left[-\frac{1}{2},1\right)\cup(2,\infty)$ (4) $\left[-\frac{1}{2},1\right)\cup(2,\infty)-\left\{\frac{3+\sqrt{5}}{2},\frac{3-\sqrt{5}}{2}\right\}$

MIT046

18. Let $f(x) = 2\cos^{-1}x + 4\cot^{-1}x - 3x^2 - 2x + 10$, $x \in [-1, 1]$. If $[a, b]$ is the range of the function then $4a - b$ is equal to: **[JEE (Main) 2022]**

(1) 11 (2) $11 - \pi$ (3) $11 + \pi$ (4) $15 - \pi$

MIT096

19. $50\ tan\left(3tan^{-1}\left(\frac{1}{2}\right)+2cos^{-1}\left(\frac{1}{\sqrt{5}}\right)\right)+4\sqrt{2}\tan\left(\frac{1}{2}tan^{-1}(2\sqrt{2})\right)$ is equal to. **[JEE (Main) 2022]**

MIT097

20. The range of $f(x)=4\sin^{-1}\left(\frac{x^2}{x^2+1}\right)$ is **[JEE (Main) 2023]**

(1) $[0, \pi]$ (2) $[0, 2\pi)$ (3) $[0, \pi)$ (4) $[0, 2\pi]$

MIT081

21. $\tan^{-1}\left(\frac{1+\sqrt{3}}{3+\sqrt{3}}\right)+\sec^{-1}\left(\sqrt{\frac{8+4\sqrt{3}}{6+3\sqrt{3}}}\right)$ is equal to **[JEE (Main) 2023]**

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

MIT082

22. $7f$ the sum of all the solutions of $\tan^{-1}\left(\frac{2x}{1-x^2}\right)+\cot^{-1}\left(\frac{1-x^2}{2x}\right)=\frac{\pi}{3}$, $-1<x<1, x\neq 0$, is $\alpha-\frac{4}{\sqrt{3}}$, then α is equal to. **[JEE (Main) 2023]**

MIT083

23. Let $a_1=1,a_2,a_3,a_4,.....$ be consecutive natural numbers. Then $\tan^{-1}\left(\frac{1}{1+a_1a_2}\right)+\tan^{-1}\left(\frac{1}{1+a_2a_3}\right)$ $+.....+\tan^{-1}\left(\frac{1}{1+a_{2021}a_{2022}}\right)$ is equal to **[JEE (Main) 2023]**

(1) $\frac{\pi}{4}-\cot^{-1}(2022)$ (2) $\cot^{-1}(2022)-\frac{\pi}{4}$

(3) $\tan^{-1}(2022)-\frac{\pi}{4}$ (4) $\frac{\pi}{4}-\tan^{-1}(2022)$

MIT084

24. Let $(a,b)\subset(0,2\pi)$ be the largest interval for which $\sin^{-1}(\sin\theta)-\cos^{-1}(\sin\theta)>0,\theta\in(0,2\pi)$, holds. If $\alpha x^2+\beta x+\sin^{-1}\left(x^2-6x+10\right)+\cos^{-1}$ $\left(x^2-6x+10\right)=0$ and $\alpha-\beta=b-a$, then α is equal to : **[JEE (Main) 2023]**

(1) $\frac{\pi}{48}$ (2) $\frac{\pi}{16}$ (3) $\frac{\pi}{8}$ (4) $\frac{\pi}{12}$

MIT085

25. If $\sin^{-1}\frac{\alpha}{17}+\cos^{-1}\frac{4}{5}-\tan^{-1}\frac{77}{36}=0$, $0<\alpha<13$, then $\sin^{-1}(\sin\alpha)+\cos^{-1}(\cos\alpha)$ is equal to **[JEE (Main) 2023]**

(1) π (2) 16 (3) 0 (4) $16-5\pi$

MIT086

EXERCISE - JEE (Advanced) PYQ

1. The value of $\cot\left(\sum_{n=1}^{23}\cot^{-1}\left(1+\sum_{k=1}^{n}2k\right)\right)$ is **[JEE (Advanced) 2013]**

(A) $\frac{23}{25}$ (B) $\frac{25}{23}$ (C) $\frac{23}{24}$ (D) $\frac{24}{23}$

MIT070

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

	List-I	**List-II**
P.	$\left(\frac{1}{y^2}\left(\frac{\cos\left(\tan^{-1}y\right)+y\sin\left(\tan^{-1}y\right)}{\cot\left(\sin^{-1}y\right)+\tan\left(\sin^{-1}y\right)}\right)^2+y^4\right)^{1/2}$ takes value	1. $\frac{1}{2}\sqrt{\frac{5}{3}}$
Q.	If $\cos x+\cos y+\cos z=0=\sin x+\sin y+\sin z$, then possible value of $\cos\frac{x-y}{2}$ is	2. $\sqrt{2}$
R.	If $\cos\left(\frac{\pi}{4}-x\right)\cos 2x+\sin x\sin 2x\sec x$ $=\cos x\sin 2x\sec x+\cos\left(\frac{\pi}{4}+x\right)\cos 2x$, then possible value of $\sec x$ is	3. $\frac{1}{2}$
S.	If $\cot\left(\sin^{-1}\sqrt{1-x^2}\right)=\sin\left(\tan^{-1}\left(x\sqrt{6}\right)\right), x\neq 0$, then possible value of x is	4. 1

[JEE (Advanced) 2013]

Codes :

	P	Q	R	S
(A)	4	3	1	2
(B)	4	3	2	1
(C)	3	4	2	1
(D)	3	4	1	2

MIT071

3. Let $f:[0,4\pi]\to[0,\pi]$ be defined by $f(x)=\cos^{-1}(\cos x)$. The number of points $x\in[0,4\pi]$ satisfying the equation $f(x)=\frac{10-x}{10}$ is **[JEE (Advanced) 2014]**

MIT072

4. If $\alpha=3\sin^{-1}\left(\frac{6}{11}\right)$ and $\beta=3\cos^{-1}\left(\frac{4}{9}\right)$ where the inverse trigonometric functions take only the principal values, then the correct option(s) is(are) **[JEE (Advanced) 2015]**

(A) $\cos\beta>0$ (B) $\sin\beta<0$ (C) $\cos(\alpha+\beta)>0$ (D) $\cos\alpha<0$

MIT073

5. The number of real solutions of the equation

$$\sin^{-1}\left(\sum_{i=1}^{\infty}x^{i+1}-x\sum_{i=1}^{\infty}\left(\frac{x}{2}\right)^i\right)=\frac{\pi}{2}-\cos^{-1}\left(\sum_{i=1}^{\infty}\left(-\frac{x}{2}\right)^i-\sum_{i=1}^{\infty}(-x)^i\right)$$

lying in the interval $\left(-\frac{1}{2},\frac{1}{2}\right)$ is ___

(Here, the inverse trigonometric functions $\sin^{-1}x$ and $\cos^{-1}x$ assume value in $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ and $[0,\pi]$, respectively.) **[JEE (Advanced) 2018]**

MIT074

6. Let $E_1 = \left\{x \in \mathbb{R} : x \neq 1 \text{ and } \frac{x}{x-1} > 0\right\}$ and $E_2 = \left\{x \in E_1 : \sin^{-1}\left(\log_e\left(\frac{x}{x-1}\right)\right) \text{ is a real number}\right\}$.

$\left(\text{Here, the inverse trigonometric function } \sin^{-1}x \text{ assumes values in } \left[-\frac{\pi}{2}, \frac{\pi}{2}\right].\right)$

Let $f : E_1 \to \mathbb{R}$ be the function defined by $f(x) = \log_e\left(\frac{x}{x-1}\right)$

and $g : E_2 \to \mathbb{R}$ be the function defined by $g(x) = \sin^{-1}\left(\log_e\left(\frac{x}{x-1}\right)\right)$.

	List-I		List-II
P.	The range of f is	**1.**	$\left(-\infty, \frac{1}{1-e}\right] \cup \left[\frac{e}{e-1}, \infty\right)$
Q.	The range of g contains	**2.**	$(0, 1)$
R.	The domain of f contains	**3.**	$\left[-\frac{1}{2}, \frac{1}{2}\right]$
S.	The domain of g is	**4.**	$(-\infty, 0) \cup (0, \infty)$
		5.	$\left(-\infty, \frac{e}{e-1}\right]$
		6.	$(-\infty, 0) \cup \left(\frac{1}{2}, \frac{e}{e-1}\right]$

The correct option is : **[JEE (Advanced) 2018]**

(A) P → 4; Q → 2; R → 1; S → 1 (B) P → 3; Q → 3; R → 6; S → 5

(C) P → 4; Q → 2; R → 1; S → 6 (D) P → 4; Q → 3; R → 6; S → 5

MIT075

7. The value of $\sec^{-1}\left(\frac{1}{4}\sum_{k=0}^{10}\sec\left(\frac{7\pi}{12}+\frac{k\pi}{2}\right)\sec\left(\frac{7\pi}{12}+\frac{(k+1)\pi}{2}\right)\right)$ in the interval $\left[-\frac{\pi}{4}, \frac{3\pi}{4}\right]$ equals

[JEE (Advanced) 2019]

MIT076

8. For any positive integer n, let $S_n : (0, \infty) \to \mathbb{R}$ be defined by $S_n(x) = \sum_{k=1}^{n}\cot^{-1}\left(\frac{1+k(k+1)x^2}{x}\right)$, where for any $x \in \mathbb{R}$, $\cot^{-1}x \in (0, \pi)$ and $\tan^{-1}(x) \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$. Then which of the following statements is (are) **TRUE** ? **[JEE (Advanced) 2021]**

(A) $S_{10}(x) = \frac{\pi}{2} - \tan^{-1}\left(\frac{1+11x^2}{10x}\right)$, for all $x > 0$

(B) $\lim_{n\to\infty}\cot\left(S_n(x)\right) = x$, for all $x > 0$

(C) The equation $S_3(x) = \frac{\pi}{4}$ has a root in $(0, \infty)$

(D) $\tan\left(S_n(x)\right) \leq \frac{1}{2}$, for all $n \geq 1$ and $x > 0$

MIT077

9. Considering only the principal values of the inverse trigonometric functions, the value of $\frac{3}{2}\cos^{-1}\sqrt{\frac{2}{2+\pi^2}}+\frac{1}{4}\sin^{-1}\frac{2\sqrt{2}\pi}{2+\pi^2}+\tan^{-1}\frac{\sqrt{2}}{\pi}$ is _____. **[JEE (Advanced) 2022]**

MIT078

10. Let $\tan^{-1}(x)\in\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$, for $x \in \mathbb{R}$. Then the number of real solutions of the equation $\sqrt{1+\cos(2x)}=\sqrt{2}\tan^{-1}(\tan x)$ in the set $\left(-\frac{3\pi}{2},-\frac{\pi}{2}\right)\cup\left(-\frac{\pi}{2},\frac{\pi}{2}\right)\cup\left(\frac{\pi}{2},\frac{3\pi}{2}\right)$ is equal to

[JEE (Advanced) 2023]

MIT079

11. For any $y \in \mathbb{R}$, let $\cot^{-1}(y) \in (0, \pi)$ and $\tan^{-1}(y) \in \left(-\frac{\pi}{2},\frac{\pi}{2}\right)$. Then the sum of all the solutions of the equation $\tan^{-1}\left(\frac{6y}{9-y^2}\right)+\cot^{-1}\left(\frac{9-y^2}{6y}\right)=\frac{2\pi}{3}$ for $0 < |y| < 3$, is equal to

[JEE (Advanced) 2023]

(A) $2\sqrt{3}-3$ (B) $3-2\sqrt{3}$ (C) $4\sqrt{3}-6$ (D) $6-4\sqrt{3}$

MIT080

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.

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1. The domain of definition of $f(x)=\sin^{-1}(|x-1|-2)$ is:

(1) $[-2, 0] \cup [2, 4]$ (2) $(-2, 0) \cup (2, 4)$ (3) $[-2, 0] \cup [1, 3]$ (4) $(-2, 0) \cup (1, 3)$

MIT098

2. Domain of $f(x)=\cos^{-1}x+\cot^{-1}x+\operatorname{cosec}^{-1}x$ is

(1) $[-1, 1]$ (2) R (3) $(-\infty, -1] \cup [1, \infty)$ (4) $\{-1, 1\}$

MIT099

3. $\operatorname{cosec}^{-1}(\cos x)$ is real if

(1) $x \in [-1, 1]$ (2) $x \in R$

(3) x is an odd multiple of $\frac{\pi}{2}$ (4) x is a multiple of π

MIT100

4. The range of the function $f(x) = \sin^{-1}\left[x^2+\frac{1}{2}\right] + \cos^{-1}\left[x^2-\frac{1}{2}\right]$, where [ ] is the greatest integer function, is:

(1) $\{\pi\}$ (2) $\left\{\pi, \frac{\pi}{2}\right\}$ (3) $\left\{\frac{\pi}{2}, \frac{3\pi}{4}\right\}$ (4) $\left\{\frac{\pi}{2}\right\}$

MIT101

5. If $\pi \le x \le 2\pi$, then $\cos^{-1}(\cos x)$ is equal to

(1) x (2) $\pi - x$ (3) $2\pi + x$ (4) $2\pi - x$

MIT102

6. If $\sin^{-1}x + \sin^{-1}y = \frac{2\pi}{3}$, then $\cos^{-1}x + \cos^{-1}y$ is equal to

(1) $\frac{2\pi}{3}$ (2) $\frac{\pi}{3}$ (3) $\frac{\pi}{6}$ (4) π

MIT103

7. If $x \ge 0$ and $\theta = \sin^{-1}x + \cos^{-1}x - \tan^{-1}x$, then

(1) $\frac{\pi}{2} \le \theta \le \frac{3\pi}{4}$ (2) $0 \le \theta \le \frac{\pi}{4}$ (3) $0 \le \theta < \frac{\pi}{2}$ (4) $\frac{\pi}{4} \le \theta \le \frac{\pi}{2}$

MIT104

8. The numerical value of $\cot\left(2\sin^{-1}\frac{3}{5}+\cos^{-1}\frac{3}{5}\right)$ is

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

MIT105

9. **STATEMENT-1 :** $\tan^2(\sec^{-1}2)+\cot^2(\text{cosec}^{-1}3)=11$.

STATEMENT-2 : $\tan^2\theta+\sec^2\theta=1=\cot^2\theta+\text{cosec}^2\theta$.

(1) STATEMENT-1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-1

(2) STATEMENT-1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-1

(3) STATEMENT-1 is true, STATEMENT-2 is false

(4) STATEMENT-1 is false, STATEMENT-2 is true

MIT106

10. If α is a real root of the equation $x^3+3x-\tan 2=0$, then $\cot^{-1}\alpha+\cot^{-1}\frac{1}{\alpha}-\frac{\pi}{2}$ can be equal to

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

MIT107

11. If $\sin^{-1}\left(\frac{\sqrt{x}}{2}\right)+\sin^{-1}\left(\sqrt{1-\frac{x}{4}}\right)+\tan^{-1}y=\frac{2\pi}{3}$, then:

(1) maximum value of x^2+y^2 is $\frac{49}{3}$ (2) maximum value of x^2+y^2 is 4

(3) minimum value of x^2+y^2 is $\frac{1}{2}$ (4) minimum value of x^2+y^2 is 3

MIT108

12. If $x<0$, then value of $\tan^{-1}(x)+\tan^{-1}\left(\frac{1}{x}\right)$ is equal to

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

MIT109

13. If $\sin^{-1}x+\cot^{-1}\left(\frac{1}{2}\right)=\frac{\pi}{2}$, then x is equal to

(1) 0 (2) $\frac{1}{\sqrt{5}}$ (3) $\frac{2}{\sqrt{5}}$ (4) $\frac{\sqrt{3}}{2}$

MIT110

14. If $f(x)=\tan^{-1}\left(\frac{\sqrt{3}x-3x}{3\sqrt{3}+x^2}\right)+\tan^{-1}\left(\frac{x}{\sqrt{3}}\right)$, $0\le x\le 3$, then range of $f(x)$ is

(1) $\left[0,\frac{\pi}{2}\right)$ (2) $\left[0,\frac{\pi}{4}\right]$ (3) $\left[\frac{\pi}{6},\frac{\pi}{3}\right]$ (4) $\left[0,\frac{\pi}{3}\right]$

MIT111

15. $\cot^{-1}\left(\sqrt{\cos\alpha}\right) - \tan^{-1}\left(\sqrt{\cos\alpha}\right) = x$. then $\sin x$ is equal to -

(1) $\tan^2\left(\frac{\alpha}{2}\right)$ (2) $\cot^2\left(\frac{\alpha}{2}\right)$ (3) $\tan\alpha$ (4) $\cot\left(\frac{\alpha}{2}\right)$

MIT112

16. The Inverse trigonometric equation $\sin^{-1}x = 2\sin^{-1}\alpha$, has a solution for

(1) $-\frac{\sqrt{3}}{2} < \alpha < \frac{\sqrt{3}}{2}$ (2) all real values of α (3) $|\alpha| \le \frac{1}{\sqrt{2}}$ (4) $|\alpha| \ge \frac{1}{\sqrt{2}}$

MIT113

17. If $f(x) = \cot^{-1}x : R^+ \to \left(0, \frac{\pi}{2}\right)$ and $g(x) = 2x - x^2 : R \to$ R. Then the range of the function $f(g(x))$ wherever define is

(1) $\left(0, \frac{\pi}{2}\right)$ (2) $\left(0, \frac{\pi}{4}\right)$ (3) $\left[\frac{\pi}{4}, \frac{\pi}{2}\right)$ (4) $\left\{\frac{\pi}{4}\right\}$

MIT114

18. Given the functions $f(x) = e^{\cos^{-1}\left(\sin\left(x+\frac{\pi}{3}\right)\right)}$, $g(x) = \text{cosec}^{-1}\left(\frac{4 - 2\cos x}{3}\right)$ and the function $h(x) = f(x)$ defined only for those values of x, which are common to the domains of the functions $f(x)$ and $g(x)$. The range of the function $h(x)$ is:

(1) $[e^{\frac{\pi}{6}}, e^{\pi}]$ (2) $[e^{-\frac{\pi}{6}}, e^{\pi}]$ (3) $(e^{\frac{\pi}{6}}, e^{\pi})$ (4) $[e^{-\frac{\pi}{6}}, e^{\frac{\pi}{6}}]$

MIT115

19. Number of integers in the solution set of the inequality $|\tan(\arcsin x)| > 1$

(1) 1 (2) 2 (3) 3 (4) 4

MIT116

20. Solve $2\tan^{-1}x = \cos^{-1}\frac{1-a^2}{1+a^2} - \cos^{-1}\frac{1-b^2}{1+b^2}$ $(a > 0, b > 0)$

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

MIT117

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 $\cos^{-1}x + \cos^{-1}y + \cos^{-1}z = \pi$, where $-1 \le x, y, z \le 1$, then find the value of $x^2 + y^2 + z^2 + 2xyz$

MIT118

2. The sum of absolute value of all possible values of x for which $\cos \tan^{-1} \sin \cot^{-1} x = \sqrt{\frac{226}{227}}$.

MIT119

3. Number of integers in the solution set of the inequality $\arcsin x > \arccos x$ is

MIT120

4. If $\frac{1}{2}\sin^{-1}\left(\frac{3\sin 2\theta}{5+4\cos 2\theta}\right) = \frac{\pi}{4}$, then $\tan\theta$ is equal to

MIT121

5. The number of real solutions of equation $\sqrt{1+\cos 2x} = \sqrt{2}\sin^{-1}(\sin x)$, $-10\pi \le x \le 10\pi$, is/are

MIT122

6. The domain of the function $f(x) = \sqrt{\frac{1}{(|x|-1)\cos^{-1}(2x+1)\,.\tan 3x}}$ is $\left(-\frac{\pi}{\mu}, \lambda\right)$, then the value of $\lambda + \mu$ is

MIT123

7. If the complete solution set of the inequality $\text{arc}\cot^2 x - 5\,\text{arc}\cot x + 6 > 0$ is $(\cot\alpha, \infty) \cup (-\infty, \cot\beta)$ then the value of $\alpha + \beta$ is

MIT124

8. If $\cot^{-1}\frac{n}{\pi} > \frac{\pi}{6}$, $n \in N$, then the maximum value of 'n' is:

MIT125

9. If $\alpha = \cos^{-1}\left(\frac{3}{5}\right)$, $\beta = \tan^{-1}\left(\frac{1}{3}\right)$, where $0 < \alpha, \beta < \frac{\pi}{2}$, also $\alpha - \beta$ is equal to $\sin^{-1}\left(\frac{a}{5\sqrt{b}}\right)$ then the value of $a + b$ is equal to

MIT126

10. If the value of $\sum_{n=1}^{\infty} \tan^{-1}\frac{4n}{n^4 - 2n^2 + 2}$ is equal to $\tan^{-1}\lambda + \tan^{-1} 3$, then the value of λ is

MIT127

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 **FOUR** 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

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1. The value of $\cot^{-1}\left\{\dfrac{\sqrt{1-\sin x}+\sqrt{1+\sin x}}{\sqrt{1-\sin x}-\sqrt{1+\sin x}}\right\}$, where $\dfrac{\pi}{2} < x < \pi$, is:

(A) $\pi - \dfrac{x}{2}$ (B) $\dfrac{\pi}{2} + \dfrac{x}{2}$

(C) $\dfrac{x}{2}$ (D) $2\pi - \dfrac{x}{2}$

MIT128

2. The domain of the function $f(x) = \sin^{-1}\left(\dfrac{1+x^3}{2x^{3/2}}\right) + \sqrt{\sin(\sin x)} + \log_{(3\{x\}+1)}\left(x^2+1\right)$,

where {.} represents fractional part function, is:

(A) $x \in \{1\}$ (B) $x \in R - \{1, -1\}$

(C) $x > 3, x \neq I$ (D) $x \in \phi$

MIT129

3. The complete solution set of the inequality $\left[\cot^{-1}x\right]^2 - 6\left[\cot^{-1}x\right] + 9 \leq 0$, where [.] denotes greatest integer function, is

(A) $(-\infty, \cot 3]$ (B) $[\cot 3, \cot 2]$

(C) $[\cot 3, \infty)$ (D) $(-\infty, \cot 2]$

MIT130

4. Let $D \equiv [-1, 1]$ is the domain of the following functions, state which of them are injective.

(A) $f(x) = \begin{cases} \tan^{-1}\dfrac{1}{x} & x \neq 0 \\ 1 & x = 0 \end{cases}$ (B) $g(x) = x^3$

(C) $h(x) = \sin 2x$ (D) $k(x) = \cos(\pi x/2)$

MIT131

SECTION-II

- This section contains **ELEVEN** 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.

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5. Which of following pairs of functions are identical.

(A) $f(x) = e^{\ell n \sec^{-1} x}$ and $g(x) = \sec^{-1} x$

(B) $f(x) = \tan(\tan^{-1} x)$ and $g(x) = \cot(\cot^{-1} x)$

(C) $f(x) = sgn\,(x)$ and $g(x) = sgn\,(sgn\,(x))$

(D) $f(x) = \cot^2 x . \cos^2 x$ and $g(x) = \cot^2 x - \cos^2 x$

MIT132

6. If $\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \frac{3\pi}{2}$, then

(A) $x^{100} + y^{100} + z^{100} - \frac{9}{x^{101} + y^{101} + z^{101}} = 0$ (B) $x^{22} + y^{42} + z^{62} - x^{220} - y^{420} - z^{620} = 0$

(C) $x^{50} + y^{25} + z^5 = 0$ (D) $\frac{x^{2008} + y^{2008} + z^{2008}}{(xyz)^{2009}} = 0$

MIT133

7. If X = cosec tan^{-1} cos cot^{-1} sec sin^{-1} a and Y = sec cot^{-1} sin tan^{-1} cosec cos^{-1} a; where $0 \le a < 1$. Find the relation between X and Y. Then

(A) $X = Y$ (B) $Y = \sqrt{3 - a^2}$

(C) $X \neq Y$ (D) $X = 2Y$

MIT134

8. If α satisfies the inequation $x^2 - x - 2 > 0$, then a value exists for

(A) $\sin^{-1}\alpha$ (B) $\cos^{-1}\alpha$ (C) $\sec^{-1}\alpha$ (D) $\operatorname{cosec}^{-1}\alpha$

MIT135

9. For the function $f(x) = \ell n\ (\sin^{-1}\ \log_2 x)$,

(A) Domain is $\left[\frac{1}{2}, 2\right]$ (B) Range is $\left(-\infty, \ell n\frac{\pi}{2}\right]$

(C) Domain is (1, 2] (D) Range is R

MIT136

10. In the following functions defined from [–1, 1] to [–1, 1] , then functions which are not bijective are

(A) $\sin(\sin^{-1}x)$ (B) $\frac{2}{\pi}\sin^{-1}(\sin x)$ (C) $(\operatorname{sgn} x)\ \ell n\ e^x$ (D) $x^3 \operatorname{sgn} x$

MIT137

11. The expression $\frac{1}{\sqrt{2}}\left\{\frac{\sin\cot^{-1}\cos\tan^{-1}t}{\cos\tan^{-1}\sin\cot^{-1}\sqrt{2}t}\right\}.\left\{\sqrt{\frac{1+2t^2}{2+t^2}}\right\}$ can take the value

(A) 1/2 (B) –5 (C) 1 (D) 3/4

MIT138

12. If $0 < x < 1$, then $\tan^{-1}\frac{\sqrt{1-x^2}}{1+x}$ is equal to:

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

MIT139

13. If $f(x) = \cos^{-1}x + \cos^{-1}\left\{\frac{x}{2} + \frac{1}{2}\sqrt{3-3x^2}\right\}$, then

(A) $f\left(\frac{2}{3}\right) = \frac{\pi}{3}$ (B) $f\left(\frac{2}{3}\right) = \frac{\pi}{2}$ (C) $f\left(\frac{1}{3}\right) = \frac{\pi}{3}$ (D) $f\left(\frac{1}{3}\right) = 2\cos^{-1}\frac{1}{3} - \frac{\pi}{3}$

MIT140

14. If $\sin^2(2\cos^{-1}(\tan x)) = 1$ then x may be

(A) $x = \pi + \tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$ (B) $x = \pi - \tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$

(C) $x = -\pi + \tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$ (D) $x = -\pi - \tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$

MIT141

15. If $\sin^{-1}x + 2\cot^{-1}\left(y^2 - 2y\right) = 2\pi$, then

(A) $x + y = y^2$ (B) $x^2 = x + y$ (C) $y = y^2$ (D) $x^2 - x + y = y^2$

MIT142

SECTION–III

- This section contains **ONE** paragraph.
- Based on each paragraph, 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, 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. 16 - 18)

Let the domain and range of inverse circular functions are defined as follows

	Domain	**Range**
$\sin^{-1}x$	$[-1, 1]$	$\left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$
$\cos^{-1}x$	$[-1, 1]$	$[0, \pi]$
$\tan^{-1}x$	R	$\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$
$\cot^{-1}x$	R	$(0, \pi)$
$\text{cosec}^{-1}x$	$(-\infty, -1] \cup [1, \infty)$	$\left[\frac{\pi}{2}, \frac{3\pi}{2}\right] - \{\pi\}$
$\sec^{-1}x$	$(-\infty, -1] \cup [1, \infty)$	$[0, \pi] - \left\{\frac{\pi}{2}\right\}$

16. $\sin^{-1}x < \frac{3\pi}{4}$ then solution set of x is

(A) $\left(\frac{1}{\sqrt{2}}, 1\right]$ (B) $\left(-\frac{1}{\sqrt{2}}, -1\right]$

(C) $\left[-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right]$ (D) none of these

MIT143

17. If $x \in \left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$, $\text{cosec}^{-1}\,\text{cosec}\,x$ is

(A) $2\pi - x$ (B) $\pi + x$

(C) $\pi - x$ (D) $-\pi - x$

MIT144

18. If $x \in [-1, 1]$, then range of $\tan^{-1}(-x)$ is

(A) $\left[\frac{3\pi}{4}, \frac{7\pi}{4}\right]$ (B) $\left[\frac{3\pi}{4}, \frac{5\pi}{4}\right]$

(C) $[-\pi, 0]$ (D) $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$

MIT145

SECTION–IV

- This section contains **TWO** questions.
- Each question contains two columns, Column-I and Column-II.
- Column-I has four entries (A), (B), (C) and (D).
- Column-II has four entries (p), (q), (r), (s).
- Match the entries in Column-I with the entries in Column-II.
- For each question, marks will be awarded in one of the following categories:

Full Marks	: +4	If only correct answer is given.
Zero Marks	: 0	If no answer is given.
Negative Marks	: –1	For incorrect answer

19. Let $f(x)=\sin^{-1}x$, $g(x)=\cos^{-1}x$ and $h(x)=\tan^{-1}x$. For what complete interval of variation of x the following are true.

	Column-I		**Column-II**
(A)	$f\left(\sqrt{x}\right)+g\left(\sqrt{x}\right)=\pi/2$	(p)	$[0,\infty)$
(B)	$f(x)+g\left(\sqrt{1-x^2}\right)=0$	(q)	$[0,1]$
(C)	$g\left(\frac{1-x^2}{1+x^2}\right)=2h(x)$	(r)	$(-\infty,1)$
(D)	$h(x)+h(1)=h\left(\frac{1+x}{1-x}\right)$	(s)	$[-1,0]$

MIT146

20. Match the column:

	Column-I		**Column-II**
(P)	$\tan\left(\sin^{-1}\frac{3}{5}+\cot^{-1}\frac{3}{2}\right)$	(1)	$\frac{\sqrt{2}}{4}$
(Q)	$\cos\left(\sin^{-1}\frac{4}{5}+\cos^{-1}\frac{2}{3}\right)$	(2)	$2\sqrt{2}$
(R)	$\sin\left(\frac{1}{4}\text{arc}\sin\frac{\sqrt{63}}{8}\right)$	(3)	$\frac{17}{6}$
(S)	$\cot\left[\cos^{-1}\left(\frac{3}{4}\right)+\sin^{-1}\left(\frac{3}{4}\right)-\sec^{-1}3\right]$	(4)	$\frac{6-4\sqrt{5}}{15}$

MIT147

ANSWER KEY

EXERCISE - O

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

EXERCISE - S

1.	2	**2.**	20	**3.**	0	**4.**	0	**5.**	1
6.	1	**7.**	53	**8.**	1	**9.**	1	**10.**	2
11.	4	**12.**	23						

EXERCISE - JEE (Main) PYQ

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	1	1	3	4	3	4	1	3	4	2
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	1	3	2	4	1	3	4	2	29	2
Que.	21	22	23	24	25					
Ans.	3	2	1,3	4	1					

EXERCISE - JEE (Advanced) PYQ

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	B	B	3	B,C,D	2	A	0.00	A,B	2.35 or 2.36	3
Que.	11									
Ans.	C									

JEE (Main) Practice Paper

Section-A	**Q.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	A.	1	4	4	1	4	2	4	2	3	3
	Q.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
	A.	1	2	2	2	1	3	3	1	2	1
Section-B	**Q.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	A.	1	30	1	3	20	6	5	5	19	2

JEE (Advanced) Practice Paper

Section-I	**Q.**	**1**	**2**	**3**	**4**				
	A.	B	D	A	B				
Section-II	**Q.**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	A.	B,C,D	A,B	A,B	C,D	B,C	B,C,D	A,D	A,B
	Q.	**13**	**14**	**15**					
	A.	A,D	A,B,C,D	C,D					
Section-III	**Q.**	**16**	**17**	**18**					
	A.	A	C	B					
Section-IV	**Q.**	**19**			**20**				
	A.	A → q; B → s; C → p; D → r			P → 3; Q → 4; R → 1; S → 2				