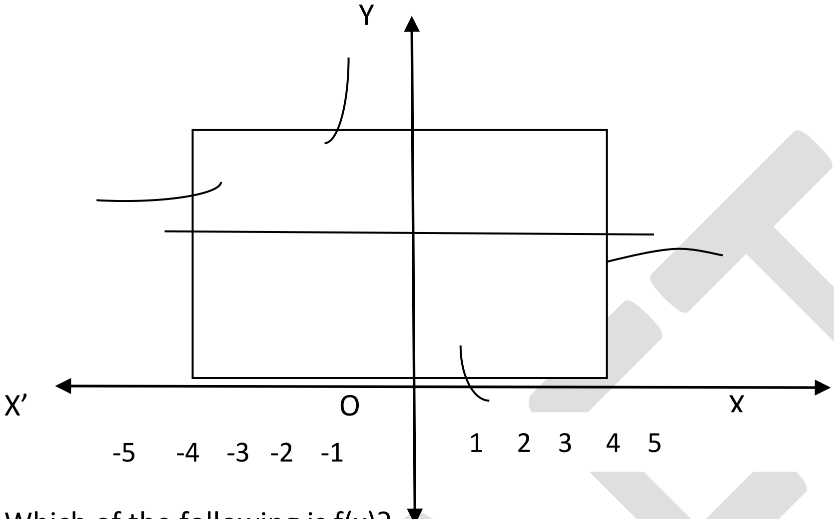
CHAPTER-2

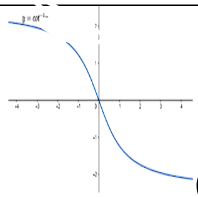
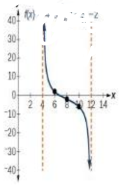
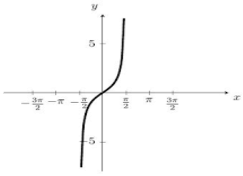
INVERSE TRIGONOMETRIC FUNCTION

CLASS-XII

01 MARK TYPE QUESTIONS

Q. NO	QUESTION	MARK
1	Shown below is the graph of function 'f' whose domain is R – (-1,1). Some portion of graph is hidden behind square.  Which of the following is f(x)? a) $\tan^{-1} x$ b) $\cot^{-1}x$ c) $\sec^{-1}x$ d) $\text{cosec}^{-1}x$	1
2	The domain of the function y = $\sin^{-1}(-x^2)$ is a)[0,1] b)(0,1) c)[-1,1] d)(-1,1)	1
3	If x < 0, y < 0 such that xy = 1, then $\tan^{-1} x + \tan^{-1} y$ equals a) $\pi/2$ b) $-\pi/2$ c) $-\pi$ d) None of these	1
4	The positive integral solution of the equation $\tan^{-1}x + \cos^{-1}\frac{y}{\sqrt{1+y^2}} = \sin^{-1}\frac{3}{\sqrt{10}}$ is a) x =1, y =2 b) x = 2, y =1 c) x = 3, y =2 d) x = -2, y = -1	1
5	If $\tan^{-1} x = \pi/10$ for some x ∈ R, then the value of $\cot^{-1} x$ is a) $\pi/5$ b) $2\pi/5$ c) $3\pi/5$ d) $4\pi/5$	1
6	The greatest and least values of $(\sin^{-1} x)^2 + (\cos^{-1} x)^2$ are respectively a) $\pi^2/8,\ 5\pi^2/4$ b) $\pi^2/4, 5\pi^2/8$ c) $5\pi^2/4, \pi^2/8$ d) $5\pi^2/8, \pi^2/4$	1

7	The value of sin(3 $\pi/2$) – sin (sec^{-1} t + cosec^{-1} t), when $\lvert t \rvert \geq 1$ is a) 0 b) 1 c) -1 d) -2	1
8	The principal value of cos^{-1}(1/2) + sin^{-1}(-1/$\sqrt{2}$) is a) $\pi/12$ b) π c) $\pi/3$ d) π /6	1
9	tan^{-1}($\frac{x}{y}$) – tan^{-1}($\frac{x-y}{x+y}$)=___________ a) $\frac{\pi}{2}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{4}$ d) -3$\frac{\pi}{4}$	1
10	Value of Sin($\pi/3$ - sin^{-1}(-1/2)) is a)1/2 b)1/3 c)1/4 d)1	1
11	For the following statement answer TRUE OR FALSE as appropriate: The value of cos^{-1}cos$\frac{5\pi}{4}$ is $\frac{5\pi}{4}$.	1
12	For the following statement answer TRUE OR FALSE as appropriate: cos^{-1}x is an increasing function in its domain (T/F)and is periodic in nature(T/F): (a)T,T (b)T,F (c)F,T (d)F,F	1
13	Fill in the blanks (3-5) If sin$^{-1}\frac{1}{3}$ + cos^{-1}x=$\frac{\pi}{2}$ then the value of x is ----------	1
14	The range of tan^{-1}x is---------------	1
15	The principal value branch of sec^{-1}x is-------------	1
16	Multiple choice questions: Find the value of tan$^{-1}\sqrt{3}$-cot$^{-1}\sqrt{3}$ is; (a)$\frac{\pi}{3}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{6}$ (d) $\frac{3\pi}{2}$	1
17	The value of cos^{-1}cos (1540^0) is; (a)1540^0 (b)1490^0 (c)100^0 (d)none of these	1
18	The domain of the function f(x)=sin^{-1}(2x-3) is: (a)x$\in$[1,2] (b)x$\in$(1,2) (c)x$\in$[-1,1] (d)none of these	1
19	Assertion(A):All trigonometric functions have their inverses over their respective domains. Reason(R): The inverse of tan^{-1}x exists for some x $\in$ R (a)Both assertion and reason are correct and reason is the correct explanation of assertion. (b)both assertion and reason are correct but reason is not the correct explanation of assertion (c)assertion is correct but reason is incorrect (d)assertion is incorrect but reason is correct	1
20	The graph of cot^{-1}x is:	1

	(a)  (b)  (c)  (d)none	
21	**The domain of $\sin^{-1}(2x)$ is** (a) [0, 1] (b) [– 1, 1] (c) [-1/2, 1/2] (d) [–2, 2]	1
22	**The value of the expression $\sin [\cot^{-1} (\cos (\tan^{-1} 1))]$ is** (a) 0 (b) 1 (c) $1/\sqrt{3}$ (d) $\sqrt{(2/3)}$	1
23	**$\sin[\pi/3 - \sin^{-1}(-½)]$ is equal to:** (a) ½ (b) ⅓ (c) -1 (d) 1	1
24	**If $\cos^{-1} x + \sin^{-1} x = \pi$, then the value of x is** (a)$1/ \sqrt{2}$ (b) $1/\sqrt{3}$ (c) $3/\sqrt{2}$ (d) $2/\sqrt{3}$	1
25	**If $\tan^{-1} (\cot \theta) = 2\theta$, then θ is equal to** (a) π/3 (b) π/4 (c) π/6 (d) None of these	1
26	**$\cot(\pi/4 - 2\cot^{-1} 3) =$**	1

	(a) 7 (b) 6 (c) 5 (d) None of these	
27	**The domain of y = $\cos^{-1}(x^2 - 4)$ is** (a) [3, 5] (b) [0, π] (c) [-√5, -√3] ∩ [-√5, √3] (d) [-√5, -√3] ∪ [√3, √5]	1
28	**The principal value of** **$\tan^{-1}$(tan 3π/5) is** (a) 2π/5 (b) -2π/5 (c) 3π/5 (d) -3π/5	1
29	**The domain of $\sin^{-1}(2x)$ is** (a) [0, 1] (b) [– 1, 1] (c) [-1/2, 1/2] (d) [–2, 2]	1
30	2$\tan^{-1}$(cos x) = $\tan^{-1}$(2cosec x) (a) 0 (b) π/3 (c) π/4 (d) π/2	1
31	Domain of the function $\sin^{-1} x$ is (A) [0,1] (B) **R** (C) [-1,1]	1

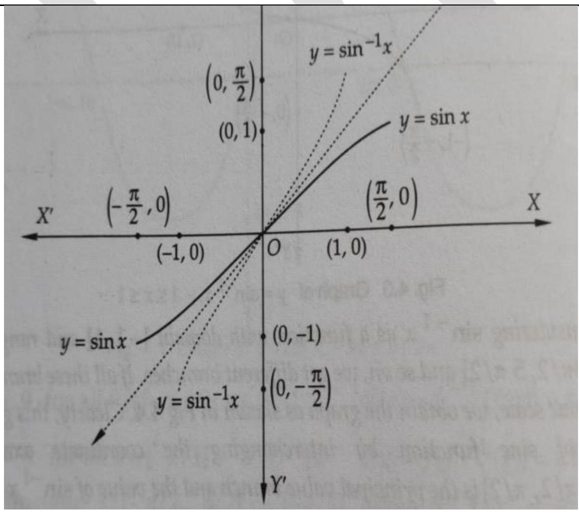
	(D) None of these	
32	If $\sin^{-1} x + \sin^{-1}(1-x) = 0$, then x is equal to: (A)0 (B) 1 (C) 2 (D) None of these	1
33	If $\sin^{-1} x - \cos^{-1} x = \frac{\pi}{6}$, then $x =$ (A)$\frac{1}{2}$ (B) $\frac{\sqrt{3}}{2}$ (C) $-\frac{1}{2}$ (D) $-\frac{\sqrt{3}}{2}$	1
34	If $\theta = \sin^{-1}\{\sin(-600°)\}$, then one of the possible value of θ is : (A)$\frac{\pi}{3}$ (B) $\frac{\pi}{2}$ (C) $\frac{2\pi}{3}$ (D) $\frac{-2\pi}{3}$	1
35	$\sin^{-1}(\cos y) = \frac{\pi}{2} - y$ is valid for (A)$-\pi \leq y \leq 0$ (B) $0 \leq y \leq \pi$ (C) $-\frac{\pi}{2} \leq y \leq \frac{\pi}{2}$ (D) None of these	1
36	The domain of $\sin^{-1}\left[\frac{2x}{1+x^2}\right]$= (A)(-2,1) (B) [-2,1] (C) (-2,0) (D) [-1,1]	1
37	$\sin^{-1}\left(\frac{4}{5}\right) + \sin^{-1}\left(\frac{5}{13}\right)$ is equal to (A)$\sin^{-1}\left(\frac{16}{65}\right)$ (B) $\cos^{-1}\left(\frac{16}{65}\right)$ (C) $-\sin^{-1}\left(\frac{16}{65}\right)$ (D) None of these	1
38	The value $\sin^{-1}\left(cos\left(\left(\frac{43\pi}{5}\right)\right)\right)$is (A)$\frac{3\pi}{5}$ (B) $\frac{-7\pi}{5}$ (C) $\frac{\pi}{10}$	1

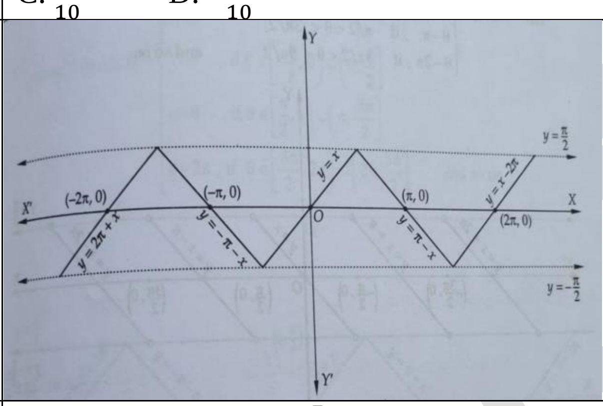
	(D) $\frac{-\pi}{10}$	
39	The principal value of $\cos^{-1}\left(\frac{1}{2}\right)+\sin^{-1}\left(-\frac{1}{\sqrt{2}}\right)$ is, (a)$\frac{\pi}{12}$ (b)$\frac{\pi}{6}$ (c)π (d)$\frac{\pi}{3}$	1
40	What is the domain of the function $\cos^{-1}(2x-3)$, (a)$[-1,1]$ (b)$(1,2)$ (c)$(-1,1)$ (d)$[1,2]$	1
41	Simplest form of $\tan^{-1}\left[\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}\right]$ is, (a)$\frac{\pi}{4}-\frac{\pi}{2}$ (b) $\frac{\pi}{4}+\frac{\pi}{2}$ (c) $\frac{\pi}{4}-\frac{1}{2}\cos^{-1}x$ (d) $\frac{\pi}{4}+\frac{1}{2}\cos^{-1}x$	1
42	The principal value of $\cos^{-1}\left(\cos\frac{13\pi}{6}\right)$ is, (a)$\frac{13\pi}{6}$ (b)$\frac{\pi}{2}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{6}$	1
43	The principal value of $\tan^{-1}\sqrt{3}-\cot^{-1}(-\sqrt{3})$ is, (a)π (b)$\frac{\pi}{2}$ (c)0 (d)$2\sqrt{3}$	1
44	If $\sin^{-1}\left(\frac{1}{5}\right)+\cos^{-1}(2x)=\frac{\pi}{2}$, then x is equals to, (a)$\frac{1}{5}$ (b)$\frac{2}{5}$ (c)$\frac{1}{10}$ (d)$\frac{5}{2}$	1
45	$\sin\left[\frac{\pi}{3}+\sin^{-1}\frac{1}{2}\right]$ is equals to, (a)1 (b)$\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{1}{4}$	1
46	The value of $\sin\left(\sec^{-1}\left(\frac{17}{15}\right)\right)$ is, (a)$\frac{8}{17}$ (b)$\frac{15}{17}$ (c)$\frac{17}{8}$ (d)$\frac{8}{15}$	1
47	**Assertion (A)** : Maximum value of $(\cos^{-1}x)^2$ is π^2. **Reason (R) :** Range of the principal value branch of $\cos^{-1}x$ is $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$. (a)Both A and R are true and R is correct explanation of A. (b)Both A and R are true but R is not correct explanation of A. (c)A is true but R is false. (d)A is false but R is true.	1
48	**Assertion (A) :** the domain of the function $\sec^{-1}(2x)$ is $\left(-\infty,\frac{-1}{2}\right]\cup\left[\frac{1}{2},\infty\right)$ **Reason (R) :** $\sec^{-1}(-2)=-\frac{\pi}{4}$ (a)Both A and R are true and R is correct explanation of A. (b)Both A and R are true but R is not correct explanation of A. (c)A is true but R is false. (d)A is false but R is true.	1
49	**Assertion (A):** $\cos^{-1}x\geq\sin^{-1}x\ for\ all\ x\epsilon[-1,1]$ **Reason (R) :** $\cos^{-1}x$ is decreasing function in $[-1,1]$ (a)Both A and R are true and R is correct explanation of A. (b)Both A and R are true but R is not correct explanation of A. (c)A is true but R is false. (d)A is false but R is true.	1
50		1

	Assertion(A): $\sin^{-1}\frac{8}{17}+\sin^{-1}\frac{3}{5}=\sin^{-1}\frac{77}{85}$ **Reason (R) :** $\sin^{-1}x+\sin^{-1}y=\sin^{-1}\left(x\sqrt{1-y^2+y\sqrt{1-x^2}}\right)$ For $\leq x,y\leq x^2+y^2$ (a)Both A and R are true and R is correct explanation of A. (b)Both A and R are true but R is not correct explanation of A. (c)A is true but R is false. (d)A is false but R is true.	
51	The value of $\sin^{-1}\left(\cos\frac{\pi}{9}\right)$ is (a) $\frac{7\pi}{18}$ (b) $\frac{5\pi}{9}$ (c) $-\frac{5\pi}{9}$ (d) $\frac{\pi}{9}$	1
52	$\sin^{-1}(\sin\frac{2\pi}{3})+\cos^{-1}(\cos\frac{2\pi}{3})$ is equal to (a)$\frac{4\pi}{3}$ (b) $\frac{2\pi}{3}$ (c) π (d) $\frac{\pi}{2}$	1
53	The principal value of $\tan^{-1}\sqrt{3}-\sec^{-1}(-2)$ (a)$-\frac{\pi}{3}$ (b) $\frac{2\pi}{3}$ (c) π (d) $\frac{\pi}{2}$	1
54	The value of $\tan^{-1}(\tan\frac{5\pi}{6})+\cos^{-1}(\cos\frac{13\pi}{6})$ (a) $\frac{7\pi}{18}$ (b) $\frac{5\pi}{9}$ (c) $-\frac{5\pi}{9}$ (d) 0	1
55	The domain of the function defined by $f(x)=\sin^{-1}\sqrt{x-1}$is (a) [1,2] (b) [-1,1] (c) [0,1] (d) none of these	1
56	The domain of the function defined by $f(x)=\cos^{-1}(2x-1)$is (a) [1,2](b) [-1,1] (c) [0,1] (d) none of these	1
57	The value of $\cos^{-1}(2x^2-1)$, $0\leq x\leq 1$ is equal to (a) $2\cos^{-1}x$(b) $2\sin^{-1}x$(c)$\pi-2\cos^{-1}x$(d) $\pi+2\cos^{-1}x$	1
58	If $y=\cos^{-1}(cos10)$, then y is equal to (a)10 (b) $4\pi-10$ (c) $2\pi+10$ (d) $2\pi-10$	1
59	If $\cos^{-1}x>\sin^{-1}x$, then (a)$x<0$ (b) $-1<x<0$ (c) $0\leq x<\frac{1}{\sqrt{2}}$(d) $-1\leq x<\frac{1}{\sqrt{2}}$	1
60	In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices. (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true but R is not the correct explanation of A.	1

	(c) A is true but R is false. (d) A is false but R is true. Assertion (A): The value of $\sin[\tan^{-1}(-\sqrt{3}) + \cos^{-1}(-\frac{\sqrt{3}}{2})]$ is 1 Reason (R): $\tan^{-1}(-x) = -\tan^{-1}x$ and $\cos^{-1}(-x) = \cos^{-1}x$.	
61	The Principal Value of $\cos^{-1}\left(\frac{-1}{2}\right)$ is (A) $\frac{\pi}{3}$ (B) $\frac{2\pi}{3}$ (C) $\frac{\pi}{6}$ (D) $\frac{5\pi}{6}$	1
62	The Principal value of $\tan^{-1}(-1)$ is (A) $\frac{\pi}{4}$ (B) $\frac{\pi}{3}$ (C) $-\frac{\pi}{3}$ (D) $\frac{-\pi}{4}$	1
63	If $\tan^{-1}\frac{3}{4}$ = x then Sin x is (A) $\frac{1}{5}$ (B) $\frac{3}{5}$ (C) $\frac{4}{5}$ (D) $\frac{3}{7}$	1
64	If $\tan^{-1}x = \sin^{-1}\frac{1}{2}$ find the value of x is (A) $\sqrt{3}$ (B) 1 (C) $\frac{1}{\sqrt{3}}$ (D) $n.d$	1
65	Evaluate $\sin[\frac{\pi}{6} - \sin^{-1}(\frac{-\sqrt{3}}{2})]$ (A) 1 (B) $\frac{1}{\sqrt{2}}$ (C) $\frac{-\sqrt{3}}{2}$ (D) $\frac{\sqrt{3}}{2}$	1
66	. Evaluate $\cos[\frac{\pi}{2} - \sin^{-1}(\frac{1}{2})]$ A) 1 (B) $\frac{\sqrt{3}}{2}$ (C) $\frac{1}{2}$ (D) 0	1
67	The value of $\tan^{-1}1 + \cos^{-1}(\frac{-1}{2})$ (A) 11/*12* (B) $\frac{\pi}{12}$ (C) $\frac{3\pi}{4}$ (D) $\frac{5\pi}{6}$	1
68	The value of $\operatorname{cosec}^{-1}(-1) + \cot^{-1}(\frac{-1}{\sqrt{3}})$ (A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$ (C) $\frac{5\pi}{12}$ (D) $\frac{\pi}{12}$	1
69	$\tan^{-1}\sqrt{3} - \sec^{-1}(-2)$ is equal to (A) π (B) $\frac{-\pi}{3}$ (C) $\frac{\pi}{3}$ (D) $\frac{2\pi}{3}$	1
70	The value of $\tan^{-1}(1) + \cos^{-1}\left(\frac{-1}{2}\right) + \sin^{-1}\left(\frac{-1}{2}\right)$ (A) π (B) $\frac{-\pi}{3}$ (C) $\frac{\pi}{3}$ (D) $\frac{3\pi}{4}$	1
71	If $\tan^{-1}x = y$, then (a) $-1 < y < 1$ (b) $\frac{-\pi}{2} \le y \le \frac{\pi}{2}$	1

	(c) $\frac{-\pi}{2}$<y<$\frac{\pi}{2}$ (d) y ∈ $\left\{\frac{-\pi}{2}, \frac{\pi}{2}\right\}$	
72	Assertion (A) All trigonometric functions have their inverses over their respective domains. Reason (R) The inverse of $\tan^{-1} x$ exists for some x ∈ R (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true but R is not the correct explanation of A. (c) A is true but R is false. (d) A is false but R is true.	1
73	The value of $\sin(\tan^{-1}x)$ where $\lvert x \rvert < 1$ (a) $\frac{x}{\sqrt{1-x^2}}$ (b) $\frac{1}{\sqrt{1-x^2}}$ (c) $\frac{1}{\sqrt{1+x^2}}$ (d) $\frac{x}{\sqrt{1+x^2}}$	1
74	$\left[\sin^{-1}\frac{\pi}{3} + \sin^{-1}\left(\frac{1}{2}\right)\right]$ is equal to (a) 1 (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{1}{4}$	1
75	Simplest form of $\tan^{-1}\left(\frac{\sqrt{1+\cos x}+\sqrt{1-\cos x}}{\sqrt{1+\cos x}-\sqrt{1-\cos x}}\right)$, $\pi < x < \frac{3\pi}{2}$ (a) $\frac{\pi}{4} - \frac{x}{2}$ (b) $\frac{3\pi}{2} - \frac{x}{2}$ (c) $-\frac{x}{2}$ (d) $\pi - \frac{x}{2}$	1
76	Assertion (A) Range of $[\sin^{-1} x + 2\cos^{-1} x]$ is [0 , π]. Reason (R) Principal value branch of $\sin^{-1} x$ has range $[-\frac{\pi}{2}, \frac{\pi}{2}]$ (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true but R is not the correct explanation of A. (c) A is true but R is false. (d) A is false but R is true.	1
77	Assertion (A) The domain of the function $\sec^{-1} 2x$ is $(-\infty, -\frac{1}{2}] \cup [\frac{1}{2}, \infty)$ Reason (R) $\sec^{-1}(-2) = -\frac{\pi}{4}$ (a) Both A and R are true and R is the correct explanation of A.	1

	(b) Both A and R are true but R is not the correct explanation of A. (c) A is true but R is false. (d) A is false but R is true.	
78	The value of $\sin^{-1}[\sin(-\frac{17\pi}{8})]$ is (a) $\frac{17\pi}{8}$ (b) $\frac{\pi}{8}$ (c) - $-\frac{\pi}{8}$ (d) $\frac{13\pi}{8}$	1
79	The value of sin ($\cot^{-1}$ x) is (a) $\sqrt{1+x^2}$ (b) x (c) $(1+x^2)^{\frac{-3}{2}}$ (d) $(1+x^2)^{\frac{-1}{2}}$	1
80	If $\sin^{-1}x > \cos^{-1}x$, then x should lie in the interval (a) $\left(-1, \frac{-1}{\sqrt{2}}\right)$ (b) $\left(0, \frac{-1}{\sqrt{2}}\right)$ (c) $\left(\frac{1}{\sqrt{2}}, 1\right)$ (d) $\left(\frac{1}{\sqrt{2}}, 0\right)$	1
81	The principal value of $\cos^{-1}[\cos 680^0]$ is A. 30^0 B. 40^0 C. 50^0 D. 60^0	**1**
82	 **Graphs of y = sin x and y = $\sin^{-1}$x as mirror images of each other in the line mirror of** **A. x + y = 0 B. x – y = 0** **C. -x + 2y = 0 D.None of these**	**1**

83	Domain of the function $\cos^{-1}(2x - 1)$ is A. (0,1) B. [0,1) C. (0,1] D. [0,1]	**1**
84	The principal value of $\sin^{-1}(-\frac{1}{2})$ is A. $\frac{\pi}{3}$ B. $\frac{\pi}{4}$ C. $-\frac{\pi}{6}$ D. $\frac{\pi}{6}$	**1**
85	The value of $\sin^{-1}[\cos(\frac{33\pi}{5})]$ is A. $\frac{\pi}{5}$ B. $-\frac{\pi}{5}$ C. $\frac{\pi}{10}$ D. $-\frac{\pi}{10}$	**1**
86	 The given figure shows the graph of A. $y = \sin[\sin^{-1}(x)]$ B. $y = \sin[\cos^{-1}(x)]$ C. $y = \tan[\tan^{-1}(x)]$ D. $y = \cos[\cos^{-1}(x)]$	**1**
87	The value of $\cos^{-1}[\cos(\frac{7\pi}{6})]$ is A. $\frac{7\pi}{6}$ B. $\frac{\pi}{6}$ C. $\frac{5\pi}{6}$ D. $-\frac{7\pi}{6}$	**1**
88	**The minimum value of n for which** $\tan^{-1}(\frac{n}{\pi}) > \frac{\pi}{4}$, n ∈ N is A. **2** B. **3** C. **4** D. **5**	**1**
89	**Domain of f (x) = $\sin^{-1}x + \cos x$** **A. [-1, 1]** **B. (-1, 1)** **C. R** **D. R - (-1, 1)**	**1**
90	**Write one branch of $\tan^{-1}x$ other than principal value branch.** **A.** $[-\frac{3\pi}{2}, -\frac{\pi}{2}]$ **B.** $(-\frac{3\pi}{2}, -\frac{\pi}{2}]$ **C.** $(-\frac{3\pi}{2}, -\frac{\pi}{2})$ **D.** $[-\frac{3\pi}{2}, -\frac{\pi}{2})$	**1**

ANSWERS:

Q. NO	ANSWER	MARKS
1	c) $\sec^{-1}x$	1
2	c) [-1,1]	1
3	b) $-\pi/2$	1
4	a)x=1,y = 2	1
5	b)2 $\pi/5$	1
6	c)5 $\pi^2/4$, $\pi^2/8$	1
7	d)-2	1
8	a) $\pi/12$	1
9	c) $\pi/4$	1
10	d)1	1
11	Solution Ans:False Let $\cos^{-1}\cos\frac{5\pi}{4}$ =x $\cos x=\cos\frac{5\pi}{4}$ $\cos x=\cos(2\pi - \frac{5\pi}{4})$ $\cos x=\cos\frac{3\pi}{4}$ $x=\frac{3\pi}{4}$	1
12	Solution: Ans: option c $\text{Cos}^{-1}x$ is a decreasing function in its domain and is periodic in nature	1
13	Solution: Given $\sin^{-1}\frac{1}{3} + \cos^{-1}x=\frac{\pi}{2}$ $\cos^{-1}x=\frac{\pi}{2} - \sin^{-1}\frac{1}{3}$ $x=\cos(\frac{\pi}{2} - \sin^{-1}\frac{1}{3})$ $x=\sin(\sin^{-1}\frac{1}{3})$ $x=\frac{1}{3}$ so the value of x is 1/3	1
14	Solution: The range of $\tan^{-1}x$ is $(\frac{-\pi}{2}, \frac{\pi}{2})$	1
15	Solution: The principal value branch of $\sec^{-1}x$ is $[0,\pi] - \{\frac{\pi}{2}\}$	1
16	Solution: Ans:(a) Let $y=\tan^{-1}\sqrt{3}$ $\tan y=\sqrt{3}$ $\tan y=\tan\frac{\pi}{3}$ $y=\frac{\pi}{3}$ since the range of $\tan^{-1}x$ is $(\frac{-\pi}{2}, \frac{\pi}{2})$ hence the principal value is $\frac{\pi}{3}$	1
17	Solution:	1

	Ans:(c) Given $\cos^{-1}(\cos 1540°) = \cos^{-1}\{\cos(360*4+100°)\}$ $= \cos^{-1}\cos 100°$ $[\text{Cos}(2\pi + \theta) = \cos\theta$ $= 100°$ $[\cos^{-1}\cos\theta = \theta, \theta \epsilon [0,\pi]$ $\therefore \cos^{-1}(\cos 1540°) = 100°$	
18	Solution: Ans: (c) The domain of $\sin^{-1}x$ is[-1.1] Therefore $f(x)=\sin^{-1}(2x+3)$, for all x Satisfying;$-1 \leq 2x-3 \leq 1$ $-1+3 \leq 2x-3+3 \leq 1+3$ $2 \leq 2x \leq 4$ $1 \leq x \leq 2$ $x \epsilon [1,2]$	1
19	Solution: Ans(d) Assertion: we know that all trigonometric functions have inverse over their restricted domains So, assertion is incorrect. Reason(R) $\tan^{-1}: R \to (\frac{-\pi}{2}, \frac{\pi}{2})$ i.e. the inverse of tan x exists for some xϵ R so, reason is correct.	1
20	Answer: (a)	1
21	(c) [-1/2, 1/2]	1
22	(d) √(2/3)	1
23	(d) 1	1
24	(c) 3/√2	1
25	(c) π/6	1
26	7	1
27	(d) [-√5, -√3] ∪ [√3, √5]	1
28	(b) -2π/5	1
29	(c) [-1/2, 1/2]	1
30	(c) π/4	1
31	(c)	1
32	(d)	1
33	(b)	1
34	(a)	1
35	(a)	1
36	(b)	1
37	(b)	1
38	(d)	1
39	(a)	1
40	(d)	1
41	(c)	1
42	(d)	1
43	(b)	1
44	(c)	1

45	(a)	1
46	(a)	1
47	(c)	1
48	(c)	1
49	(d)	1
50	(a)	1
51	(a) $\frac{7\pi}{18}$	1
52	(c) π	1
53	(a) $-\frac{\pi}{3}$	1
54	(d) 0	1
55	(a) [1,2]	1
56	(c) [0,1]	1
57	(a) $2\cos^{-1} x$	1
58	(b) $4\pi - 10$	1
59	(d) $-1 \leq x < \frac{1}{\sqrt{2}}$	1
60	(c) A is true but R is false	1
61	B	1
62	D	1
63	B	1
64	C	1
65	A	1
66	C	1
67	A	1
68	A	1
69	B	1
70	D	1
71	(c) $\frac{-\pi}{2} < y < \frac{\pi}{2}$	1
72	(d)	1
73	(d)	1
74	(a)	1
75	(a)	1
76	(d)	1
77	(c)	1
78	(c)	1
79	(d)	1
80	(c)	1
81	B	1
82	B	1
83	D	1
84	C	1

85	D	1
86	A	1
87	C	1
88	C	1
89	A	1
90	C	1

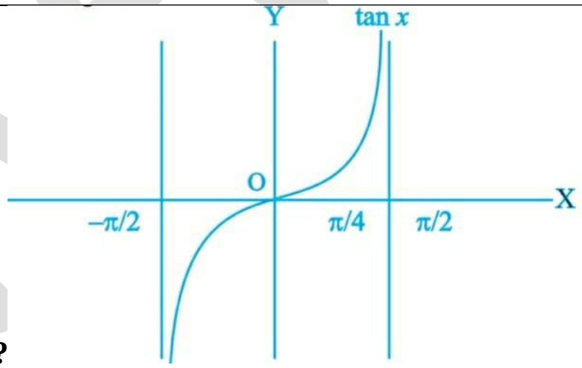
CHAPTER-2

INVERSE T FUNCTION

CLASS-XII

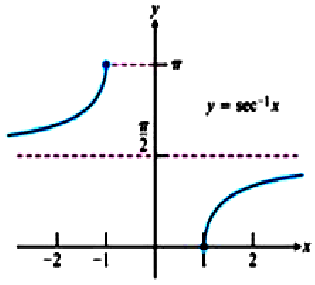
02 MARKS TYPE QUESTIONS

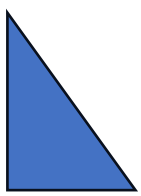
Q. NO	QUESTION	MARK
1.	$\cot^{-1} x = \cos^{-1}(-1) - \text{cosec}^{-1} (2/\sqrt{3})$ Based on the above information find $\tan^{-1} (\frac{1}{x})$ using the principal value of inverse trigonometric function. Show your work.	2
2.	Find the value of $\tan^2 (\sec^{-1} 2) + \cot^2 (\text{cosec}^{-1} 3)$.	2
3.	If $\alpha = \tan^{-1} (\tan 5\pi/4)$ and $\beta = \tan^{-1} (-\tan 2\pi/3)$, then establish a relation between α and β.	2
4.	Compute the value of $\tan^{-1} 1 + \tan^{-1} 2 + \tan^{-1} 3$.	2
5.	If $\cos (\tan^{-1} x) = \sin (\cot^{-1} \frac{3}{4})$ then solve for x.	2
6.	Let x, y, z $\epsilon[-1,1]$ be such that $\sin^{-1}x+\sin^{-1}y+\sin^{-1}z=\frac{3\pi}{2}$ find the values of $x^{2020}+y^{2021}+z^{2022}$	2
7.	Draw the graph of $\sec^{-1}x$ and write the domain of $\sec^{-1}(2x+1)$	2
8.	Evaluate the following question : $\tan^{-1}(\frac{\cos x}{1+\sin x}), \frac{-\pi}{2} < x < \frac{\pi}{2}$	2
9.	In a right angled triangle PQR b, p, h denote the base, perpendicular and hypotenuse respectively and $\angle QPR=\Theta$.Express $\sin^{-1}(\frac{5}{13})$ in terms of other five trigonometric functions.	2
10.	Prove that $\tan(\cot^{-1}x)=\cot(\tan^{-1}x)$ state with the reason whether the equality is valid for all the values of x	2
11.	What is the principal value of $\sin^{-1} (-2)$	2
12.	**Find the value of $\cot (\tan^{-1} \alpha + \cot^{-1} \alpha)$**	2
13.	Write the principal value of $\tan^{-1}[\sin(-\pi/2)$	2
14.	Find x ,$\sin^{-1}\frac{1}{3} + \cos^{-1} x = \frac{\pi}{2}$	2
15.	If $\sin (\sin^{-1}15 + \cos^{-1}x) = 1$, then find the value of x.	2
16.	Find the value of $\tan^{-1}\left[2\cos\left(2\sin^{-1}\frac{1}{2}\right)\right]+\tan^{-1} 1$	2
17.	Evaluate $\sin^{-1}\left(\sin\frac{3\pi}{4}\right) + \cos^{-1}\left(\cos\frac{3\pi}{4}\right) + \tan^{-1} 1$	2
18.	Find the domain of $y = \sin^{-1}(x^2 - 4)$	2
19.	Find the value of $\sin^{-1}\left[\cos\frac{33\pi}{5}\right]$.	2
20.	Show that $\sin^{-1}\left(2x\sqrt{1-x^2}\right) = 2\cos^{-1} x, \frac{1}{\sqrt{2}} \le x \le 1$.	2
21.	Simplify, $\frac{9\pi}{8} - \frac{9}{4}\sin^{-1}\left(\frac{1}{3}\right)$.	2
22.	Find the value of $\tan^{-1}[2\sin(2\cos^{-1}\frac{\sqrt{3}}{2})]$	2
23.	Find the value of $\tan^{-1}(-\frac{1}{\sqrt{3}}) + \cot^{-1}\left(\frac{1}{\sqrt{3}}\right)+\tan^{-1}\left\{\sin\left(-\frac{\pi}{2}\right)\right\}$	2
24.	Find the principal value of $\tan^{-1}\sqrt{3} - \sec^{-1}(-2)$	2

25.	Find the value of $\tan(2\tan^{-1}\frac{1}{5})$	2
26.	Find the principal value of $\tan^{-1}1+\cos^{-1}(-\frac{1}{2})$	2
27.	If $\sin^{-1}x+\sin^{-1}y=2\pi/3$, then find the value of $\cos^{-1}x+\cos^{-1}y$	2
28.	Find the domain of $\sin^{-1}(x^2-4)$	2
29.	Find the value of $\sin^{-1}(\cos 33\pi/5)$	2
30.	Write the principal value of $\cos^{-1}\left(\frac{1}{2}\right)+2\sin^{-1}\left(\frac{1}{2}\right)$	2
31.	Write the domain and range (principal value branch) of the the following function $f(x)=\cos^{-1}x$	2
32.	Write the domain and range of $\tan^{-1}x$	2
33.	Find the value of $\tan^{-1}[2\cos(2\sin^{-1}\frac{1}{2})]+\tan^{-1}1$	2
34.	Evaluate $\sin^{-1}(\sin\frac{3\pi}{4})+\cos^{-1}(\cos\frac{3\pi}{4})+\tan^{-1}(1)$	2
35.	Draw the graph of $f(x)=\sin^{-1}x$, $x\in[\frac{-1}{\sqrt{2}},\frac{1}{\sqrt{2}}]$ Also write the range of f(x).	2
36.	Express $\tan^{-1}(\frac{\cos x}{1+\sin x})$, $\frac{-3\pi}{2}<x<\frac{\pi}{2}$, in simplest form.	2
37.	 **Which is greater than 1 and $\tan^{-1}1$?**	2
38.	**Find the value of** $\tan^{-1}[\tan(\frac{5\pi}{6})]+\cos^{-1}[\cos(\frac{13\pi}{6})]$.	2
39.	**Express the expression in the simplest form** $\tan^{-1}[\frac{x}{a+\sqrt{a^2-x^2}}]$	2
40.	Evaluate $\sin[\frac{\pi}{3}+\sin^{-1}(-\frac{1}{2})]$.	2
41.	**Give one real example which does not satisfy the property of inverse function.**	2

ANSWERS:

Q. NO	ANSWER	MARKS
1.	$\cot^{-1} x = \cos^{-1}(-1) - \text{cosec}^{-1}(2/\sqrt{3})$ or, $\cot^{-1} x = \pi - \pi/3 = 2\pi/3$ or, $\tan^{-1}(1/x) = 2\pi/3$	2
2.	$\tan^2(\sec^{-1} 2) + \cot^2(\text{cosec}^{-1} 3)$ $= \sec^2(\sec^{-1} 2) - 1 + \text{cosec}^2(\text{cosec}^{-1} 3) - 1$ $= \{\sec(\sec^{-1} 2)\}^2 + \{\text{cosec}(\text{cosec}^{-1} 3)\}^2 - 2$ $=(2)^2 + (3)^2 - 2 = 11$	2
3.	$\alpha = \tan^{-1}(\tan 5\pi/4)$ and $\beta = \tan^{-1}(-\tan 2\pi/3)$ $= \tan^{-1}[\tan(\pi + \pi/4)]$ $= \tan^{-1}(-\tan(\pi - \pi/3))$ $= \tan^{-1}[\tan \pi/4]$ $= \tan^{-1}(\tan \pi/3)$ $= \pi/4$ $= \pi/3$ $\pi = 4\alpha$ $\pi = 3\beta$ Therefore, $4\alpha = 3\beta$	2
4.	$\tan^{-1} 1 + \tan^{-1} 2 + \tan^{-1} 3$ $= \tan^{-1} 1 + \tan^{-1}\left(\frac{2+3}{1-2.3}\right)$ $= \tan^{-1} 1 + \tan^{-1}(-1)$ $= \pi/4 + 3\pi/4 = \pi$	2
5.	$\cos(\tan^{-1} x) = \sin(\cot^{-1}\frac{3}{4})$ Let $\tan^{-1} x = \alpha$ Or, $x = \tan\alpha$ Or, $\cos\alpha = \frac{1}{\sqrt{1+x^2}}$ Or, $\alpha = \cos^{-1}\frac{1}{\sqrt{1+x^2}}$ Similarly let $\cot^{-1}\frac{3}{4} = \beta$ Cot $\beta = 3/4$ Sin $\beta = 4/5$ Equating both the sides we get $\frac{1}{\sqrt{1+x^2}} = 4/5$ Squaring both sides $16(1 + x^2) = 25$ $X = \pm 3/4$	2
6.	Solution: For any $x \in [-1,1]$, the maximum value of $\sin^{-1}x$ is, $\frac{\pi}{2}$ and it attains the value at x=1. $\therefore \sin^{-1}x \le \frac{\pi}{2}, sin - 1y \le \frac{\pi}{2}, sin - 1z \le \frac{\pi}{2}$ for all x, y, z$\in$ [-1,1] $=\sin^{-1}x+\sin^{-1}y+\sin^{-1}z \le \frac{\pi}{2} + \frac{\pi}{2} + \frac{\pi}{2}$ for all x, y, z$\in$ [-1,1] $= \sin^{-1}x+\sin^{-1}y+\sin^{-1}z \le \frac{3\pi}{2}$ for all x, y, z$\in$ [-1,1]	2

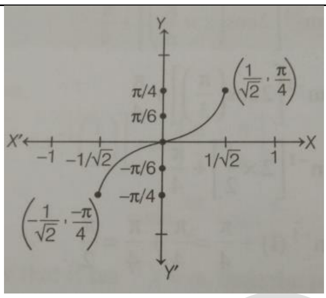
<table>
<tr><td></td><td>∴ $\sin^{-1}x+\sin^{-1}y+\sin^{-1}z=\frac{3\pi}{2}$
∴ $\sin^{-1}x=\frac{\pi}{2}$, $\sin^{-1}y=\frac{\pi}{2}$, $\sin^{-1}z=\frac{\pi}{2}$
= x = 1, y = 1 ,z = 1
∴$x^{2020}+y^{2021}+z^{2022}=(1)^{2021}+(1)^{2022}+(1)^{2023}=3$</td><td></td></tr>
<tr><td>7.</td><td>Solution:
The graph of sec-1x


The domain of sec-1x is(-∞,-1]∪[1,∞)
Therefore, sec-1(2x+1) is meaningful,if
2x+1 ≥ 1 or , 2x+1 ≤ -1
2x ≥ 0 or , 2x≤ -2
x ≥ 0 or , x ≤ -1
x ϵ(-∞,-1]∪ [0, ∞)
Hence, the domain of sac-^{1}(2x+1) is (-∞,-1] ∪ [0, ∞)</td><td>2</td></tr>
<tr><td>8.</td><td>Solution:
tan-1($\frac{cosx}{1+sinx}$) =tan-1{$\frac{cos2\frac{x}{2}-sin2\frac{x}{2}}{cos2\frac{x}{2}+sin2\frac{x}{2}+2sin\frac{x}{2}cos\frac{x}{2}}$}
={$\frac{(cos\frac{x}{2}-sin\frac{x}{2})(cos\frac{x}{2}+sin\frac{x}{2})}{(cos\frac{x}{2}+sin\frac{x}{2})2}$}
= tan-1{$\frac{cos\frac{x}{2}-sin\frac{x}{2}}{cos\frac{x}{2}+sin\frac{x}{2}}$}
=tan-1{$\frac{1-tan\frac{x}{2}}{1+tan\frac{x}{2}}$}
=tan-1{tan($\frac{\pi}{4}-\frac{x}{2}$)}
= $\frac{\pi}{4}-\frac{x}{2}$ [$\frac{-\pi}{2}<x<\frac{\pi}{2}=\frac{-\pi}{4}<-\frac{x}{2}<\frac{\pi}{4}=0<\frac{\pi}{4}-\frac{x}{2}<\frac{\pi}{2}$]</td><td>2</td></tr>
<tr><td>9.</td><td>solution:
Let b, p and h denote the base , perpendicular and
hypotenuse of a right triangle PQR and let <QPR=Ɵ
If sin-1$\frac{5}{13}$ is to be expressed in terms of other five inverse trigonometric , then we construct a right triangle with perpendicular p=5 and hypotenuse h=13.trhe base b of this triangle is b=12.
Ɵ=sin-1$\frac{5}{13}$ =cos-1$\frac{12}{13}$= tan-1$\frac{5}{12}$= cot-1$\frac{12}{5}$ = sec-1$\frac{13}{12}$ =cosec-1$\frac{13}{5}$
</td><td>2</td></tr>
<tr><td>10.</td><td>Solution:
We know that tan-1x+cot-1=$\frac{\pi}{2}$
Or, cot-1x=$\frac{\pi}{2}$ - tan-1x for all xϵR
tan(cot-1x)=tan($\frac{\pi}{2}$ -tan-1x) for all xϵR
=cot(tan-1x) for all xϵR
Clearly, the equality holds for all xϵR as tan-1x+cot-1x=$\frac{\pi}{2}$</td><td>2</td></tr>
</table>

11.	$\sec^{-1}(-2) = \pi - \sec^{-1}(2)$ [$\because \sec^{-1}(-x) = \pi - \sec^{-1}(x)$; $\lvert x\rvert \geq 1$ $= \pi - \sec^{-1}(\sec \pi3) = \pi - \pi3$ [$\because \sec \pi3 = 2$ and $\sec^{-1}(\sec\theta) = \theta$; $\forall\ \theta \in [0, \pi] - \{\pi2\}$] $= 2\pi3$ which is the required principal value.	2
12.	Given that: cot ($\tan^{-1}\boldsymbol{\alpha} + \cot^{-1}\boldsymbol{\alpha}$) = cot ($\boldsymbol{\pi/2}$) (since, $\tan^{-1} x + \cot^{-1} x = \pi/2$) = cot (180°/2) (we know that cot 90° = 0) = cot (90°) = 0 Therefore, the value of cot ($\tan^{-1}\alpha + \cot^{-1}\alpha$) is 0.	2
13.	We have, $\tan^{-1}\left[\sin\left(-\frac{\pi}{2}\right)\right]$ $= \tan^{-1}\left[-\sin\left(\frac{\pi}{2}\right)\right]$ $\left[\because \sin^{-1}(-x) = -\sin^{-1}x,\ x \in (-1, 1)\right]$ $= \tan^{-1}(-1)$ $\left[\because \sin\left(\frac{\pi}{2}\right) = 1\right]$ $= \tan^{-1}\left(-\tan\frac{\pi}{4}\right)$ $\left[\because \tan\frac{\pi}{4} = 1\right]$ $= \tan^{-1}\left[\tan\left(\frac{-\pi}{4}\right)\right] = \frac{-\pi}{4}$ $\left[\because \tan^{-1}(\tan\theta) = \theta; \forall\theta \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)\right]$	2
14.	$\sin^{-1}\frac{1}{3} + \cos^{-1}x = \frac{\pi}{2}$ Or $\sin^{-1}\frac{1}{3} + \frac{\pi}{2} - \sin^{-1}x = \frac{\pi}{2}$ Or $\sin^{-1}\frac{1}{3} = \sin^{-1}x$ Or x=1/3	2

15.	Given, $\sin\left(\sin^{-1}\frac{1}{5}+\cos^{-1}x\right)=1$ $\Rightarrow \quad \sin^{-1}\frac{1}{5}+\cos^{-1}x=\sin^{-1}(1)$ $[\because \sin\theta = x \Rightarrow \theta=\sin^{-1}x]$ $\Rightarrow \quad \sin^{-1}\frac{1}{5}+\cos^{-1}x=\sin^{-1}\left(\sin\frac{\pi}{2}\right) \quad \left[\because \sin\frac{\pi}{2}=1\right]$ $\Rightarrow \quad \sin^{-1}\frac{1}{5}+\cos^{-1}x=\frac{\pi}{2}$ $\Rightarrow \quad \sin^{-1}\frac{1}{5}=\frac{\pi}{2}-\cos^{-1}x$ $\Rightarrow \quad \sin^{-1}\frac{1}{5}=\sin^{-1}x$ $\left[\because \sin^{-1}x+\cos^{-1}x=\frac{\pi}{2}; x\in[-1,1]\right]$ $\therefore \quad x=\frac{1}{5}$	2
16.	We have $\tan^{-1}\left[2cos\left(2\sin^{-1}\frac{1}{2}\right)\right]+\tan^{-1}1$ $=\tan^{-1}\left[2cos\left(2\sin^{-1}\left(sin\frac{\pi}{6}\right)\right)\right]+\tan^{-1}\left(tan\frac{\pi}{4}\right)$ $=\tan^{-1}\left[2cos\left(2*\frac{\pi}{6}\right)\right]+\frac{\pi}{4}$ $=\frac{\pi}{4}+\frac{\pi}{4}$ $=\frac{\pi}{2}$	2
17.	$\sin^{-1}\left(\sin\frac{3\pi}{4}\right)+\cos^{-1}\left(cos\frac{3\pi}{4}\right)+\tan^{-1}1$ $=\sin^{-1}\left(sin\left(\pi-\frac{\pi}{4}\right)\right)+\frac{3\pi}{4}+\frac{\pi}{4}$ $=\sin^{-1}\left(\sin\frac{\pi}{4}\right)+\pi \quad =\frac{5\pi}{4}$	2
18.	We have , $y=\sin^{-1}(x^2-4)$ $-1\le x^2-4\le 1$ $-1+4\le x^2\le 1+4$ $3\le x^2\le 5$ $\sqrt{3}\le \lvert x\rvert \le\sqrt{5}$ So domain of y is $\left[-\sqrt{5},-\sqrt{3}\right]\cup\left[\sqrt{3},\sqrt{5}\right]$	2
19.	let $y=\sin^{-1}\left[\cos\frac{33\pi}{5}\right]$ $=\sin^{-1}\left(\cos\frac{3\pi}{5}\right)$ $=\sin^{-1}\left(cos\left(\frac{\pi}{2}+\frac{\pi}{10}\right)\right)$ $=\sin^{-1}\left(-\sin\frac{\pi}{10}\right) \quad =-\frac{\pi}{10}$	2
20.	$\sin^{-1}\left(2x\sqrt{1-x^2}\right)=2\cos^{-1}x$ On putting $x=\cos t$ where t $=\cos^{-1}x$ L.H.S = $\sin^{-1}(2\cos t\sqrt{1-cos^2 t})$ $=\sin^{-1}(2\cos t\sin t)$ $=\sin^{-1}(\sin 2t)$	2

	$=2t=2\cos^{-1}x = R.H.S$	
21.	$\frac{9\pi}{8} - \frac{9}{4}\sin^{-1}\left(\frac{1}{3}\right)$ $= \frac{9}{4}\left[\frac{\pi}{2} - \sin^{-1}\left(\frac{1}{3}\right)\right]$ $= \frac{9}{4}\cos^{-1}\frac{1}{3} = \frac{9}{4}\sin^{-1}\frac{2\sqrt{2}}{3}$	2
22.	$\tan^{-1}[2\sin(2\cos^{-1}\frac{\sqrt{3}}{2})]$ $= \tan^{-1}[2\sin(2.\frac{\pi}{6})]$ $= \tan^{-1}[2\sin\frac{\pi}{3}]$ $= \tan^{-1}\sqrt{3}$ $= \frac{\pi}{3}$	2
23.	$\tan^{-1}(-\frac{1}{\sqrt{3}}) + \cot^{-1}\left(\frac{1}{\sqrt{3}}\right) + \tan^{-1}\left\{\sin\left(-\frac{\pi}{2}\right)\right\}$ $= -\tan^{-1}\left(\frac{1}{\sqrt{3}}\right) + \cot^{-1}\left(\frac{1}{\sqrt{3}}\right) - \tan^{-1}1$ $= -\frac{\pi}{6} + \frac{\pi}{3} - \frac{\pi}{4}$ $= -\frac{\pi}{12}$	2
24.	$\tan^{-1}\sqrt{3} - \sec^{-1}(-2)$ $= \frac{\pi}{3} - (\pi - \sec^{-1}(2))$ $= \frac{\pi}{3} - \pi + \frac{\pi}{3}$ $= -\frac{\pi}{3}$	2
25.	$\tan(2\tan^{-1}\frac{1}{5})$ $= \frac{5}{12}$	2
26.	$\tan^{-1}1 + \cos^{-1}(-\frac{1}{2})$ $= \frac{\pi}{4} + \pi - \frac{\pi}{3}$ $= \frac{11\pi}{12}$	2
27.	$(\pi/2 - \cos^{-1}x) + (\pi/2 - \cos^{-1}x) = 2\pi/3$, implies $\cos^{-1}x + \cos^{-1}y = \pi/3$	2
28.	$-1 \le x^2 - 4 \le 1 \Rightarrow 3 \le x^2 \le 5 \Rightarrow x \in [-\sqrt{5}, -\sqrt{3}] \cup [\sqrt{3}, \sqrt{5}]$	2
29.	$\sin^{-1}(\cos 33\pi/5) = \sin^{-1}(\cos(6\pi + 3\pi/5)) = \sin^{-1}(\cos(3\pi/5)) = \pi/2 - \cos^{-1}(\cos(3\pi/5))$ $= \pi/2 - 3\pi/5 = -\pi/10$	2

30.	We have , $\cos^{-1}\left(\frac{1}{2}\right) = \cos^{-1}\left(\cos\frac{\pi}{3}\right) = \frac{\pi}{3}$ $\sin^{-1}\left(\frac{1}{2}\right) = \sin^{-1}\left(\sin\frac{\pi}{6}\right) = \frac{\pi}{6}$ $\cos^{-1}\left(\frac{1}{2}\right) + 2\sin^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{3} + 2\left(\frac{\pi}{6}\right) = \frac{2\pi}{3}$	2
31.	since , $\cos : [0, \pi] \to [-1, 1]$ is one one and onto function. so its inverse exists and is given by $\cos^{-1} : [-1, 1] \to [0, \pi]$. Domain $= [-1, 1]$ and Range $= [0, \pi]$	2
32.	Domain = R Range = $(\frac{-\pi}{2}, \frac{\pi}{2})$	2
33.	$\frac{\pi}{2}$	2
34.	$\frac{5\pi}{4}$	2
35.	 Range = $[\frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}]$	2
36.	$\frac{\pi}{4} + \frac{x}{2}$	2
37.	We have, $1 > \frac{\pi}{4}$ $\tan 1 > \tan\frac{\pi}{4}$ $\tan 1 > 1$ $\tan 1 > 1 > \frac{\pi}{4}$ $\tan 1 > \frac{\pi}{4}$ tan 1 > **tan $^{-1}$1**	2
38.	$\tan^{-1}[\tan(\frac{5\pi}{6})] + \cos^{-1}[\cos(\frac{13\pi}{6})]$ $\tan^{-1}[-\tan(\frac{\pi}{6})] + \cos^{-1}[\cos(\frac{\pi}{6})]$ $\tan^{-1}[\tan(-\frac{\pi}{6})] + \frac{\pi}{6}$ $-\frac{\pi}{6} + \frac{\pi}{6}$ 0	2
39.	**tan $^{-1}$ [$\frac{x}{a+\sqrt{a^2-x^2}}$]** **tan $^{-1}$ [$\frac{a\sin\theta}{a+\sqrt{a^2(1-\sin^2\theta)}}$]**	2

	$\tan^{-1}\left[\frac{a\sin\theta}{a(1+\cos\theta)}\right]$ **$\tan^{-1}\left[\tan\frac{\theta}{2}\right]$** **$\frac{\theta}{2}$** $\frac{1}{2}\sin^{-1}\left[\left(\frac{x}{a}\right)\right]$	
40.	$\sin\left[\frac{\pi}{3} + \sin^{-1}\left(-\frac{1}{2}\right)\right]$. $\sin\left[\frac{\pi}{3} - \frac{\pi}{6}\right]$. $\sin\left[\frac{\pi}{6}\right]$. $\frac{1}{2}$	2
41.	f : Parents → Children Parents = { Vivek, Sarita} Children = { Pinki, Gopal, Rajan}	2

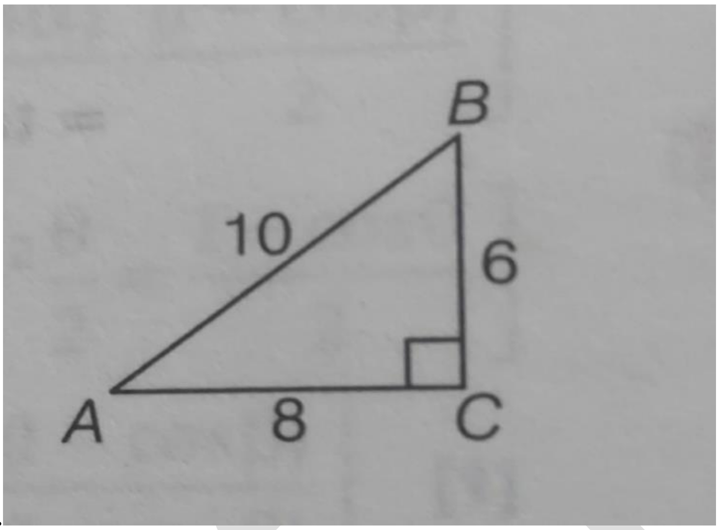
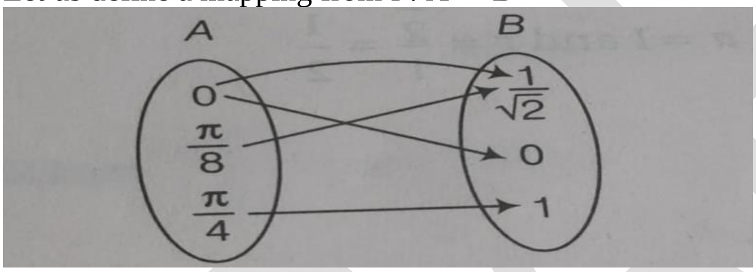
CHAPTER-2

INVERSE TROGONOMETRIC FUNCTION

CLASS-XII

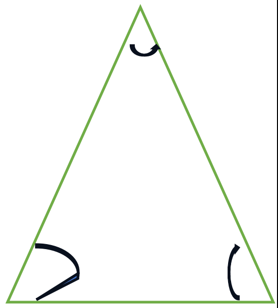
03 MARKS TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	Find the number of real solutions of the equation $\sqrt{1+\cos 2x} = \sqrt{2}\cos^{-1}(\cos x)$ in $[\pi/2, \pi]$	3
2.	Express $\tan(\cos^{-1} x)$ in terms of x only and hence evaluate $\tan(\cos^{-1}\frac{8}{17})$.	3
3.	Is $\tan(\cot^{-1} x) = \cot(\tan^{-1} x)$? Justify your answer.	3
4.	$\tan^{-1}x + \tan^{-1}y = \pi/4$; $xy < 1$, then write the value of $x + y + xy$.	3
5.	write the value of $\cos^{-1}(-1/2) + 2\sin^{-1}(1/2)$.	3
6.	Write the value of $\tan(2\tan^{-1}1/5)$	3
7.	$\tan^{-1}x + \tan^{-1}y = \pi/4$; $xy < 1$, then write the value of $x + y + xy$.	3
8.	write the value of $\cos^{-1}(-1/2) + 2\sin^{-1}(1/2)$.	3
9.	Write the value of $\tan(2\tan^{-1}1/5)$	3
10.	Evaluate $3\sin^{-1}\left(\frac{1}{\sqrt{2}}\right) + 2\cos^{-1}\left(\frac{\sqrt{3}}{2}\right) + \cos^{-1}0$	3
11.	Express $\tan^{-1}\left(\frac{\cos x}{1-\sin x}\right), \frac{-3\pi}{2} < x < \frac{\pi}{2}$, in the simplest form.	3
12.	Write in simplest form $\tan^{-1}\left(\frac{\sqrt{1-\cos x}}{\sqrt{1+\cos x}}\right), 0 < x < \pi$.	3
13.	Simplify $\tan^{-1}\frac{x}{\sqrt{a^2-x^2}}, \lvert x\rvert < a$.	3
14.	Simplify $\cot^{-1}\left(\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right)$, where, $x \in \left(0, \frac{\pi}{4}\right)$	3
15.	Prove that, $2\tan^{-1}\left(\sqrt{\frac{a-b}{a+b}}\tan\frac{x}{2}\right) = \cos^{-1}\left(\frac{a\cos x+b}{a+b\cos x}\right)$	3
16.	Prove the following: $\cos[\tan^{-1}\{\sin(\cot^{-1}x)\}] = \sqrt{\frac{1+x^2}{2+x^2}}$	3
17.	Prove that $\tan^{-1}\left(\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}\right) = \frac{\pi}{4} - \frac{1}{2}\cos^{-1}x$.	3
18.	Prove that : $\cos^{-1}\left(\frac{4}{5}\right) + \cos^{-1}\left(\frac{12}{13}\right) = \cos^{-1}\left(\frac{33}{65}\right)$	3
19.	Find the value of $\tan\frac{1}{2}\left[\sin^{-1}\frac{2x}{1+x^2} + \cos^{-1}\frac{1-y^2}{1+y^2}\right], \lvert x\rvert < 1, y > 0$ and $xy<1$	3
20.	Write the following functions in simplest form $\tan^{-1}\left(\frac{\sqrt{a-x}}{\sqrt{a+x}}\right)$	3
21.	Express $\tan^{-1}\left(\frac{\cos x-\sin x}{\cos x+\sin x}\right)$, $x < \pi$ in the simplest form.	3
22.	If $\alpha = \sin^{-1}x + \cos^{-1}x - \tan^{-1}x$, $x \geq 0$, then find the smallest interval in which α lies.	3
23.	Solve for x : $\cos(2\sin^{-1}x) = \frac{1}{9}$	3

24.	Evaluate: $\tan^{-1}(-\frac{1}{\sqrt{3}}) + \cot^{-1}(\frac{1}{\sqrt{3}}) + \tan^{-1}[\sin(-\frac{\pi}{2})]$	**3**
25.	A right angled triangle ABC is given here. With the help of inverse trigonometric function, prove that  $\angle A + \angle B + \angle C = 180^0$.	**3**
26.	Let us define a mapping from f : A → B  Such that f(x) = sin 2x. Is the inverse function exists?.If so, find the inverse, domain and range of f (x).	**3**

ANSWERS:

Q. NO	ANSWER	MARKS
1.	$\sqrt{1+\cos 2x}$ = $\sqrt{2}$ cos^{-1}(cos x) , [$\pi/2, \pi$] ⇒$\sqrt{1+2\,cos^2x-1} = \sqrt{2}$ cos^{-1}(cos x) ⇒ $\sqrt{2}$ cos x = $\sqrt{2}$ cos^{-1}(cos x) ⇒ cos x = x which is not true for any x ∈ [$\pi/2, \pi$] Hence, no real solution exists in the given interval.	3
2.	Let cos^{-1} x = θ ⇒ x = cos θ Now sin θ = $\sqrt{1-\ x^2}$ So, tan θ = $\frac{\sin\theta}{\cos\theta}$ = $\frac{\sqrt{1-x^2}}{x}$ Hence, tan (cos$^{-1}\frac{8}{17}$) = $\frac{\sqrt{1-(\frac{8}{17})^2}}{\frac{8}{17}}$ = $\frac{\frac{15}{17}}{\frac{8}{17}}$ = 15/8	3
3.	Let cot^{-1} x = θ, X = cot θ =tan (π /2 – θ) Tan^{-1}x = (π /2 – θ) So, tan(cot^{-1} x) = tan θ= cot(π /2 – θ)= cot(π /2- cot^{-1} x)= cot (Tan^{-1}x) This equality is valid for all values of x since tan^{-1}x and cot^{-1} x are true for all x ϵ R.	3
4.	We have $a_1 = a, a_2 = a + d, a_3 = a + 2d$....... And, $d = a_2 - a_1 = a_3 - a_2 = a_4 - a_3 = ... = a_n - a_{n-1}$ Given that, $\tan\left[\tan^{-1}\left(\frac{d}{1+a_1a_2}\right)+\tan^{-1}\left(\frac{d}{1+a_2a_3}\right)+\tan^{-1}\left(\frac{d}{1+a_3a_4}\right)+ ....\right.$ $= \tan^{-1}\left[\tan^{-1}\left(\frac{a_2-a_1}{1+a_1a_2}\right)+\tan^{-1}\left(\frac{a_3-a_2}{1+a_2a_3}\right)+ .... + \tan^{-1}\left(\frac{a_n-a}{1+a_{n-}}\right.\right.$ $= \tan\left[\left(\tan^{-1}a_2 - \tan^{-1}a_1\right)+\left(\tan^{-1}a_3-\tan^{-1}a_2\right)+ .... + \left(\tan^{-1}\right.\right.$ $= \tan\left[\tan^{-1}a_n - \tan^{-1}a_1\right]$ $\left[Scince, \tan^{-1}x - \tan^{-1}y = \tan^{-1}\left(\frac{x-y}{1+xy}\right)\right]$ $= \tan\left[\tan^{-1}\left(\frac{a_n-a_1}{1+a_1a_n}\right)\right]$ $\left[scince, \tan\left(\tan^{-1}x\right) = x\right]$ $= \frac{a_n-a_1}{1+a_1a_n}$	3

5.	Solution: The sum of three angles of triangle is π A+B+C=π ⇒$\cot^{-1}3+\cot^{-1}2+C=\pi$ ⇒$\cot^{-1}\frac{6-1}{3+2} + C = \pi$ {$\cot^{-1}x+\cot^{-1}y=\cot^{-1}\frac{xy-1}{x+y}$ } ⇒$\cot^{-1}\frac{5}{5}+C = \pi$ ⇒$\cot^{-1}1 + C = \pi$ ⇒$\frac{\pi}{4}+C=\pi$ ⇒$C=\pi - \frac{\pi}{4} = \frac{3\pi}{4}$ 	3
6.	Solution: The given equation is; $\cos(\tan^{-1}x)=\sin(\cot^{-1}\frac{3}{4})$ ⇒$\cos(\tan^{-1}x)=\cos(\frac{\pi}{2} - \cot^{-1}\frac{3}{4})$ [$\sin\theta=\cos(\frac{\pi}{2}-\theta)$] ⇒$\cos(\tan^{-1}x)=\cos(\tan^{-1}\frac{3}{4})$ [$\tan^{-1}x+\cot^{-1}=\frac{\pi}{2}$] ⇒$\tan^{-1}x=\tan^{-1}\frac{3}{4}$ ⇒$x=\frac{3}{4}$	3
7.	Given, $\tan^{-1}x + \tan^{-1}y = \frac{\pi}{4}, xy<1$ We know that, $\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-xy}\right), xy<1$ ∴ $\tan^{-1}\left(\frac{x+y}{1-xy}\right) = \frac{\pi}{4} \Rightarrow \frac{x+y}{1-xy} = \tan\frac{\pi}{4}$ ⇒ $\frac{x+y}{1-xy}=1$ $\left[\because \tan\frac{\pi}{4}=1\right]$ ⇒ $x+y=1-xy$ ∴ $x+y+xy=1$	3

8.	We have, $\cos^{-1}\left(\frac{-1}{2}\right)+2\sin^{-1}\left(\frac{1}{2}\right)$ $=\left[\pi-\cos^{-1}\left(\frac{1}{2}\right)\right]+2\sin^{-1}\left(\frac{1}{2}\right)$ $[\because \cos^{-1}(-x)=\pi-\cos^{-1}x;\ \forall x\in[-1,1]]$ $=\left[\pi-\cos^{-1}\left(\cos\frac{\pi}{3}\right)\right]+2\sin^{-1}\left(\sin\frac{\pi}{6}\right)$ $\left[\because \cos\frac{\pi}{3}=\frac{1}{2} \text{ and } \sin\frac{\pi}{6}=\frac{1}{2}\right]$ $=\left[\pi-\frac{\pi}{3}\right]+2\times\frac{\pi}{6}$ $\left[\begin{array}{l}\because\ \cos^{-1}(\cos\theta)=\theta;\ \forall\theta\in[0,\pi]\\ \text{and } \sin^{-1}(\sin\theta)=\theta;\ \forall\theta\in\left[\frac{-\pi}{2},\frac{\pi}{2}\right]\end{array}\right]$ $=\frac{2\pi}{3}+\frac{\pi}{3}=\frac{2\pi+\pi}{3}=\pi$	3
9.	$\tan\left(2\tan^{-1}\frac{1}{5}\right)=\tan\left[\tan^{-1}\left(\frac{2\times\frac{1}{5}}{1-\left(\frac{1}{5}\right)^2}\right)\right]$ $\left[\because 2\tan^{-1}x=\tan^{-1}\left(\frac{2x}{1-x^2}\right);-1<x<1\right]$ $=\tan\left[\tan^{-1}\left(\frac{2\times5}{24}\right)\right]=\tan\left[\tan^{-1}\left(\frac{5}{12}\right)\right]=\frac{5}{12}$ $[\because \tan(\tan^{-1}x)=x;\ \forall x\in R]$	3
10.	$3\sin^{-1}\left(\frac{1}{\sqrt{2}}\right)+2\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)+\cos^{-1}0$ $=3\sin^{-1}\left(\sin\frac{\pi}{4}\right)+2\cos^{-1}\left(\cos\frac{\pi}{6}\right)+\cos^{-1}\left(\cos\frac{\pi}{2}\right)$ $=3\frac{\pi}{4}+2*\frac{\pi}{6}+\frac{\pi}{2}$ $=\frac{19\pi}{12}$	3
11.	We have $\tan^{-1}\left(\frac{\cos x}{1-\sin x}\right)=\tan^{-1}\left[\frac{\sin\left(\frac{\pi}{2}-x\right)}{1-\cos\left(\frac{\pi}{2}-x\right)}\right]$ $=\tan^{-1}\left[\frac{2\sin\left(\frac{\pi}{4}-\frac{x}{2}\right)\cos\left(\frac{\pi}{4}-\frac{x}{2}\right)}{2sin^2\left(\frac{\pi}{4}-\frac{x}{2}\right)}\right]$ $=\tan^{-1}\cot\left(\frac{\pi}{4}-\frac{x}{2}\right)$ $=\tan^{-1}\left[\tan\left(\frac{\pi}{2}-\left(\frac{\pi}{4}-\frac{x}{2}\right)\right)\right]$ $=\frac{\pi}{4}+\frac{x}{2}$ as $\frac{-3\pi}{2}<x<\frac{\pi}{2}$	3

12.	$Let\ \tan^{-1}\left(\frac{\sqrt{1-\cos x}}{\sqrt{1+\cos x}}\right)=y$ Y=$\tan^{-1}\left[\sqrt{\frac{2sin^2\left(\frac{x}{2}\right)}{2cos^2\left(\frac{x}{2}\right)}}\right]$ Y=$\tan^{-1}\left[\sqrt{tan^2\left(\frac{x}{2}\right)}\right]$ Y=$\tan^{-1}\left[tan\left(\frac{x}{2}\right)\right]$ Y=$\frac{x}{2}$, x<π	3
13.	$y=\tan^{-1}\frac{x}{\sqrt{a^2-x^2}},$ Let $x=a\sin\theta$ So, $y=\tan^{-1}\left(\frac{a\sin\theta}{\sqrt{a^2-a^2cos^2\theta}}\right)$ $=\tan^{-1}\left(\frac{a\sin\theta}{a\cos\theta}\right)\ =\theta\ \ =\sin^{-1}\frac{x}{a}$	3
14.	$\cot^{-1}\left(\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right)$ $=\cot^{-1}\left(\frac{\sqrt{\left(\cos\frac{x}{2}+\sin\frac{x}{2}\right)^2}+\sqrt{\left(\cos\frac{x}{2}-\sin\frac{x}{2}\right)^2}}{\sqrt{\left(\cos\frac{x}{2}+\sin\frac{x}{2}\right)^2}-\sqrt{\left(\cos\frac{x}{2}-\sin\frac{x}{2}\right)^2}}\right)$ $=\cot^{-1}\left(\cot\frac{x}{2}\right)\ =\frac{x}{2}$	3
15.	$2\tan^{-1}\left(\sqrt{\frac{a-b}{a+b}}\tan\frac{x}{2}\right)=\cos^{-1}\left(\frac{a\cos x+b}{a+b\cos x}\right)$	3
16.	$\cos[\tan^{-1}\{\sin(\cot^{-1}x)\}]=\sqrt{\frac{1+x^2}{2+x^2}}$ $\mathrm{L.H.S.}=\cos[\tan^{-1}\{\sin(\cot^{-1}x)\}]$ Let $\cot^{-1}x=\theta\ \ \Rightarrow x=cot\theta$ $\mathrm{L.H.S.}=\cos[\tan^{-1}\{\sin\theta\}]$ $==\sqrt{\frac{1+x^2}{2+x^2}}$	3
17.	$\mathrm{L.H.S.}=\tan^{-1}\left(\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}\right)$ $=\tan^{-1}\left(\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}\times\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}-\sqrt{1-x}}\right)$ $=\tan^{-1}\left(\frac{1-\sqrt{1-x^2}}{x}\right)$ $=\tan^{-1}\left(\frac{1-\sqrt{1-sin^2\theta}}{sin\theta}\right)$ where $x=sin\theta$ $=\tan^{-1}\left(\tan\frac{\theta}{2}\right)$ $=\frac{\theta}{2}$ $=\frac{1}{2}\sin^{-1}x$	3

	$= \frac{1}{2}\left(\frac{\pi}{2} - \cos^{-1} x\right)$ $= \frac{\pi}{4} - \frac{1}{2}\cos^{-1} x.$	
18.	We have, $\cos^{-1}\left(\frac{4}{5}\right) + \cos^{-1}\left(\frac{12}{13}\right) = \tan^{-1}\left(\frac{3}{4}\right) + \tan^{-1}\left(\frac{5}{12}\right) = \tan^{-1}\left(\frac{\frac{3}{4}+\frac{5}{12}}{1-\frac{3}{4}\text{x}\frac{5}{12}}\right) = \tan^{-1}\left(\frac{56}{33}\right)$ $= \cos^{-1}\left(\frac{33}{65}\right)$	3
19.	We have , $\tan\frac{1}{2}\left[\sin^{-1}\frac{2x}{1+x^2} + \cos^{-1}\frac{1-y^2}{1+y^2}\right] = \tan\frac{1}{2}\left[2\tan^{-1}x + 2\tan^{-1}y\right] = \tan\left[\tan^{-1}x + \tan^{-1}t\right]$ $= \tan\left[\tan^{-1}\left(\frac{x+y}{1-xy}\right)\right] = \frac{x+y}{1-xy}$	3
20.	We have , $\tan^{-1}\left(\frac{\sqrt{a-x}}{\sqrt{a+x}}\right)$, Putting x= a cost So $\tan^{-1}\left(\frac{\sqrt{a-a\cos t}}{\sqrt{a+a\cos t}}\right) = \tan^{-1}\left(\frac{\sqrt{2a}\sin t}{\sqrt{2a}\cos t}\right) = \tan^{-1}(\tan t) = t = \cos^{-1}\frac{x}{a}$	3
21.	$\frac{\pi}{4} - \frac{x}{2}$	3
22.	$\frac{\pi}{4} \le \alpha \le \frac{\pi}{2}$	3
23.	x = $\frac{2}{3}$	3
24.	$\tan^{-1}(-\frac{1}{\sqrt{3}}) + \cot^{-1}(\frac{1}{\sqrt{3}}) + \tan^{-1}[\sin(-\frac{\pi}{2})]$ $- \frac{\pi}{6} + \frac{\pi}{3}$ - $\frac{\pi}{4}$ $- \frac{\pi}{12}$	3
25.	Sin A = $\frac{3}{5}$, A = $\sin^{-1}(\frac{3}{5})$ sin B = $\frac{4}{5}$, B = $\sin^{-1}(\frac{4}{5})$ < A + < B + < C = $\sin^{-1}(\frac{3}{5}) + \sin^{-1}(\frac{4}{5}) + 90^0$ Let x = $\sin^{-1}(\frac{3}{5})$, y = $\sin^{-1}(\frac{4}{5})$. Then, cos x = $\frac{4}{5}$, cos y = $\frac{3}{5}$. Sin(x + y) = sinx cosy + cosx siny $= \frac{25}{25}$ = 1 x + y = 90^0 < A + < B + < C = $\sin^{-1}(\frac{3}{5}) + \sin^{-1}(\frac{4}{5}) + 90^0$	3

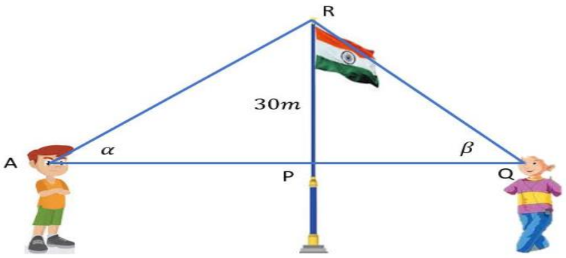
	$= 90^0 + 90^0$ $= 180^0$	
26.	It is one one onto. So inverse exists. $2x = \sin^{-1}y$ $x = ½ \sin^{-1}y$ Domain = { $\frac{1}{\sqrt{2}}$, 0, 1 }, Range = { 0, $\frac{\pi}{8}$, $\frac{\pi}{4}$ }	3

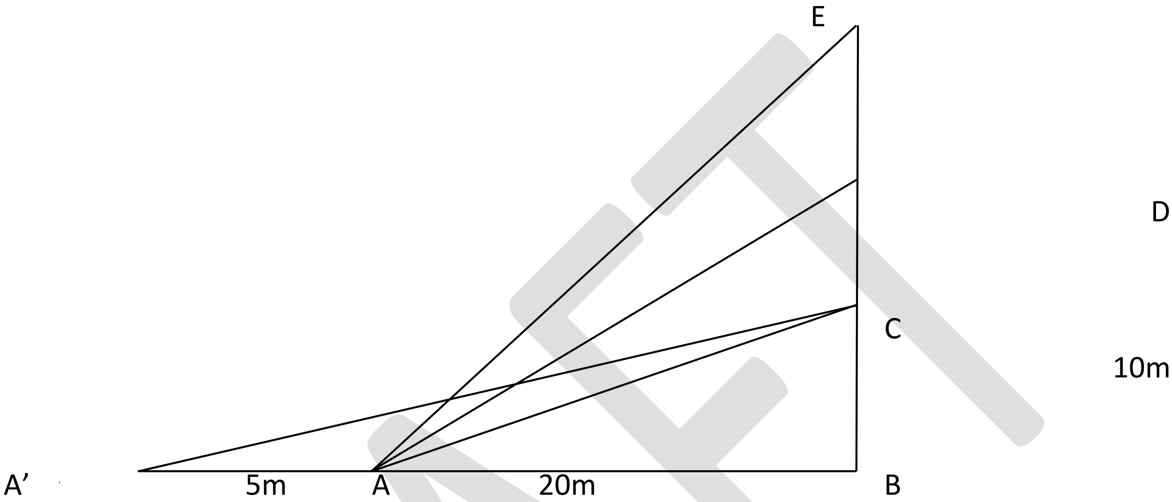
CHAPTER-2

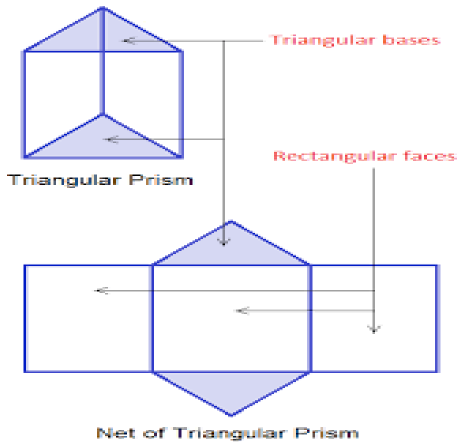
INVERSE T FUNCTION

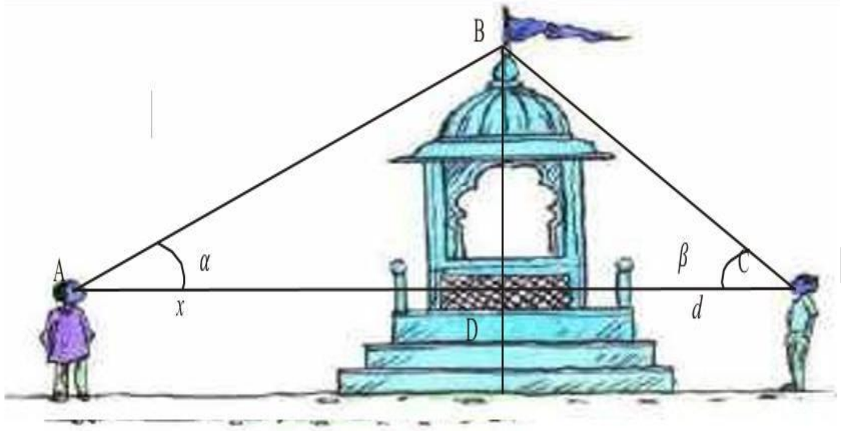
CLASS-XII

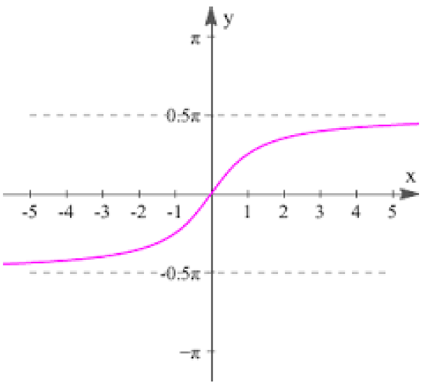
04 MARKS TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	Two men on either side of a flag staff of 30 metres high from the level of eye observe its top at the angles of elevation α and β respectively (as shown in the figure above). The distance between the two men is $40\sqrt{3}$ metres and the distance between the first person A and the flag staff is $30\sqrt{3}$ metres. Based on the above information answer the following questions.  a) Find ∠QAR and ∠AQR. b) Find ∠ARQ. c) Find the principal value of $\sin^{-1}\{\sin(\alpha + \frac{2\pi}{3})\}$ d) Find the principal value of $\cos^{-1}\{\cos(\beta + \frac{\pi}{3})\}$	4

2.	The Government of India is planning to fix a hoarding board at the face of a building on the road of a busy market for awareness on COVID-19 protocol. Ram, Robert and Rahim are the three engineers who are working on this project. “A”is considered to be a person viewing the hoarding board 20 metres away from the building, standing at the edge of a pathway nearby. Ram, Robert and Rahim suggested to the firm to place the hoarding board at three different locations namely C,D and E. “C” is at a height of 10 metres from the ground level. For the viewer A, the angle of elevation of “D” is double the angle of elevation of “C”. The angle of elevation of “E” is triple the angle of elevation of “C” for the same viewer. Look at the figure given and based on the above information answer the following.  a) Determine ∠CAB in terms of $\tan^{-1}$. b) Determine ∠DAB in terms of $\tan^{-1}$. c) Determine ∠EAB in terms of $\tan^{-1}$. d) A’ is another viewer standing on the same line of observation across the road. If the width of the road is 5 metres , then find the difference between ∠CAB & ∠CA’B.	4

3.	Architect Rahut was asked to design an office building for a multinational company. the fine storied building has five pillars in the lawn, which are congruent and in the shape of triangular prisms .Two of the base angles are given to be $\tan^{-1}2$ and $\tan^{-1}3$  (i)$\tan^{-1}2+\tan^{-1}3$----------------- (a)$\frac{\pi}{4}$ (b) $\frac{\pi}{2}$ (c) $\frac{3\pi}{4}$ (d)π (ii)the third angle is (a)$\frac{\pi}{4}$ (b) $\frac{\pi}{2}$ (c) $\frac{3\pi}{4}$ (d)π (iii)If $\tan^{-1}x + \tan^{-1}y = \frac{\pi}{4}$ then x+y+xy=--------------------- (a)1 (b)0 (c)-1 (d)none of these (iv)$\tan^{-1}x+\tan^{-1}y+\tan^{-1}z= \frac{\pi}{2}$, then xy+yz+zx=------ (a)1 (b)0 (c)xyz (d)xy+yz+zx	4
4.	In a school project Anu was asked to construct a triangle and name it as ABC . Two angles A and B were given to be equal to $\tan^{-1}\frac{1}{2}$ and $\tan^{-1}\frac{1}{3}$ respectively;  (i)The value of sinA is ------------- (a)$\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{\sqrt{5}}$ (d) $\frac{2}{\sqrt{5}}$ (ii)Cos(A+B+C)=---------- (a)1 (b)0 (c)-1 (d)$\frac{1}{2}$ (iii)if $B=\cos^{-1}x$ then x=----- (a)$\frac{1}{\sqrt{5}}$ (b) $\frac{3}{\sqrt{10}}$ (c) $\frac{1}{\sqrt{10}}$ (d) $\frac{2}{\sqrt{5}}$ (iv)the value of A+B=-------- (a)$\frac{\pi}{6}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$	4
5.	Solve for X, $\tan^{-1}(x + 1) + \tan^{-1}(x - 1) = \tan^{-1}8/31$	4

6.	Prove that $\sin^{-1}(3/5) - \sin^{-1}(8/17) = \cos^{-1}(84/85)$.	4
7.	Prove that if $\frac{1}{2} \leq x \leq 1$, then $$\cos^{-1} x + \cos^{-1}\left[\frac{x}{2} + \frac{\sqrt{3-3x^2}}{2}\right] = \frac{\pi}{3}$$	4
8.	Write the given function in simplest form $\tan^{-1}\left(\frac{\cos x - \sin x}{\cos x + \sin x}\right), \frac{-\pi}{4} < x < \frac{3\pi}{4}$.	4
9.	Today in class of Mathematics, Mr. Gupta was explaining the inverse trigonometry functions. He draws the graph of the $\sin^{-1} x$ and explained that for $\sin^{-1} x$, the branch with range $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ is called principal value branch. Thus, $sin^{-1} : [-1,1] \rightarrow \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$. Based on the above information answer the following questions, (1)Find the domain of $\sin^{-1}\sqrt{x-1}$. [1] (2)Find the domain of $\sin^{-1}[x]$. [1] (3)Find the value of $\sin\left[\frac{\pi}{3} - \sin^{-1}\left(-\frac{1}{2}\right)\right]$. [2]	4
10.	 Two men on either side of a temple of 30 meters high observe its top at the angles of elevation α and β respectively. (as shown in the figure above). The distance between the two men is 40√3 meters and the distance between the first person A and the temple is 30√3 meters. Based on the above information answer the following: (i)Find $\angle CAB = \alpha$ in term of $\sin^{-1}$ (ii) Find $\angle CAB = \alpha$ in term of $\cos^{-1}$ (iii) Find $\angle BCA = \beta$ in term of $\tan^{-1}$ OR Find the domain and range of $\cos^{-1} x$	4
11.	Read the following passage and answer the following questions. In a school project Ravi was asked to construct a triangle ABC in which B and C are given by $\tan^{-1}\left(\frac{1}{2}\right)$ and $\tan^{-1}\left(\frac{1}{3}\right)$ respectively. (i) Find the value of sinB (ii) Find the value of cosC (iii) Find the value of B+C OR Find the value of cos (B+C)	4
12.	Ram and Mohan are students of class XII. One day their Mathematics teacher told them about Inverse trigonometric functions. Teacher sketch the graph of $y = \tan^{-1} x$ on the board	4

	as follows.  Based on the above information answer the following questions i) The domain of $\tan^{-1}(3x + 2)$ is a) **R** b) R^+ c) $(-\pi/2, \pi/2)$ d) $(0, \pi)$ ii) Principal value of $\tan^{-1}(-1)$ is a) $\pi/4$ b) **$-\pi/4$** c) -1 d) $3\pi/4$ **iii)**The principal value of $\tan^{-1}(\tan(-6))$ is a) -6 b) $2\pi - 6$ c) $6 - 2\pi$ d) None	
13.	In a school project manisha was asked toncinstr ucted a tringle ABC in wihich two angles B and C are given by $\tan^{-1}\left(\frac{1}{2}\right)$ and $\tan^{-1}\left(\frac{1}{3}\right)$ respective ly. (i) Find the value of sinB (ii) find the value of cosc (iii) Find the value of $B + C$ OR Find the value of $B + C$	4
14.	Show that $\tan\left(\frac{1}{2}\sin^{-1}\frac{3}{4}\right) = \frac{4-\sqrt{7}}{3}$	4
15.	Prove the following $\cos[\tan^{-1}\{\sin(\cot^{-1}x)\}] = \sqrt{\frac{1+x^2}{2+x^2}}$	4

ANSWERS:

Q. NO	ANSWER	MARKS
1.	a)In ΔRPA, tan α = RP/AP= 30/ $30\sqrt{3}$ = $1/\sqrt{3}$ = tan $\pi/6$ So, α = ∠QAR= $\pi/6$ PQ = $40\sqrt{3} - 30\sqrt{3}$= $10\sqrt{3}$ b)In ΔRPQ, tan β =RP/PQ= $30/10\sqrt{3}$ = $\sqrt{3}$ = tan $\pi/3$ So, β = ∠AQR= $\pi/3$ c) $\sin^{-1}$\{ $\sin(\alpha+\frac{2\pi}{3})$ \} = $\sin^{-1}$\{ $\sin(\pi/6+\frac{2\pi}{3})$ \} = $\sin^{-1}$\{ $\sin(5\pi/6)$ \}= $\sin^{-1}$\{ $\sin(\pi-\pi/6)$ \} = $\pi/6 \epsilon [-\pi/2, \pi/2]$ d)$\cos^{-1}$ \{ $\cos(\beta+\frac{\pi}{3})$\}= $\cos^{-1}$ \{ $\cos(\pi/3+\frac{\pi}{3})$\} = $\cos^{-1}$ \{ cos $(2\pi/3)$\} = $2\pi/3 \epsilon [0, \pi]$	4
2.	a)In ΔABC , tan∠CAB = BC/AB= 10/20= ½ So, ∠CAB= $\tan^{-1}(1/2)$ b) ∠DAB= 2 ∠CAB= 2 $\tan^{-1}(1/2)$ = $\tan^{-1}(\frac{2.\frac{1}{2}}{1-(\frac{1}{2})^2})$ = $\tan^{-1}(4/3)$ c) ∠EAB= 3 ∠CAB= 3 $\tan^{-1}(1/2)$ = $\tan^{-1}(\frac{\frac{3.1}{2}-(\frac{1}{2})^2}{1-3(\frac{1}{2})^2})$ = $\tan^{-1}(11/2)$ d) In ΔA'BC , tan A' = BC/A'B = 10/25 = 2/5 So, A' = $\tan^{-1}(2/5)$ Now, ∠CAB - ∠CA'B = $\tan^{-1}(1/2)$ - $\tan^{-1}(2/5)$ = $\tan^{-1}$ $(\frac{\frac{1}{2}-\frac{2}{5}}{1+\frac{1}{2}.\frac{2}{5}})$=tan- $^{1}(1/12)$	4
3.	Solution: (i)$\tan^{-1}2+\tan^{-1}3=\tan^{-1}(\frac{2+3}{1-2*3})$ $=\tan^{-1}(\frac{5}{1-6})$ $=\tan^{-1}((\frac{5}{-5})$ $=\tan^{-1}(-1)$ $=\pi - \frac{\pi}{4}$ $= \frac{3\pi}{4}$ (ii)let the third angle be x Since all three angles are in a triangle Sum of angles=180° Sum of angles=π tan-12+tan-13+x=π $\frac{3\pi}{4}$ +x= π x= π- $\frac{3\pi}{4}$ x =$\frac{\pi}{4}$ (iii)given that $\tan^{-1}x+\tan^{-1}y=\frac{\pi}{4}$	4

	$\tan^{-1}(\frac{x+y}{1-xy}) = \frac{\pi}{4}$ $\frac{x+y}{1-xy} = tan\frac{\pi}{4}$ $\frac{x+y}{1-xy} = 1$ x+y=1-xy x+y+xy=1 (iii)given that $\tan^{-1}x+\tan^{-1}y+\tan^{-1}z=\pi$ $\tan^{-1}x+\tan^{-1}y=\pi-\tan^{-1}z$ $\tan^{-1}x+\tan^{-1}y = \tan^{-1}0- \tan^{-1}z$ $\tan^{-1}(\frac{x+y}{1-xy})=\tan^{-1}(-z)$ $\frac{x+y}{1-xy} = -z$ ⇒x+y=- z + xyz x+y+z=xyz (iv)given that $\tan^{-1}x+\tan^{-1}y+\tan^{-1}z=\frac{\pi}{2}$ $\tan^{-1}x+\tan^{-1}y=\frac{\pi}{2} - \tan^{-1}z$ $\tan^{-1}x+\tan^{-1}y=\cot^{-1}z$ $\tan^{-1}x+\tan^{-1}y=\tan^{-1}\frac{1}{z}$ $\tan^{-1}(\frac{x+y}{1-xy}) = \tan^{-1}\frac{1}{z}$ $\frac{x+y}{1-xy} = \frac{1}{z}$ xz+yz=1-xy xy+xz+yz=1	
4.	Solution: (i)given $A=\tan^{-1}\frac{1}{2}$ $\tan A=\frac{1}{2}$ now we know that $1+\tan^2A=\sec^2A$ $1+\tan^2A=\frac{1}{cos2A}$ $1+\tan^2A=\frac{1}{1-sin2A}$ Putting $\tan A=\frac{1}{2}$ $1+(\frac{1}{2})^2=\frac{1}{1-sin2A}$ $1+\frac{1}{4}=\frac{1}{1-sin2A}$ $\Rightarrow\frac{5}{4}=\frac{1}{1-sin2A}$ $1-\sin^2A=\frac{4}{5}$ $\Rightarrow 1-\frac{4}{5}=\sin^2A$ $\Rightarrow\frac{1}{5} =\sin^2A$ $\sin^2A=\frac{1}{5}$ $\sin A=\frac{1}{\sqrt{5}}$ (ii) since ABC is a triangle By angle sum property of triangle $A+B+C=180^0$ Thus , Cos(A+B+C)=cos180°=-1 (iii) Given B = tan-1(⅓) ⇒ tan B = ⅓	4

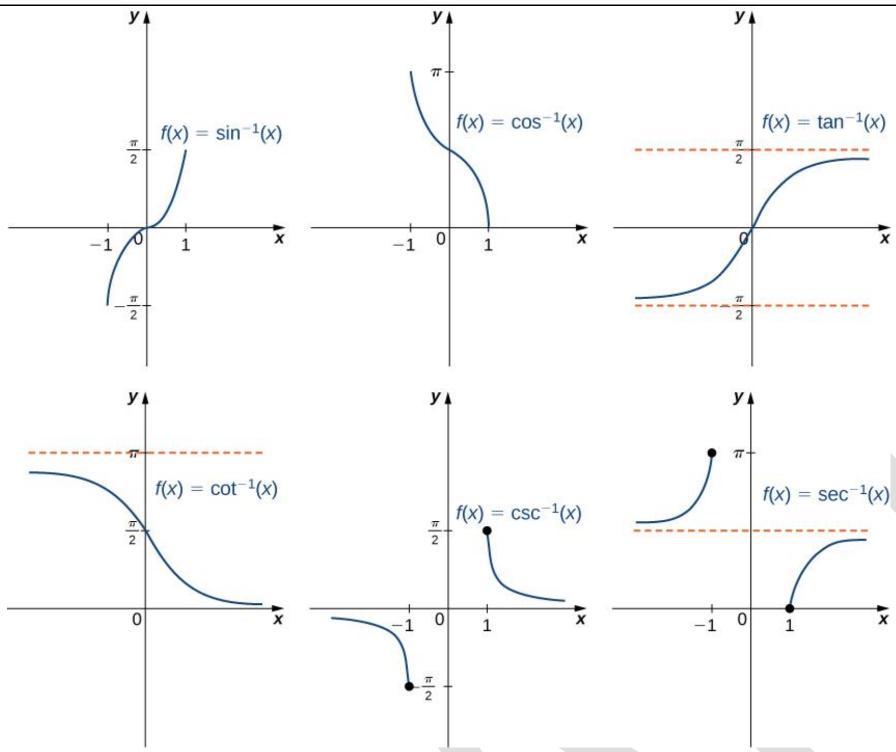
	$\therefore \cos B = 3/\sqrt{10}$ B = cos-1($3/\sqrt{10}$) $\Rightarrow x = 3/\sqrt{10}$ (iv) Given A=$\tan^{-1}\frac{1}{2}$ B=tan-1$\frac{1}{3}$ Now, A+B= $\tan^{-1}\frac{1}{2}+\tan^{-1}\frac{1}{3}$ Using $\tan^{-1}x+\tan^{-1}y=\tan^{-1}(\frac{x+y}{1-xy})$ $= \tan^{-1}(\frac{\frac{1}{2}+\frac{1}{3}}{1-\frac{1\times1}{2\times3}})$ $= \tan^{-1}(\frac{\frac{3+2}{2\times3}}{1-\frac{1}{6}})$ $=\tan^{-1}(\frac{\frac{5}{6}}{\frac{5}{6}})$ $= \tan^{-1}(1)$ $=\frac{\pi}{4}$	
5.	$\Rightarrow \quad \tan^{-1}\left[\frac{(x+1)+(x-1)}{1-(x+1)(x-1)}\right]=\tan^{-1}\frac{8}{31}$ $\left[\because \tan^{-1}x+\tan^{-1}y=\tan^{-1}\left(\frac{x+y}{1-xy}\right);\ xy<1\right]$ $\Rightarrow \quad \tan^{-1}\left(\frac{2x}{1-(x^2-1)}\right)=\tan^{-1}\frac{8}{31}$ $\Rightarrow \quad \frac{2x}{2-x^2}=\frac{8}{31}$ **$\Rightarrow 62x = 16 - 8x^2$** **$\Rightarrow 8x^2 + 62x - 16 = 0$** **$\Rightarrow 4x^2 + 31x - 8 = 0$** **$\Rightarrow 4x^2 + 32x - x - 8 = 0$** **$\Rightarrow 4x(x + 8) - 1(x + 8) = 0$** **$\Rightarrow (x + 8)(4x - 1) = 0$** **$\therefore$ x = -8 or x = 14** **But x = – 8 gives LHS = $\tan^{-1}(-7) + \tan^{-1}(-9)$** **= $-\tan^{-1}(7) - \tan^{-1}(9)$,** **which is negative, while RHS is positive.** **So, x = – 8 is not possible.** **Hence, x = 14 is the only solution of the given equation**.	4
6.	**Let $\sin^{-1}(3/5)$ = a and $\sin^{-1}(8/17)$ = b** **Thus, we can write sin a = 3/5 and sin b = 8/17** **Now, find the value of cos a and cos b** **To find cos a:** **Cos a = $\sqrt{[1 - \sin^2 a]}$** **= $\sqrt{[1 - (3/5)^2]}$** **= $\sqrt{[1 - (9/25)]}$**	4

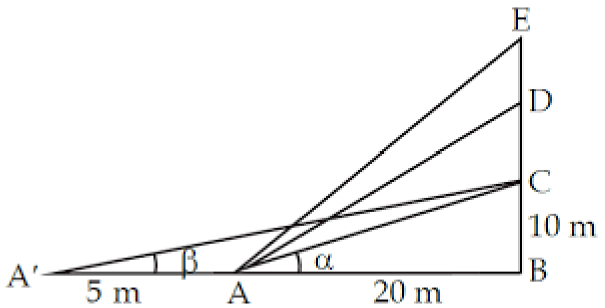
	= √[(25-9)/25] = 4/5 Thus, the value of cos a = 4/5 To find cos b: Cos b= √[1 - sin^2 b] = √[1 - $(8/17)^2$] = √[1 - (64/289)] = √[(289-64)/289] = 15/17 Thus, the value of cos b = 15/17 We know that cos (a- b) = cos a cos b + sin a sin b Now, substitute the values for cos a, cos b, sin a and sin b in the formula, we get: cos (a - b) = (4/5)x (15/17) + (3/5)x(8/17) cos (a - b) = (60 + 24)/(17x 5) cos (a - b) = 84/85 (a - b) = cos^{-1} (84/85) Substituting the values of a and b sin^{-1} (3/5)- sin^{-1} (8/7) = cos^{-1} (84/85) Hence proved.	
7.	Let $\cos^{-1} x = \theta$ then x= cos θ We have $\cos^{-1} x + \cos^{-1}\left[\frac{x}{2} + \frac{\sqrt{3-3x^2}}{2}\right] = \frac{\pi}{3}$ LHS= $\theta + \cos^{-1}\left[\frac{cos\theta}{2} + \frac{\sqrt{3-3cos^2\theta}}{2}\right]$ $= \theta + \cos^{-1}\left[\frac{cos\theta}{2} + \frac{\sqrt{3}\sqrt{1-cos^2\theta}}{2}\right]$ $= \theta + \cos^{-1}\left[\frac{cos\theta}{2} + \frac{\sqrt{3}sin\theta}{2}\right]$	4

	$= \theta + \cos^{-1}\left[cos\theta cos\frac{\pi}{3} + sin\frac{\pi}{3}sin\theta\right]$ $= \theta + \cos^{-1}\left[cos\left(\theta - \frac{\pi}{3}\right)\right]$ $= \theta + \frac{\pi}{3} - \theta \quad = \frac{\pi}{3}$	
8.	Let $\tan^{-1}\left(\frac{\cos x - \sin x}{\cos x + \sin x}\right) = y$(say) Taking common 'cos x' from numerator and denominator, we get $Y = \tan^{-1}\left[\frac{1-\frac{\sin x}{\cos x}}{1+\frac{\sin x}{\cos x}}\right] = \tan^{-1}\left[\frac{1-\tan x}{1+\tan x}\right]$ $= \tan^{-1}\left[\frac{\tan\frac{\pi}{4} - \tan x}{1+\tan\frac{\pi}{4}tanx}\right]$ $\left[\tan\frac{\pi}{4} = 1\right]$ $= \tan^{-1}\left[\tan\left(\frac{\pi}{4} - x\right)\right]$ $\left[\frac{\tan A - \tan B}{1+\tan A \tan B} = \tan(A-B)\right]$ $= \frac{\pi}{4} - x, 0 < x < \pi$	4
9.	(1)Since, $0 \le x - 1 \le 1$ $1 \le x \le 2,$ Domain = $[1,2]$ (2)Since, domain of $\sin^{-1} x = [-1,1]$ So, $[x] = \begin{cases} -1, -1 \le x < 0 \\ 0, \quad 0 \le x < 1 \\ 1, \quad 1 \le x < 2 \end{cases}$ So Domain of $\sin^{-1}[x] = [-1, 2)$ (3) $\sin\left[\frac{\pi}{3} - \sin^{-1}\left(-\frac{1}{2}\right)\right]$ $= \sin\left[\frac{\pi}{3} + \frac{\pi}{6}\right] = \sin\left(\frac{\pi}{2}\right) = 1$	4
10.	(i) $\alpha = \sin^{-1}\left(\frac{1}{2}\right)$ (ii) $\alpha = \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (iii) $\beta = \tan^{-1}(\sqrt{3})$ OR Range = $[0, \pi]$	4
11.	(i) $\frac{1}{\sqrt{5}}$ (ii) $\frac{3}{\sqrt{10}}$ (iii) $\frac{\pi}{4}$ OR $\frac{1}{\sqrt{2}}$	4
12.	**i) (a)** x is real, implies 3x + 2 is real. So domain is R (ii)(b) tan(-π/4) = -1 implies $\tan^{-1}(-1) = -\pi/4$ (iii) **(b)**$\tan^{-1}(\tan(-6)) = \tan^{-1}(-\tan 6) = \tan^{-1}(\tan(2\pi - 6)) = 2\pi - 6$	

13.	We have, $\tan^{-1}\left(\frac{1}{2}\right) = B$ => tanB = 1/2 and $\tan^{-1}\left(\frac{1}{3}\right) = C$ => tanC = 1/3 (i) $\sin B = \frac{1}{\sqrt{5}}$ and (ii) $\cos C = \frac{3}{\sqrt{10}}$ (*iii*) $\tan(B+C) = \frac{\tan B + \tan C}{1 - \tan B \tan C} = \frac{\frac{1}{2}+\frac{1}{3}}{1-\frac{1}{2} x \frac{1}{3}} = 1 = \tan\frac{\pi}{4} \Rightarrow B + C = \frac{\pi}{4}$ OR $\cos B = \frac{2}{\sqrt{5}}$ and $\sin C = \frac{3}{\sqrt{10}}$ $\cos(B+C) = \cos B\cos C - \sin B\sin C = \frac{2}{\sqrt{5}} x \frac{3}{\sqrt{10}} - \frac{1}{\sqrt{5}} x \frac{3}{\sqrt{10}} = \frac{1}{\sqrt{2}}$	
14.	Let $\sin^{-1}\frac{3}{4} = x$, sin x=3/4 , $\frac{2\tan\frac{x}{2}}{1+\tan^{2}\frac{x}{2}} = \frac{3}{4}$ $\tan\frac{x}{2} = \frac{4\pm\sqrt{7}}{3}$ $\tan\left(\frac{1}{2}\sin^{-1}\frac{3}{4}\right) = \frac{4-\sqrt{7}}{3}$	4
15.	Let $\cot^{-1}x = y$ $\cos[\tan^{-1}\{\sin(\cot^{-1}x)\}] = \cos[\tan^{-1}\{\sin y\}] = \cos[\tan^{-1}\{\frac{1}{cosec\, y}\}]$ $= \cos[\tan^{-1}\{\frac{1}{\sqrt{1+cot^2 y}}\}] = \cos[\tan^{-1}\{\frac{1}{\sqrt{1+x^2}}\}]$ let $\tan^{-1}\frac{1}{\sqrt{1+x^2}} = a$ such that $\tan a = \frac{1}{\sqrt{1+x^2}}$ $\tan^2 a = \frac{1}{1+x^2}$ $\frac{\sin^2 a}{\cos^2 a} + 1 = \frac{1}{1+x^2} + 1$ $\frac{1}{\cos^2 a} = \frac{2+x^2}{1+x^2}$ $\text{Cos } a = \sqrt{\frac{1+x^2}{2+x^2}}$	4

CHAPTER-2
INVERSE TRIGONOMETRIC FUNCTION
CLASS-XII
05 MARKS TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	 Based on the above graphs answer the following. i)Find the domain of $\tan^{-1}x$. ii) Find the principal value branch of $\text{cosec}^{-1}x$. iii) Write another two branch of $\sin^{-1}x$ other than principal value branch. iv) If x < 0, then find the value of $\tan^{-1}x + \tan^{-1}\frac{1}{x}$. v) Find the domain of $\sin^{-1}(2x-3)$	5
2.	Let f: A→B be a bijective function then f^{-1}: B→ Ais a function such that $f(f^{-1}(x)) = x$ for all x ∈ B and $f^{-1}(f(x)) = x$ for all x ∈ A. For ensuring bijectivity, domain of trigonometric function are restricted. Based on the above information, answer the following questions. i)Find the value of $\sin^{-1}(\sin 10)$. ii) Find the value of $\tan^{-1}\left(\sqrt{\frac{1-\cos x}{1+\cos x}}\right)$ if x∈ $(-\pi , \pi)$. iii) Express $\sin(\tan^{-1}x)$ in terms of x only. iv) Express the function $\cos(\text{cosec}^{-1}x)$ in terms of x only. v) Is $\sin^{-1}x$ equal to $(\sin x)^{-1}$?	5
3.	The government of India is planning to fix a hoarding board at the face of a building on the road of a busy market for awareness on COVID-19 protocol. Ram, Robert and Rahim are the three engineers who are working on this project “A” is considered to be a person viewing the hoarding board 20 meter away from the building , standing at the edge of a pathway nearby. Ram, Robert and Rahim suggested to the firm to place the hoarding board at three different locations namely C,D and E.”C” is at the height of 10 meter from the ground level .For the viewer “A” ,the angle of elevation of “D” is double the angle of elevation of “C”. The angle of elevation of “E” is triple the angle of elevation of “C” for the same viewer. Look at the figure given and based on the above information answer the following;	5



(i)measure the angle <CAB=--------

(a)$\tan^{-1}2$ (b)$\tan^{-1}1$ (c)$\tan^{-1}(\frac{1}{2})$ (d)$\tan^{-1}3$

(ii)Measure of $< DAB$=-----------

(a)$\tan^{-1}(\frac{3}{4})$ (b)$\tan^{-1}3$ (c)$\tan^{-1}(\frac{4}{3})$ (d)$\tan^{-1}4$

(iii)measure of $< EAB =$----------

(a)$\tan^{-1}11$ (b)$\tan^{-1}3$ (c)$\tan^{-1}\frac{2}{11}$ (d)$\tan^{-1}\frac{11}{2}$

(iv) A is another viewer standing on the same line of observation across the road .if the width of the road is 5meter , then the difference between <C'AB and <CA'B is

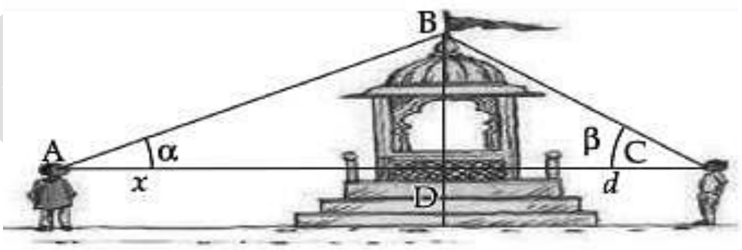
(a)$\tan^{-1}\frac{1}{12}$ (b)$\tan^{-1}\frac{1}{8}$ (c)$\tan^{-1}\frac{2}{5}$ (d)$\tan^{-1}\frac{11}{21}$

(v) Domain and range of $\tan^{-1} x$ =

(a) $R^+,(\frac{-\pi}{2},\frac{\pi}{2})$ (b) $R^-,(\frac{-\pi}{2},\frac{\pi}{2})$ (c) R, $(\frac{-\pi}{2},\frac{\pi}{2})$

(d) R, $(0,\frac{\pi}{2})$

4. Two men on either side of a temple of 30m high observe its top at the angles of elevation α and β respectively. The distance between the two men is $40\sqrt{3}$m and the distance between the first person A and the temple is $30\sqrt{3}$ — 5



Based on the above information answer the following questions

(i)$< CAB = \alpha =$

(a)$\sin^{-1}\frac{2}{\sqrt{3}}$ (b) $\sin^{-1}\frac{1}{2}$ (c)$\sin^{-1}2$ (d) $\sin^{-1}\frac{\sqrt{3}}{2}$

(ii))$< CAB = \alpha =$

(a)$\cos^{-1}\frac{1}{5}$ (b) $\cos^{-1}\frac{2}{5}$ (c) $\cos^{-1}\frac{\sqrt{3}}{2}$ (d) $\cos^{-1}\frac{4}{5}$

(iii)$< BCA$ =β=

(a)$\tan^{-1}\frac{1}{2}$ (b) $\tan^{-1}2$ (c) $\tan^{-1}\frac{1}{\sqrt{3}}$ (d) $\tan^{-1}\sqrt{3}$

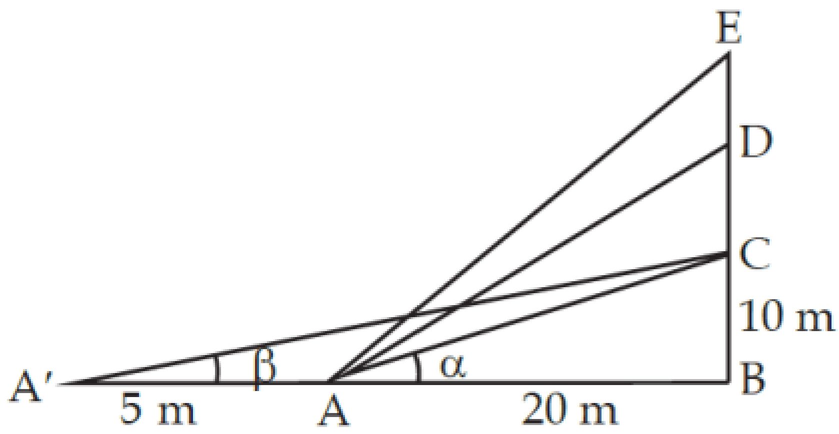
(iv)$< ABC =$

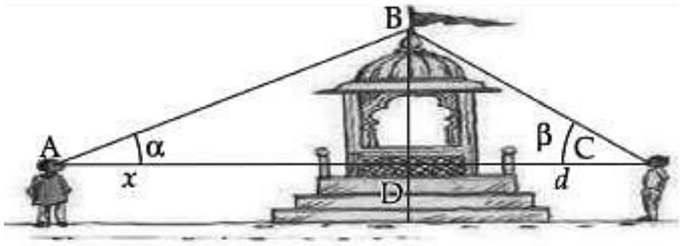
(a)$\frac{\pi}{4}$ (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{3}$

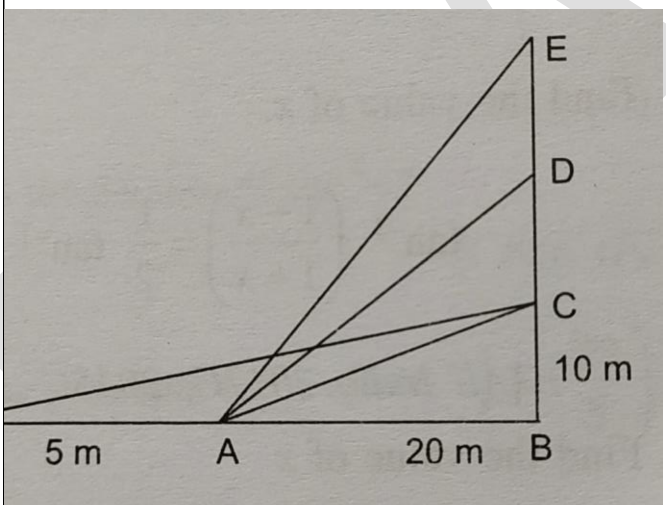
(v)Domain and range of $\cos^{-1}x$=

(a)(-1,1),(0,π) (b)[-1,1],(0,π)

(c)[-1,1],[0,π] (d)(-1,1),$[\frac{-\pi}{2},\frac{\pi}{2}]$

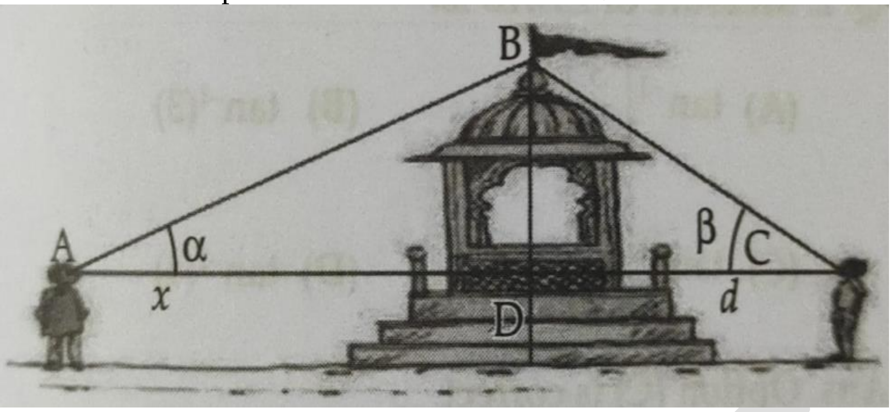
5.	The Government of India is planning to fix a hoarding board at the face of a building on the road of a busy market for awareness on COVID-19 protocol. Ram, Robert and Rahim are the three engineers who are working on this project. ‘A’ is considered to be a person viewing the hoarding board 20 metres away from the building, standing at the edge of a pathway nearby, Ram Robert and Rahim suggested to the film to place the hoarding board at three different locations namely C, D and E. ‘C’ is at the height of 10 metres from the ground level. For the viewer ‘A’, the angle of elevation of ‘D’ is double the angle of elevation of ‘C’. The angle of elevation of ‘E’ is triple the angle of elevation of ‘C’ for the same viewer. ***Look at the figure given and based on the above information answer the following:***  **(i)** **Measure of ∠CAB =** (a) $\tan^{-1}(2)$ (b) $\tan^{-1}(1/2)$ (c) tan–¹(1) (d) $\tan^{-1}(3)$ **(ii)** **Measure of ∠DAB =** (a) $\tan^{-1}(3/4)$ (b) $\tan^{-1}(3)$ (c) $\tan^{-1}(4/3)$ (d) $\tan^{-1}(4)$ (III) **Measure of ∠EAB** (a) $\tan^{-1}(11)$ (b) $\tan^{-1}(3)$ (c) $\tan^{-1}(2/11)$ (d) $\tan^{-1}(11/2)$ (IV) **A’ is another viewer standing on the same line of observation across the road. If the width of the road is 5 meters, then the difference between ∠CAB and ∠CA’B is** (a) $\tan^{-1}(1/12)$ (b) $\tan^{-1}(1/8)$ (c) $\tan^{-1}(2/5)$ (d) $\tan^{-1}(11/21)$	5
6.		5

<table>
<tr><td></td><td>

Two men on either side of a temple of 30 meters high observe its top at the angles of elevation α and β respectively. (as shown in the figure above). The distance between the two men is 40√3 metres and the distance between the first person A and the temple is 30√3 meters. ∠CAB = α =
• A. $\sin^{-1}(2/\sqrt{3})$
• B. $\sin^{-1}(1/2)$
• C. $\sin^{-1}(2)$
• D. $\sin^{-1}(\sqrt{3}/2)$</td><td></td></tr>
<tr><td>7.</td><td>The municipal corporation of a city is planning to fix hoarding boards at the face of a building on the road of a busy market for awareness on keeping the city clean. Anuj, Bala and Dilip are the three engineers who are working on this project. Hoardings are placed at C,D and E on the wall. C is the height of 10 meters from the ground level D and E are above it.


A is a point which is 20 meters away from the foot of the building. From A, the angle of elevation of D is doubled the angle of elevation of C. Also, from A the angle of elevation of E is triple the angle of elevation of C. Look at the figure and based on the above information answer the following:
(i) If the measure of angle CAB $=\tan^{-1} x$,Find the value of x.
(ii) If the measure of angle EAB$=\tan^{-1} z$, find the value of z.
(iii) Point P is 5 meters behind A. Then find the difference between angle CAB and CPB.
(iv) Give the domain and range of $\tan^{-1} x$</td><td>5</td></tr>
<tr><td>8.</td><td>Two men on either side of a tower of 30 meters high observe its top at the angles of elevation α and β respectively. The distance between the two men is $40\sqrt{3}$ and the distance</td><td>5</td></tr>
</table>

between the first person A and the tower is $30\sqrt{3}$ meters.



Based on the above information answer the following:

(i) If $angle\ CAB = \alpha = \sin^{-1} x$, find the value of x.

(ii) If angle CAB= α=$\cos^{-1} y$, find the value of y.

(iii) Find the measure of angle A.

) Give the domain and range of $\cos^{-1} y$

9. Shriya is preparing for her board exams. So, she decided to prepare chart of formulas of maths and important facts related to each chapter. For the chapter inverse trigonometry she has prepared the following table to remember the principal branch values of inverse trigonometric functions.

Functions	**Domain**	**Range (Principal Value Branches)**
$y = \sin^{-1} x$	[–1, 1]	$\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$
$y = \cos^{-1} x$	[–1, 1]	$[0, \pi]$
$y = \text{cosec}^{-1} x$	**R** – (–1,1)	$\left[\frac{-\pi}{2}, \frac{\pi}{2}\right] - \{0\}$
$y = \sec^{-1} x$	**R** – (–1, 1)	$[0, \pi] - \{\frac{\pi}{2}\}$
$y = \tan^{-1} x$	**R**	$\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$
$y = \cot^{-1} x$	**R**	$(0, \pi)$

Based on the above information, answer the following questions,

(1) Find the principal value of $\csc^{-1}(-1)$. [1]

(2) Find the principal value of $\sec^{-1}(-2)$. [1]

(3) Solve the following equation, [3]

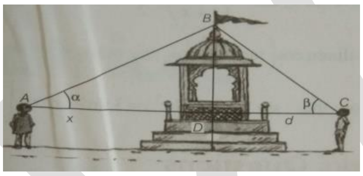
$$\tan^{-1}\left(\frac{x+1}{x-1}\right) + \tan^{-1}\left(\frac{x-1}{x}\right) = \tan^{-1}(-7)$$

5

10. If $\cos^{-1}\frac{x}{a} + \cos^{-1}\frac{y}{b} = \alpha$, prove that $\frac{x^2}{a^2} - \frac{2xy}{ab}\cos\alpha + \frac{y^2}{b^2} = sin^2\alpha$. 5

11. Prove that, $\tan\left(\frac{\pi}{4} + \frac{1}{2}\cos^{-1}\frac{a}{b}\right) + \tan\left(\frac{\pi}{4} - \frac{1}{2}\cos^{-1}\frac{a}{b}\right) = \frac{2b}{a}$ 5

12. Prove that : $\tan^{-1}\left(\frac{\cos x}{1+\sin x}\right) = \frac{\pi}{4} - \frac{x}{2},\ x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

		5
13.	Prove that : $\tan^{-1}\left(\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}\right)=\frac{\pi}{4}-\frac{1}{2}\cos^{-1}x,\ -\frac{1}{\sqrt{2}}\leq x\leq 1$	5
14.	Read the following passage and answer the following questions: In a school project Manish was asked to construct a triangle ABC in which two angles B and C are given by $\tan^{-1}(\frac{1}{2})$ and $\tan^{-1}(\frac{1}{3})$ respectively. (i) Find the value of sin B. (ii) Find the value of cos C. (iii) Find the value of B + C (iv) Find the value of cos (B+C) (v) Write the formula for $\tan^{-1} A + \tan^{-1} B$	5
15.	Read the following passage and answer the following questions: Two men on either side of a temple 15 metre high observe its top at the angles of elevation $\propto$ *and* β respectively (as shown in the figure). The distance between the two men is $20\sqrt{3}$ m and the distance between the first person A and the temple is $15\sqrt{3}$.  (i) Find $\propto$ in terms of $\sin^{-1}$, (ii) Find $\propto$ in terms of $\cos^{-1}$ (iii) Find β in terms of $\tan^{-1}$ (iv) Write the domain and range of $\cos^{-1}$ (v) Find $m\angle ABC$	5
16.	Prove that $\tan^{-1}[\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1\_x}}] = \frac{\pi}{4} - \frac{1}{2}\cos^{-1}x, 0<x<1$	**5**
17.	Find the greatest and least values of $(\sin^{-1}x)^2 + (\cos^{-1}x)^2$.	**5**

ANSWERS:

Q. NO	ANSWER	MARKS
1.	i) Domain of $\tan^{-1}x$ is R or $(-\infty, \infty)$. ii) The principal value branch of $\text{cosec}^{-1}x$ is $[-\pi/2, 0) \cup (0, \pi/2]$ or $[-\pi/2, \pi/2] - \{0\}$ iii) Another two branches of $\sin^{-1}x$ other than principal value branch are $[\pi/2, 3\pi/2]$, $[3\pi/2, 5\pi/2]$ iv) If x < 0, then $\tan^{-1}x + \tan^{-1}\frac{1}{x} = \tan^{-1}x + \cot^{-1}x - \pi = \frac{\pi}{2} - \pi = -\pi/2$ v) To find the domain of $\sin^{-1}(2x-3)$, we can write $-1 \leq 2x-3 \leq 1 \Rightarrow -1+3 \leq 2x \leq 1+3 \Rightarrow 2 \leq 2x \leq 4$ $\Rightarrow 1 \leq x \leq 2$ So, $x \in [1,2]$	5
2.	i)As we know $3\pi < 10 < 7\pi/2$ Now, $x = \sin^{-1}(\sin 10) = \sin^{-1}(\sin \pi - 10) = \sin^{-1}(\sin 3\pi - 10)$ But $0 > 3\pi - 10 > -\pi/2$ i.e. $x = 3\pi - 10$ ii) $\frac{1-\cos x}{1+\cos x} = \tan^2(x/2)$, $x/2 \in (-\pi/2, \pi/2)$ $y = \tan^{-1}\left(\sqrt{\frac{1-\cos x}{1+\cos x}}\right) = \tan^{-1}\left(\lvert \tan\frac{x}{2} \rvert\right)$ $x > 0 \Rightarrow y = x/2$ and $x < 0 \Rightarrow y = -x/2$ iii)Let $\tan^{-1}x = \theta \Rightarrow x = \tan\theta$ $\theta \in (-\pi/2, \pi/2)$ $\sin\theta = \cos\theta . \tan\theta = x / \sec\theta = x / \sqrt{1 + x^2}$ iv) Let $\text{cosec}^{-1}x = \theta \Rightarrow x = \text{cosec}\,\theta \Rightarrow \sin\theta = 1/x$ $\theta \in [-\pi/2, \pi/2] - \{0\}$ $\cos\theta = \sqrt{1 - \frac{1}{x^2}} = \frac{\sqrt{x^2-1}}{\lvert x \rvert}$ v) No, $\sin^{-1}x \neq (\sin x)^{-1}$	5
3.	solution: (i) i$\triangle$ ABC $\tan A = \frac{BC}{AB}$ $\tan A = \frac{10}{20}$ $\tan A = \frac{1}{2}$ $\angle A = \tan^{-1}\frac{1}{2}$ $\angle CAB = \tan^{-1}(\frac{1}{2})$ (ii)given that $\angle DAB = 2 \times \angle CAB$ $= 2 \times \tan^{-1}(\frac{1}{2})$ Using $2\tan^{-1}x = \tan^{-1}\frac{2x}{1-x^2}$	5

<table>
<tr>
<td></td>
<td>$=\tan^{-1}\left(\frac{2\times\frac{1}{2}}{1-(\frac{1}{2})^2}\right)$
$=\tan^{-1}\left(\frac{1}{1-\frac{1}{4}}\right)$
$=\tan^{-1}\left(\frac{1}{\frac{3}{4}}\right)$
$\tan^{-1}\frac{4}{3}$
(iii)given that
$< E$AB=2×$<$CAB
$\tan^{-1}\frac{1}{2}$
Using $3\tan^{-1}x=\tan^{-1}\frac{3x-x^3}{1-3x^2}$
$=\tan^{-1}\left(\frac{3*\frac{1-(\frac{1}{2})3}{2}}{1-3*(1/2)2}\right)$
$=\tan^{-1}\frac{(3/2)-(1/8)}{1-(3/4)}$
$=\tan^{-1}\left(\frac{\frac{3*4-1}{8}}{\frac{4-3}{4}}\right)$
$=\tan^{-1}\left(\frac{\frac{11}{8}}{\frac{1}{4}}\right)=\tan^{-1}(\{11/8\}*\{4/1\})=\tan^{-1}\frac{11}{2}$
(iv)in triangle A’BC tanA’=BC/A’B
Tan A’=10/25=2/5
Angle A’=$\tan^{-1}$(2/5)
Angle C’AB=$\tan^{-1}$(2/5)
Now,we need to find the difference between angle CAB and angle CA’B
Using tan-1x-tan-1y=$\tan^{-1}\left(\frac{x-y}{1+xy}\right)$
$=\tan^{-1}\frac{(1/2)-(2/5)}{1+((1/2)*(2/5))}$
$=\tan^{-1}\left(\frac{(5-4)/(2*5)}{1+(1/5)}\right)$
$=\tan^{-1}\left(\frac{(1/10)}{(6/5)}\right)$
$=\tan^{-1}$((1/10)*(5/6))
$=\tan^{-1}$(1/12)
(iv)since x is not defined at x=($-\pi/2$) and x=($\pi/2$)
Range of $\tan^{-1}$ excludes=($-\pi/2$) and ($-\pi/2$)
Domain of $\tan^{-1}$x is real numbers</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Solution:
I) In triangle A B D
tanα= $\frac{BD}{AD}$
tanα= $\frac{30}{30\sqrt{3}}$
tanα= $\frac{1}{\sqrt{3}}$
Hence α=30° =$\frac{\pi}{6}$
Thus, sinα= sin 30°=$\frac{1}{2}$
So, sinα $=\frac{1}{2}$
α= $sin^{-1}(\frac{1}{2})$
ii) Now, α=30°=$\frac{\pi}{6}$
Thus,
Cosα =cos30° =$\sqrt{3/2}$
Hence cosα =$\sqrt{3/2}$</td>
<td>5</td>
</tr>
</table>

	Hence cosα =$\sqrt{3/2}$ α =$cos^{-1}(\sqrt{3/2})$ iii) In triangle ABD tanβ=$\frac{BD}{AD}$ tanβ=$\frac{30}{10\sqrt{3}}$ tanβ=$\frac{3}{\sqrt{3}}$ tanβ=$\sqrt{3}$ β=$\tan^{-1}(\sqrt{3}\ )$ Also, β= $60°=\frac{\pi}{3}$ Iv) since α =30° and β= 60° In triangle ABC, By angle sum property α + β +Triangle ABC =180° $30° + 60° + traingle\ ABC = 180°$ Triangle ABC =90° Triangle ABC =$\frac{\pi}{2}$ v) Since $\cos x$ is defined at x=0, and π Domen of $\cos^{-1} x$ includes -1 and 1 Range of $\cos^{-1} x$ also includes 0 and π	
5.	Answer: (i) b (ii) c (iii) d (iv) a	5
6.	Ans= (b)	5
7.	(i) $\frac{1}{2}$ (ii) $\frac{11}{21}$ (iii) $\frac{1}{8}$ (iv) $\left(\frac{-\pi}{2}, 2\right)$	5
8.	(i) $\frac{1}{2}$ (ii) $\frac{\sqrt{3}}{2}$ (iii) $\frac{\pi}{2}$ (iv) $[-1,1],[0,\pi]$	5
9.	(1)Let, $\csc^{-1}(-1) = y$ Then, $-1 = \csc y$ Since principal value branch of $\csc^{-1} x$ is $\left[-\frac{\pi}{2},\frac{\pi}{2}\right] - \{0\}$ And $\csc\left(-\frac{\pi}{2}\right) = -1$ and $-\frac{\pi}{2} \epsilon \left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ So, principal value of $\csc^{-1}(-1) = -\frac{\pi}{2}$ (2)Let $\sec^{-1}(-2) = y$ Since principal value branch of $\sec^{-1} x = [0,\pi] - \left\{\frac{\pi}{2}\right\}$ And $\sec\frac{2\pi}{3} = -2$ and $\frac{2\pi}{3} \in [0,\pi]$ So, principal value of $\sec^{-1}(-2) = \frac{2\pi}{3}$ (3)$\tan^{-1}\left(\frac{x+1}{x-1}\right) + \tan^{-1}\left(\frac{x-1}{x}\right) = \tan^{-1}(-7)$	5

	Or $\tan^{-1}\left(\frac{\frac{x+1}{x-1}+\frac{x-1}{x}}{1-\frac{x^2-1}{x(x-1)}}\right)=\tan^{-1}(-7)$ Or $\frac{x(x+1)+(x-1)^2}{x(x-1)-(x^2-1)}=-7$ Or $2x^2-8x+8=0$ Or $x=2$	
10.	$\cos^{-1}\frac{x}{a}+\cos^{-1}\frac{y}{b}=\alpha,$ $\Rightarrow\ \cos^{-1}\left(\frac{xy}{ab}-\sqrt{1-\left(\frac{x}{a}\right)^2}\sqrt{1-\left(\frac{y}{b}\right)^2}\right)=\alpha$ $\Rightarrow \frac{xy}{ab}-\sqrt{1-\left(\frac{x}{a}\right)^2}\sqrt{1-\left(\frac{y}{b}\right)^2}=cos\alpha$ $\Rightarrow\ \frac{x^2}{a^2}-\frac{2xy}{ab}\cos\alpha+\frac{y^2}{b^2}=sin^2\alpha.$	5
11.	L.H.S = $\tan\left(\frac{\pi}{4}+\frac{1}{2}\cos^{-1}\frac{a}{b}\right)+\tan\left(\frac{\pi}{4}-\frac{1}{2}\cos^{-1}\frac{a}{b}\right)$ $=\tan\left(\frac{\pi}{4}+x\right)+\tan\left(\frac{\pi}{4}-x\right)$ Where $\frac{1}{2}\cos^{-1}\frac{a}{b}=x$ $=\frac{1+tanx}{1-tanx}+\frac{1-tanx}{1+tanx}$ $=\frac{2(1+tan^2x)}{1-tan^2x}$ $=\frac{2}{cos2x}$ $=\frac{2}{cos2\left(\frac{1}{2}\cos^{-1}\frac{a}{b}\right)}$ $=\frac{2}{cos\left(\cos^{-1}\frac{a}{b}\right)}$ $=\frac{2b}{a}$	5
12.	LHS = $\tan^{-1}\left(\frac{\cos x}{1+\sin x}\right)$ $=\tan^{-1}\left(\frac{\sin\left(\frac{\pi}{2}-x\right)}{1+\cos\left(\frac{\pi}{2}-x\right)}\right)=\tan^{-1}\left(\frac{2\sin\left(\frac{\pi}{4}-\frac{x}{2}\right)\cos\left(\frac{\pi}{4}-\frac{x}{2}\right)}{2\cos^2\left(\frac{\pi}{4}-\frac{x}{2}\right)}\right)=\tan^{-1}\left(\frac{\sin\left(\frac{\pi}{4}-\frac{x}{2}\right)}{\cos\left(\frac{\pi}{4}-\frac{x}{3}\right)}\right)$ $=\tan^{-1}\left(\tan\left(\frac{\pi}{4}-\frac{x}{2}\right)\right)=\frac{\pi}{4}-\frac{x}{2}=RHS$	

13.	LHS = $\tan^{-1}\left(\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}\right) = \tan^{-1}\left(\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}} \text{ x } \frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}-\sqrt{1-x}}\right)$ $= \tan^{-1}\left(\frac{2-2\sqrt{1-x^2}}{1+x-1+x}\right) = \tan^{-1}\left(\frac{1-\sqrt{1-x^2}}{x}\right)$ Putting $x = \sin y \Rightarrow y = \sin^{-1}x$ $= \tan^{-1}\left(\frac{1-\cos y}{\sin y}\right) = \tan^{-1}\left(\frac{2\sin^2\frac{y}{2}}{2\sin\frac{y}{2}.\cos\frac{y}{2}}\right) = \tan^{-1}\left(\tan\frac{y}{2}\right) = \frac{y}{2} = \frac{1}{2}\sin^{-1}x$ $= \frac{1}{2}\left(\frac{\pi}{2}-\cos^{-1}x\right) = \frac{\pi}{4}-\frac{1}{2}\cos^{-1}x = RHS$	
14.	(i) the value of sin B = $\frac{1}{\sqrt{5}}$ (ii) the value of cos C= $\frac{3}{\sqrt{10}}$ (iii) the value of B + C= $\frac{\pi}{4}$ (iv) the value of cos (B+C)= $\frac{1}{\sqrt{2}}$ (v) $\tan^{-1} A + \tan^{-1} B = \tan^{-1}\left(\frac{A+B}{1-AB}\right)$	5
15.	(i) $\propto = \sin^{-1}\frac{1}{2}$ (ii) $\propto = \cos^{-1}\frac{\sqrt{3}}{2}$ (iii) $\beta = \tan^{-1}\sqrt{3}$ (iv) domain and range of $\cos^{-1}x$ = [-1,1] and [0, π] (v) $m\angle ABC = \frac{\pi}{2}$	5
16.	Put x = $\cos 2\theta$ $\tan^{-1}[\frac{\sqrt{1+\cos 2\theta}-\sqrt{1-\cos 2\theta}}{\sqrt{1+\cos 2\theta}+\sqrt{1-\cos 2\theta}}] = \frac{\pi}{4} - \frac{1}{2}\cos^{-1}x$ $\tan^{-1}[\frac{\sqrt{2cos^2\theta}-\sqrt{2sin^2\theta}}{\sqrt{2cos^2\theta}+\sqrt{2sin^2\theta}}]$ $\tan^{-1}[\frac{cos\theta-sin\theta}{cos\theta+sin\theta}]$ $\tan^{-1}[\frac{1-tan\theta}{1+tan\theta}]$ $\tan^{-1}[\tan(\frac{\pi}{4}-\theta)]$ $\frac{\pi}{4} - \theta$	5

	$\frac{\pi}{4} - \frac{1}{2}\cos^{-1}x$	
17.	$(\sin^{-1}x)^2 + (\cos^{-1}x)^2$ $(\sin^{-1}x + \cos^{-1}x)^2 - 2\sin^{-1}x\cos^{-1}x$ $\frac{\pi^2}{4} - 2\sin^{-1}x\,(\frac{\pi}{2} - \sin^{-1}x)$ $\frac{\pi^2}{4} - \pi\sin^{-1}x + 2(\sin^{-1}x)^2$ $2[(\sin^{-1}x - \frac{\pi}{4})^2 + \frac{\pi^2}{16}]$ Now, $-\frac{\pi}{2} \leq \sin^{-1}x \leq \frac{\pi}{2}$ $-\frac{3\pi}{4} \leq \sin^{-1}x - \frac{\pi}{4} \leq \frac{\pi}{4}$ $0 \leq (\sin^{-1}x - \frac{\pi}{4})^2 \leq \frac{9\pi^2}{16}$ $\frac{\pi^2}{16} \leq (\sin^{-1}x - \frac{\pi}{4})^2 + \frac{\pi^2}{16} \leq \frac{5\pi^2}{8}$ $\frac{\pi^2}{8} \leq 2(\sin^{-1}x - \frac{\pi}{4})^2 + \frac{\pi^2}{16} \leq \frac{5\pi^2}{4}$ Greatest value = $\frac{5\pi^2}{4}$ Least value = $\frac{\pi^2}{8}$	5

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- Click to Join SOE ICSE Class 3 Group
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- Click to Join SOE ICSE Class 5 Group
- Click to Join SOE ICSE Class 6 Group
- Click to Join SOE ICSE Class 7 Group
- Click to Join SOE ICSE Class 8 Group
- Click to Join SOE ICSE Class 9 Group
- Click to Join SOE ICSE Class 10 Group
- Click to Join SOE ICSE Class 11 (Science) Group
- Click to Join SOE ICSE Class 11 (Commerce) Group
- Click to Join SOE ICSE Class 11 (Humanities) Group
- Click to Join SOE ICSE Class 12 (Science) Group
- Click to Join SOE ICSE Class 12(Commerce) Group
- Click to Join SOE ICSE Class 12 (Humanities) Group
- Click to Join SOE JEE/NEET Group
- Click to Join SOE CUET Group
- Click to Join SOE NDA, OLYMPIAD, NTSE Group
- Click to Join SOE School Principal Professional Development Group
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- Click to Join Nageen CBSE Class 12 (Commerce) Channel
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