REVISION NOTES

Chapter 1: Relations and Functions

REFLEXIVE, SYMMETRIC, TRANSITIVE AND EQUIVALENCE RELATIONS

A relation in set A is a subset of $A \times A$. We also write it as $R = \{(a, b) \in A \times A \mid aRb\}$.
For relation R in set A, R^{-1} is inverse relation if $aR^{-1}b \Rightarrow bRa$.

Relation R on set A is a subset of $A \times A$, i.e. $R : A \rightarrow A$.

A relation R on set A is said to be an empty relation or a void relation if no element of set A is related to any element of set A, i.e. $R = \phi$.

A relation R on set A is called a universal relation if each element of A is related to every element of A, i.e. $R = A \times A$.

A relation R on set A is called an identity relation if each element of A is related to itself only. i.e. aRa, $\forall a \in A$, we write $R = I_A$

Reflexive Relation:
A relation R in a set A is said to be reflexive, if $(a, a) \in R$, for every $a \in A$ or we say aRa, for every $a \in A$.
Note: An identity relation is reflexive relation but reflexive relation may or may not be identity relation.

Symmetric Relation:
A relation R in a set A is said to be symmetric, if $(a, b) \in R \Rightarrow (b, a) \in R$, for all $a, b \in A$. We can also say $aRb \Rightarrow bRa$, for every $a, b \in A$.

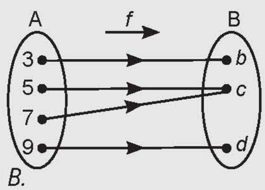
Transitive Relation:
A relation R in a set A is said to be transitive, if $(a, b) \in R$ and $(b, c) \in R \Rightarrow (a, c) \in R$, for every $a, b, c \in A$.
We can also say
$aRb, bRc \Rightarrow aRc$, for all $a, b, c \in A$.

Equivalence Relation:
A relation R in a set A is said to be an equivalence relation if relation R is reflexive, symmetric and transitive.

ONE-ONE (INJECTIVE) FUNCTION, ONTO (SURJECTIVE) FUNCTION, ONE-ONE AND ONTO (BIJECTIVE) FUNCTION

One-one (injective) function:
A function $f : A \rightarrow B$ is said to be one-one (or injective), if the images of distinct elements of A under the rule f are distinct in B, i.e. for every $a, b \in A$, $a \neq b$
$\Rightarrow f(a) \neq f(b)$
or we can also say that $f(a) = f(b) \Rightarrow a = b$.

Onto (surjective) function:
A function $f : A \rightarrow B$ is said to be onto (or surjective), if every element of B is the image of some element of A under the rule f, i.e. for every $b \in B$, there exists an element $a \in A$ such that $f(a) = b$.
Note: A function is onto if and only if range of $f = B$.



One-one and onto (bijective) function: A function $f : A \rightarrow B$ is said to be one-one and onto (or bijective) if f is both one-one and onto.

Chapter 2: Inverse Trigonometric Functions

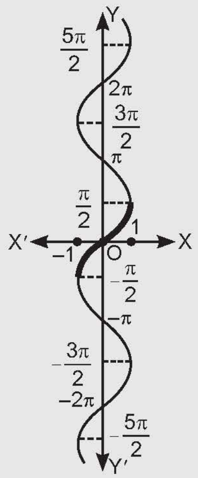
1. Table for domain and range of Inverse Trigonometric Functions:

FUNCTIONS	DOMAIN	RANGE (PRINCIPAL VALUE BRANCH)
(*i*) $y = \sin^{-1} x$	$-1 \le x \le 1$	$-\frac{\pi}{2} \le y \le \frac{\pi}{2}$
(*ii*) $y = \cos^{-1} x$	$-1 \le x \le 1$	$0 \le y \le \pi$

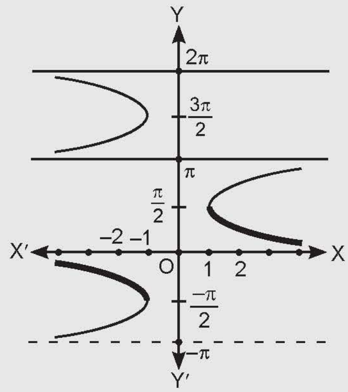
(*iii*) $y = \tan^{-1} x$	$-\infty < x < \infty$	$-\frac{\pi}{2} < y < \frac{\pi}{2}$
(*iv*) $y = \text{cosec}^{-1} x$	$x \geq 1$ or $x \leq -1$	$-\frac{\pi}{2} \leq y \leq \frac{\pi}{2}, y \neq 0$
(*v*) $y = \sec^{-1} x$	$x \geq 1$ or $x \leq -1$	$0 \leq y \leq \pi, y \neq \frac{\pi}{2}$
(*vi*) $y = \cot^{-1} x$	$-\infty < x < \infty$	$0 < y < \pi$

2. Graphs of Inverse Trigonometric functions:

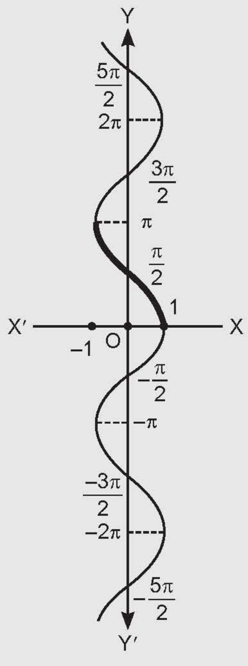
Graph of $y = \sin^{-1} x$.



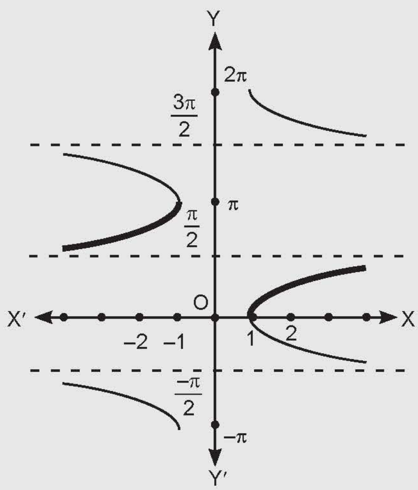
Graph of $y = \text{cosec}^{-1} x$.

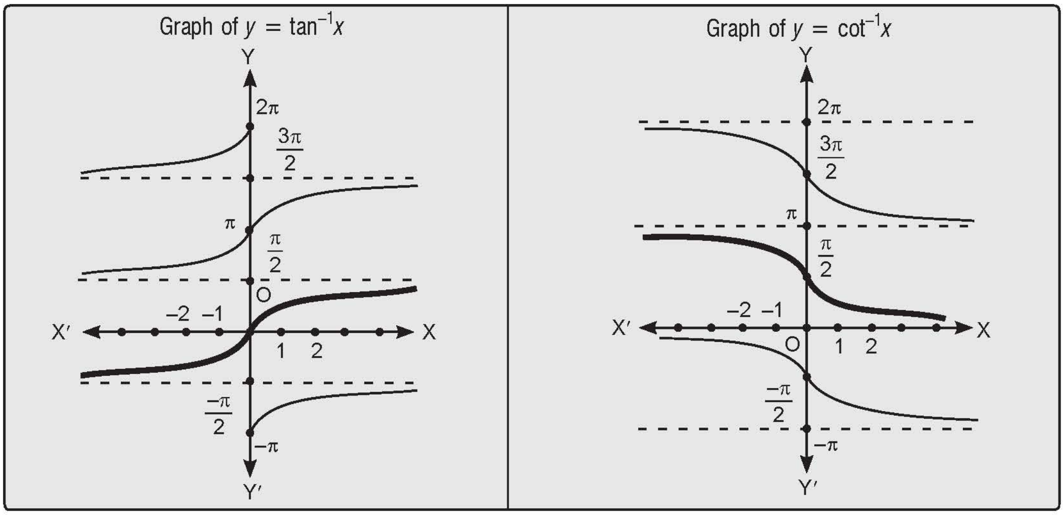


Graph of $y = \cos^{-1} x$



Graph of $y = \sec^{-1} x$





PROPERTIES OF INVERSE TRIGONOMETRIC FUNCTIONS

PROPERTIES OF INVERSE TRIGONOMETRIC FUNCTIONS

- $\sin^{-1}(\sin x) = x;\ x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$
- $\sin(\sin^{-1}x) = x;\ x \in [-1, 1]$
- $\cos^{-1}(\cos x) = x;\ x \in [0, \pi]$
- $\cos(\cos^{-1}x) = x;\ x \in [-1, 1]$
- $\tan^{-1}(\tan x) = x;\ x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$
- $\tan(\tan^{-1}x) = x;\ x \in (-\infty, \infty)$
- $\text{cosec}^{-1}(\text{cosec}\,x) = x;\ x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right] - \{0\}$
- $\text{cosec}(\text{cosec}^{-1}x) = x;\ x \in R - [-1, 1]$
- $\sec^{-1}(\sec x) = x;\ x \in [0, \pi] - \left\{\frac{\pi}{2}\right\}$
- $\sec(\sec^{-1}x) = x;\ x \in R - (-1, 1)$
- $\cot^{-1}(\cot x) = x;\ x \in (0, \pi)$
- $\cot(\cot^{-1}x) = x;\ x \in (-\infty, \infty)$

Chapter 3: Matrices

TYPES OF MATRICES

Row matrix: A matrix having only one row is called a row matrix,

Column matrix: A matrix having only one column is called a column matrix,

Zero matrix or a Null matrix: A matrix whose all the elements are zero is known as a zero matrix. It is denoted by *O*.

Square matrix: A matrix having equal number of rows and columns is a square matrix.

Diagonal matrix: A square matrix whose all the non diagonal elements are zeroes is called a diagonal matrix.

Scalar matrix: A diagonal matrix whose all the elements are equal to a scalar, is a scalar matrix.

An ***Identity matrix*** or a ***Unit matrix*** is denoted by *I*. It is a square matrix whose all non-diagonal elements are zero and diagonal elements are 1 each.