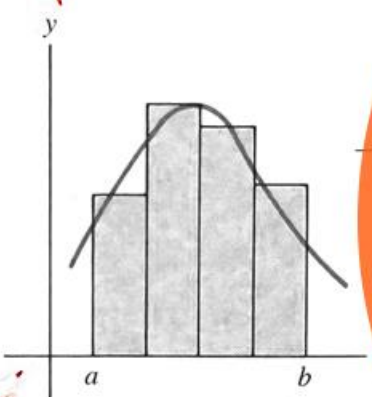
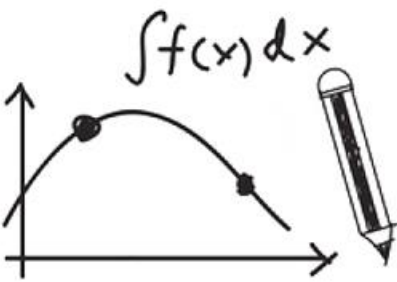


Calculus(I)

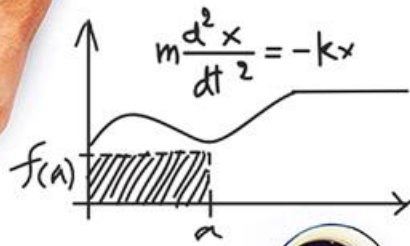
$$x^2 - 3x - 4 = 0$$

$$4x^2 - 3x - 1 = 0$$



$$\frac{d}{dx} \left[\frac{f(x)}{g(x)} \right] = \frac{g(x)f'(x) - f(x)g'(x)}{g(x)^2}$$

$$F = mg = ma = m \frac{d^2h}{dt^2}$$



Gottfried Wilhelm Leibniz

$$\frac{dA}{dt} = \frac{dB}{dt} = -\frac{dC}{dt} = \frac{dD}{dt} = (c_1)T^{\frac{1}{2}}AB - (c_2)T^{\frac{1}{2}}CD$$

$$m \frac{d^2x}{dt^2} = -kx - f \frac{dx}{dt} + A \sin(\omega t)$$

$$y' = \text{and } v' = -ky - fv + A \sin(\omega t)$$

$$m \frac{d^2x}{dt^2} = -kx$$

$$x = A \frac{dT}{dt} - (c_1)(T - T)$$

$$\frac{df(x)}{dx}$$

$$\frac{b^2 - 4ac}{4a^2}$$

$$x + \frac{b}{2a} = \frac{\sqrt{b^2 - 4ac}}{2a}$$

$$x + \frac{b}{2a} = -\frac{\sqrt{b^2 - 4ac}}{2a}$$

$$cx + h, f(x) + i$$



Limits Involving Trigonometric Functions

Lecturer: Xue Deng

Inverse function

Def

Let function $y = f(x)$, $x \in D$, satisfying
 $\forall y \in f(D), \exists x \in D, s.t.$



$x = \varphi(y)$ is called the **inverse function** of $y = f(x)$.

Denoted as

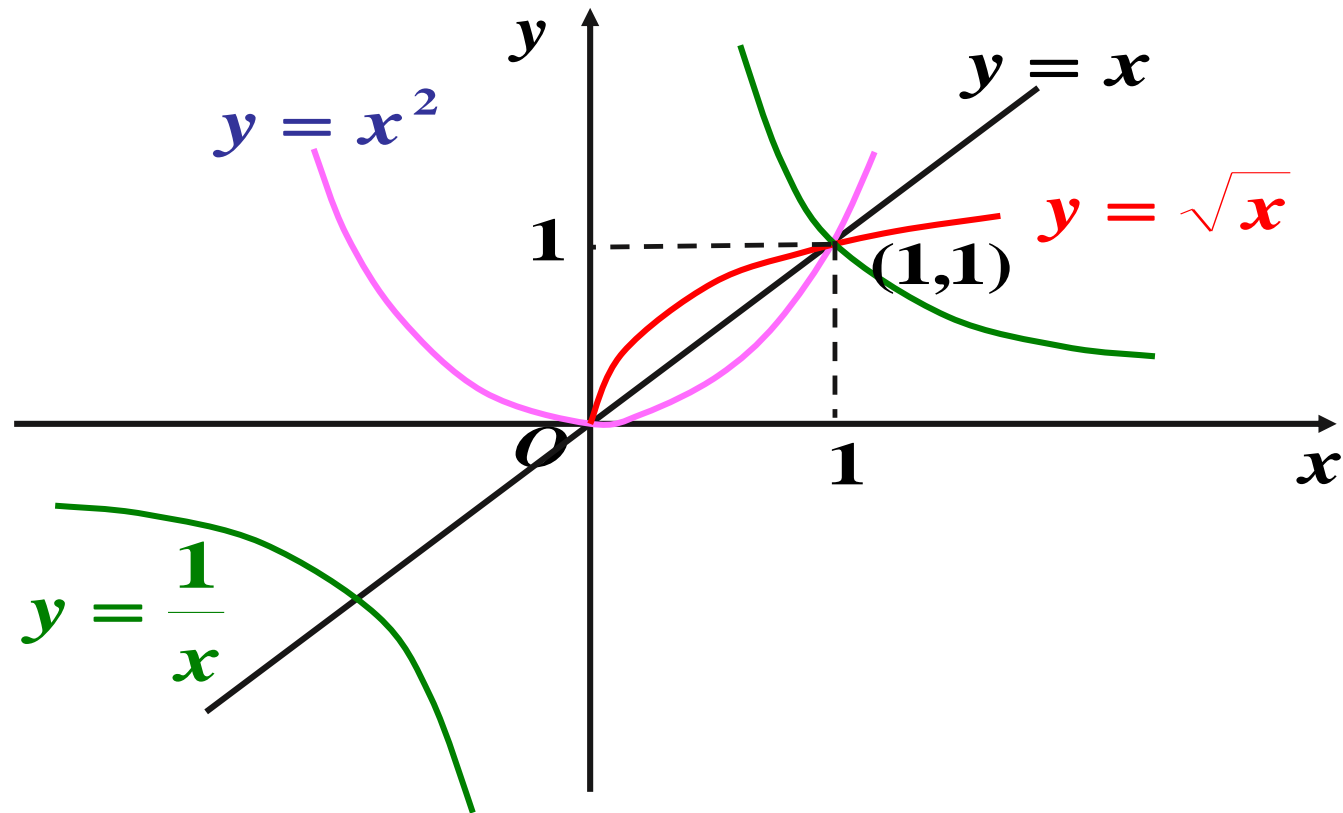
$$\varphi = f^{-1}: f(D) \rightarrow D, y \mapsto x,$$

OR

$$x = \varphi(y) = f^{-1}(y), y \in f(D),$$

Preliminaries: Basic elementary function

(1) Power function $y = x^\mu$ (μ is constant)

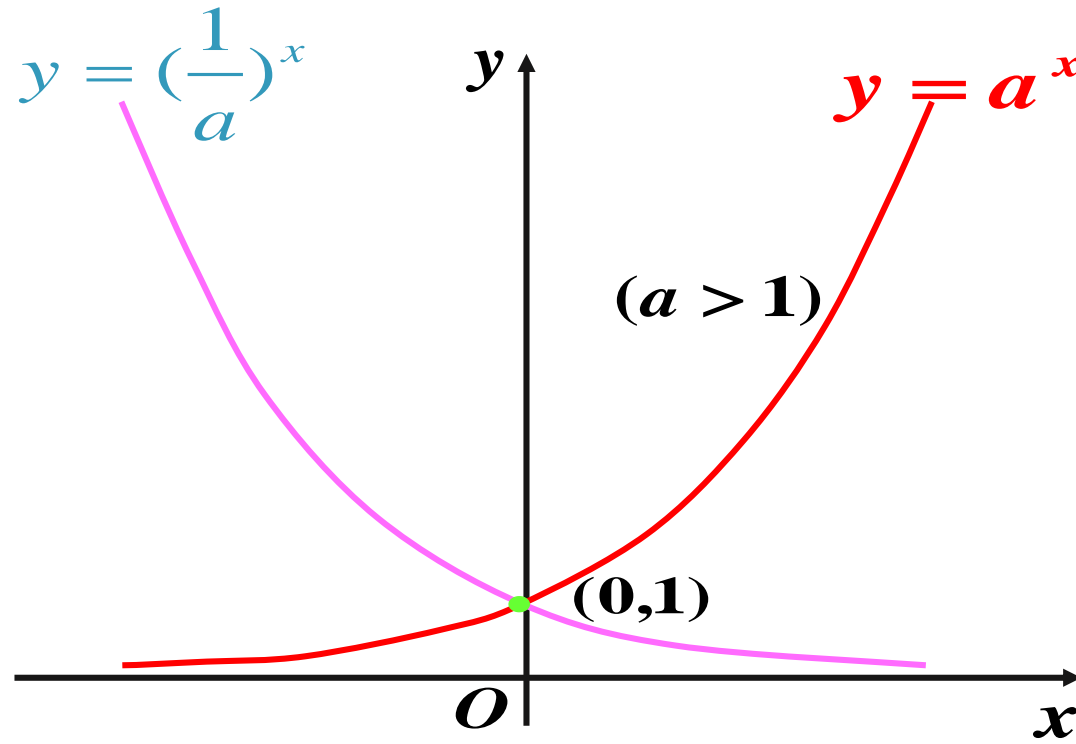


Preliminaries

(2) Exponential function

$$y = a^x \quad (a > 0, a \neq 1)$$

$$y = e^x$$



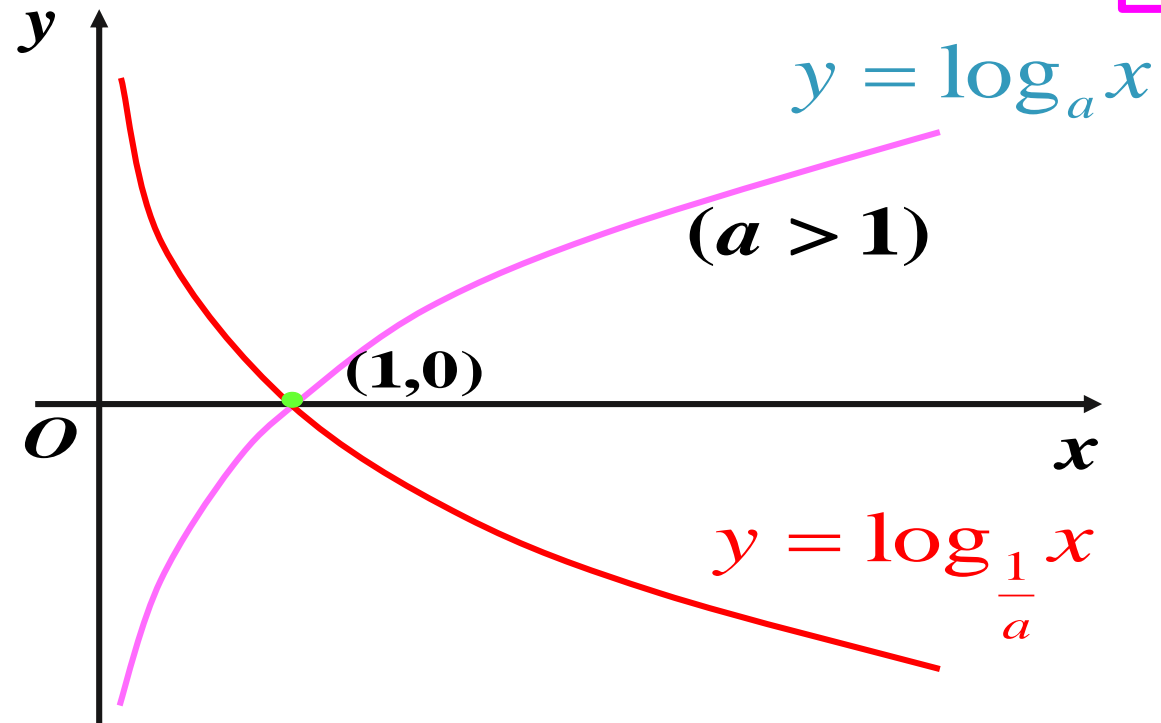
Domain is: $(-\infty, +\infty)$, Range is: $(0, +\infty)$.

Preliminaries

(3) Logarithm function

$$y = \log_a x \quad (a > 0, a \neq 1)$$

$$y = \ln x$$

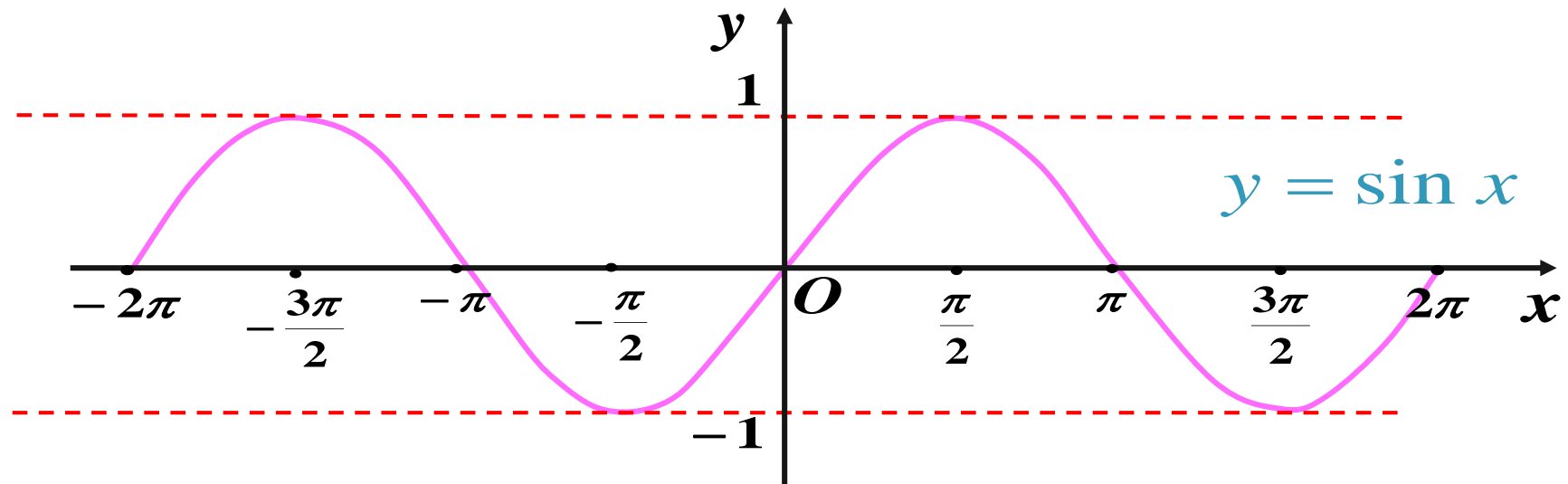


Domain is: $(0, +\infty)$, Range is: $(-\infty, +\infty)$.

Preliminaries

(4) Trigonometric function

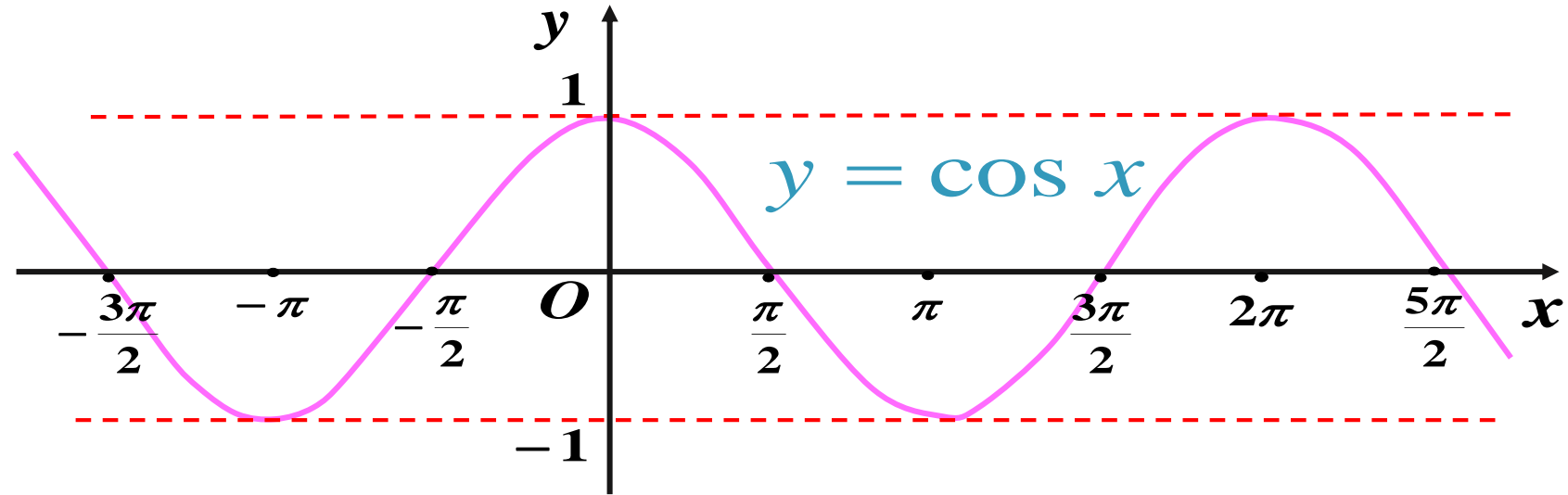
$$y = \sin x$$



Domain is: $(-\infty, +\infty)$, Range is: $[-1, 1]$.

Preliminaries

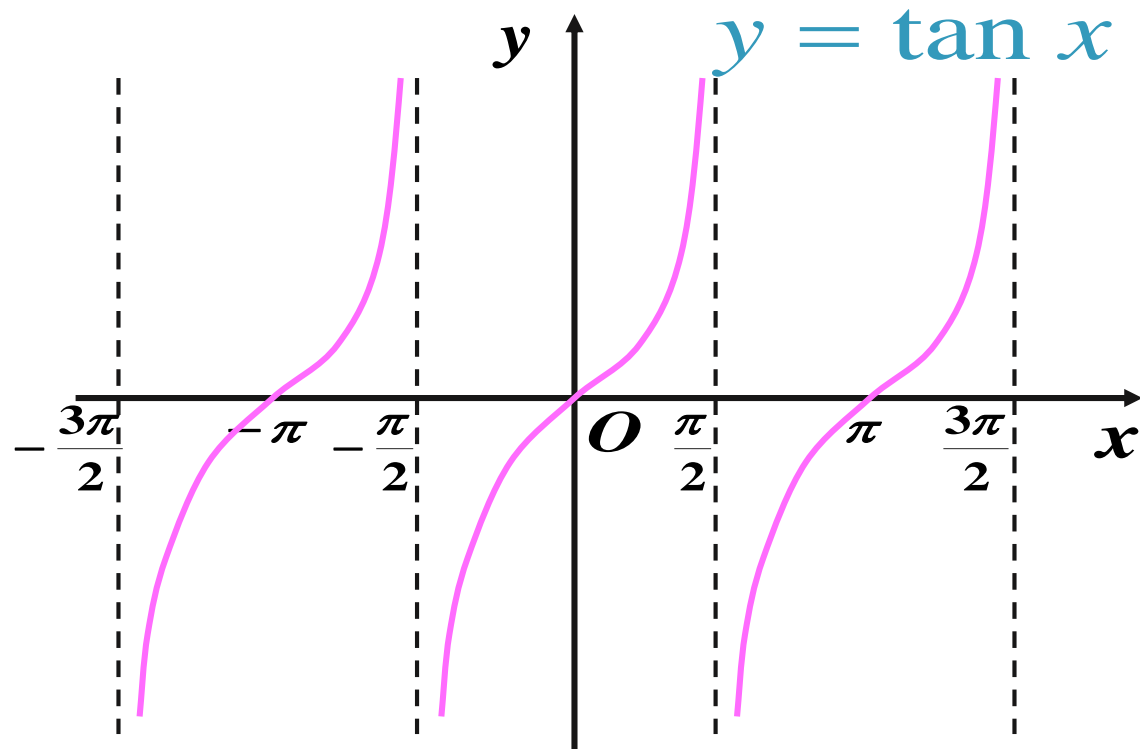
$$y = \cos x$$



Domain is: $(-\infty, +\infty)$, Range is: $[-1, 1]$.

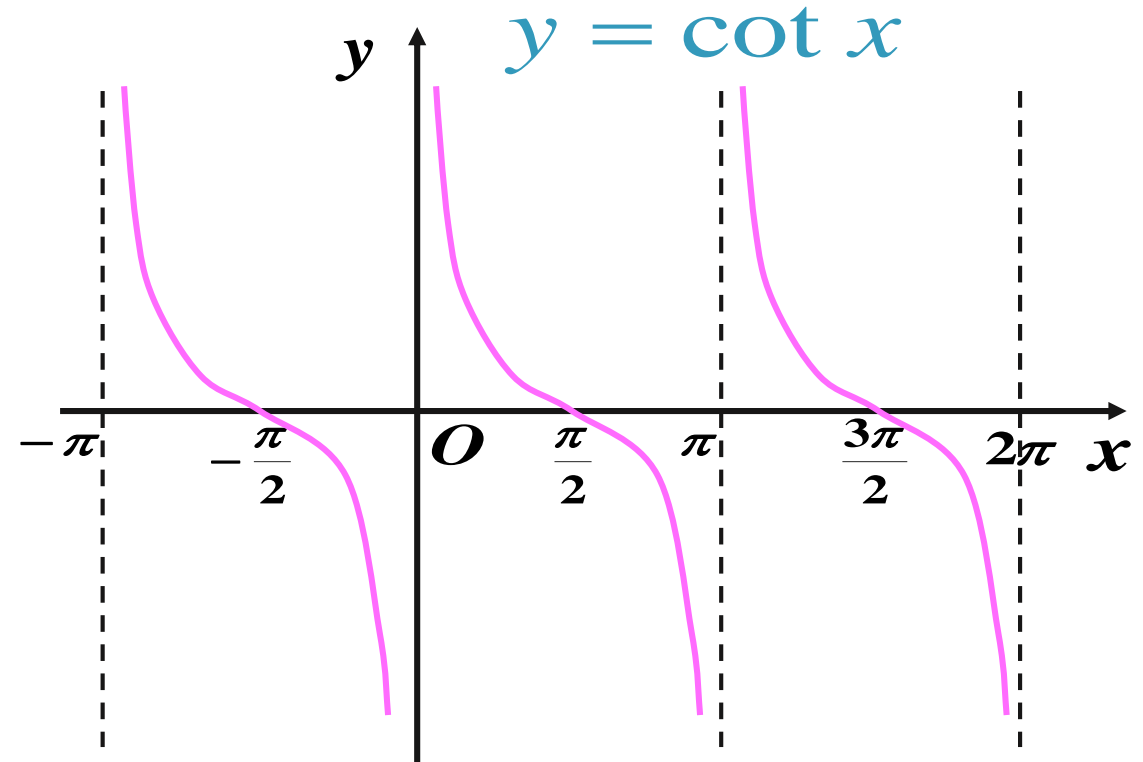
Preliminaries

$$y = \tan x$$



VS

$$y = \cot x$$



Domain is: $x \neq (2n + 1)\frac{\pi}{2}, n \in \mathbb{Z}$

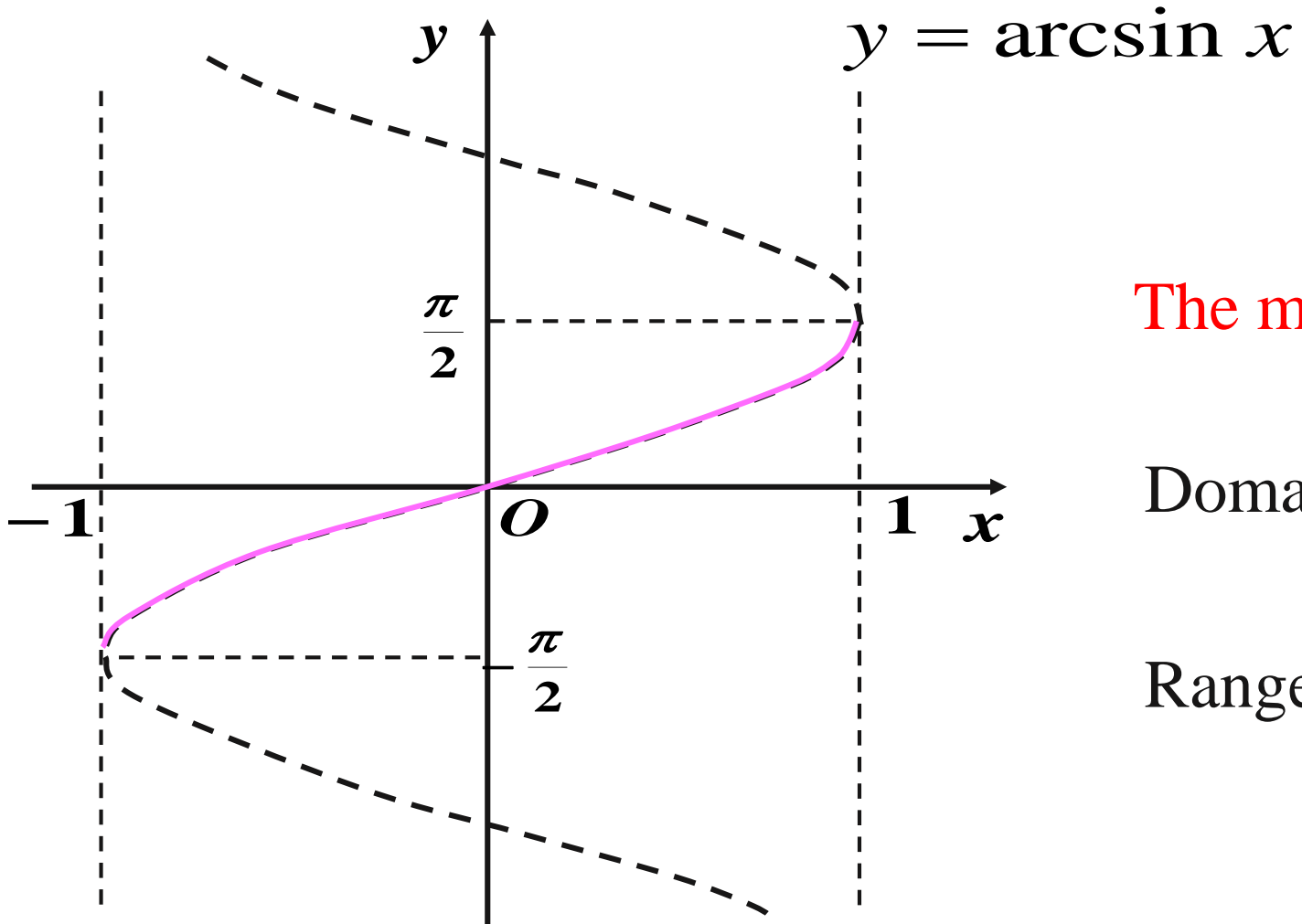
Range is: $(-\infty, +\infty)$.

Domain is: $x \neq n\pi, n \in \mathbb{Z}$

Range is: $(-\infty, +\infty)$.

Preliminaries

(5) Inverse trigonometric function



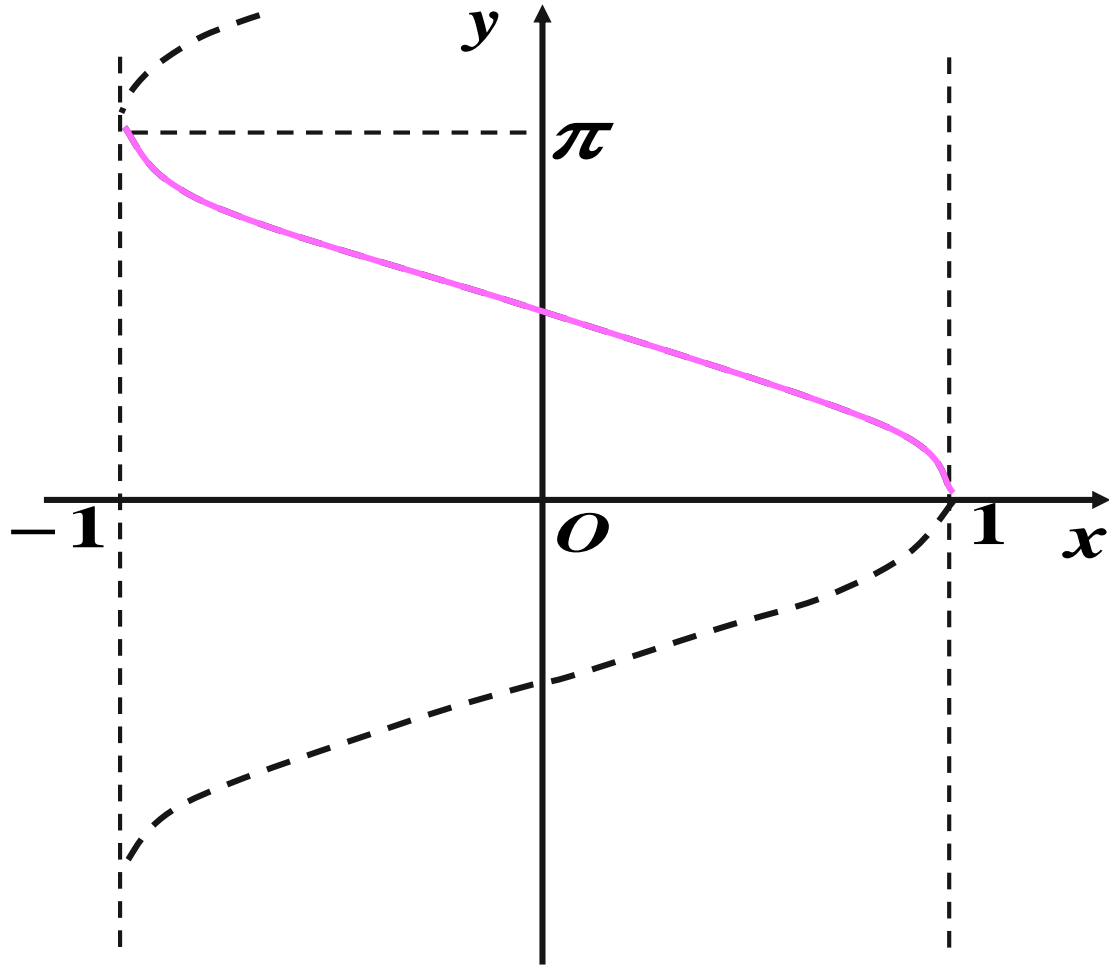
The main value: $y = \arcsin x$

Domain is: $[-1, 1]$,

Range is: $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$.

Preliminaries

$$y = \arccos x$$



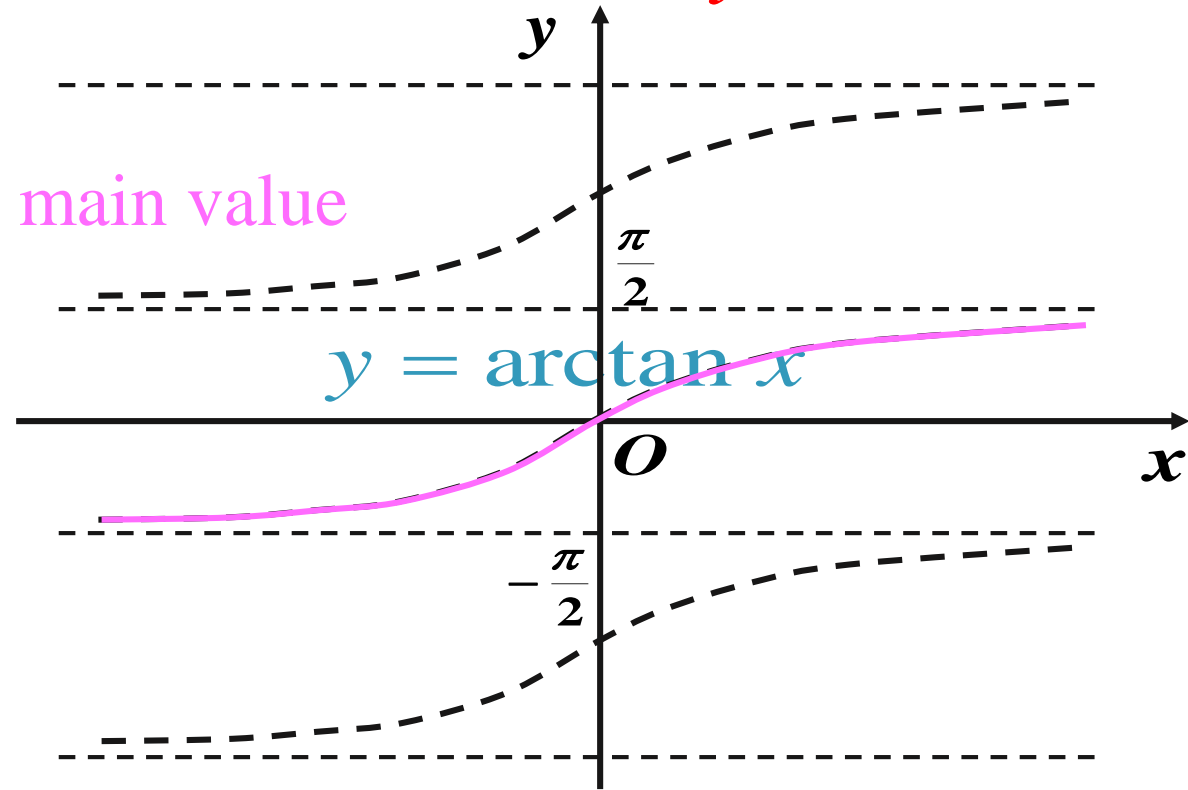
The main value: $y = \arccos x$

Domain is: $[-1, 1]$,

Range is: $[0, \pi]$.

Preliminaries

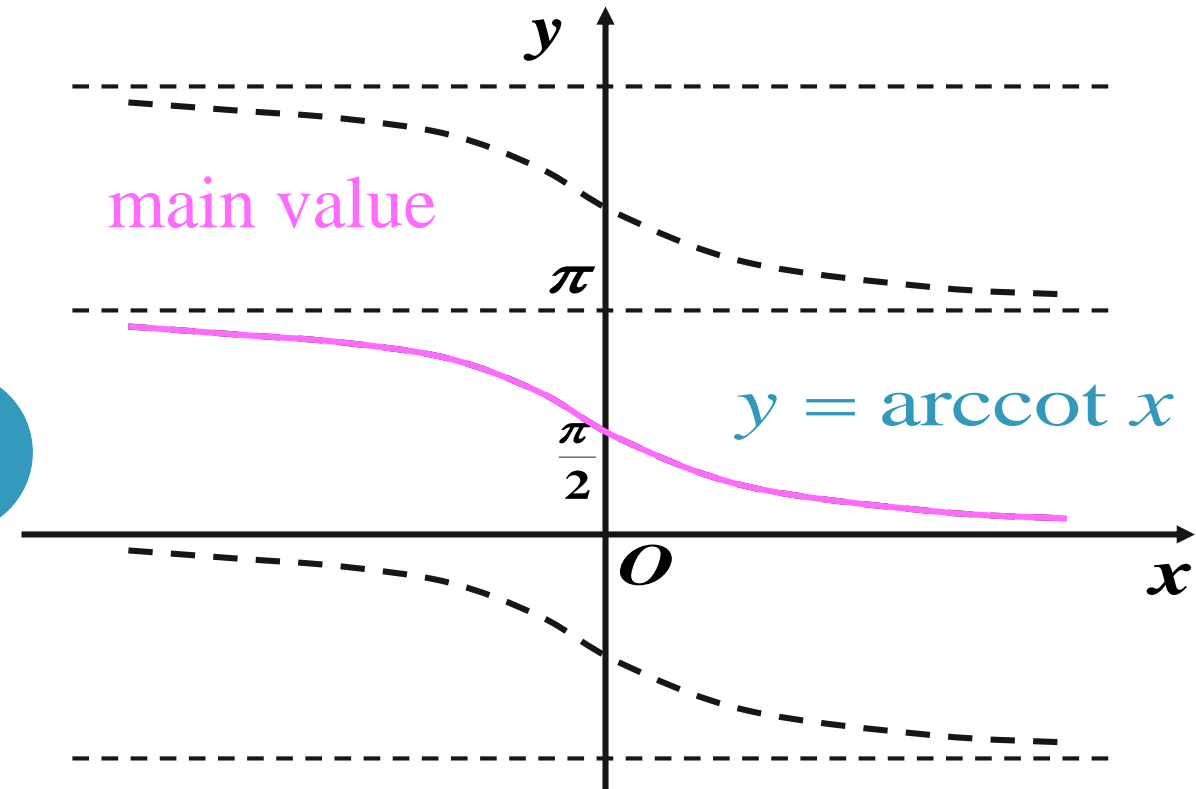
$$y = \arctan x$$



$$\text{Domain: } (-\infty, +\infty), \text{ Range: } \left(-\frac{\pi}{2}, \frac{\pi}{2}\right).$$

VS

$$y = \operatorname{arccot} x$$



$$\text{Domain: } (-\infty, +\infty), \text{ Range: } (0, \pi).$$

Power function、 Exponential function、 Logarithm function、 Trigonometric function and Inverse trigonometric function are called basic elementary function.

Limits Involving Trigonometric Functions

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