

Trigonometry

Reciprocal Identities

$$\sin \theta = \frac{1}{\csc \theta} \quad \csc \theta = \frac{1}{\sin \theta}$$

$$\cos \theta = \frac{1}{\sec \theta} \quad \sec \theta = \frac{1}{\cos \theta}$$

$$\tan \theta = \frac{1}{\cot \theta} \quad \cot \theta = \frac{1}{\tan \theta}$$

Quotient Identities

$$\frac{\sin \theta}{\cos \theta} = \tan \theta$$

$$\frac{\cos \theta}{\sin \theta} = \cot \theta$$

Pythagorean Identities

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\tan^2 \theta + 1 = \sec^2 \theta$$

$$1 + \cot^2 \theta = \csc^2 \theta$$

Cofunction Identities

$$\sin \theta = \cos(90^\circ - \theta) \quad \cos \theta = \sin(90^\circ - \theta)$$

$$\tan \theta = \cot(90^\circ - \theta) \quad \cot \theta = \tan(90^\circ - \theta)$$

$$\sec \theta = \csc(90^\circ - \theta) \quad \csc \theta = \sec(90^\circ - \theta)$$

Opposite Angle Identities

$$\sin(-\theta) = -\sin \theta$$

$$\cos(-\theta) = \cos \theta$$

$$\tan(-\theta) = -\tan \theta$$

Sum and Difference Identities

$$\sin(\alpha \pm \beta) = \sin \alpha \cos \beta \pm \cos \alpha \sin \beta$$

$$\cos(\alpha \pm \beta) = \cos \alpha \cos \beta \mp \sin \alpha \sin \beta$$

$$\tan(\alpha \pm \beta) = \frac{\tan \alpha \pm \tan \beta}{1 \mp \tan \alpha \tan \beta}$$

Double-Angle Identities

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

$$\cos 2\theta = \cos^2 \theta - \sin^2 \theta$$

$$\cos 2\theta = 2 \cos^2 \theta - 1$$

$$\cos 2\theta = 1 - 2 \sin^2 \theta$$

$$\tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$$

Half-Angle Identities

$$\sin \frac{\alpha}{2} = \pm \sqrt{\frac{1 - \cos \alpha}{2}}$$

$$\cos \frac{\alpha}{2} = \pm \sqrt{\frac{1 + \cos \alpha}{2}}$$

$$\tan \frac{\alpha}{2} = \pm \sqrt{\frac{1 - \cos \alpha}{1 + \cos \alpha}}$$

Product-Sum Identities

$$\sin \alpha \cos \beta = \frac{1}{2} [\sin(\alpha + \beta) + \sin(\alpha - \beta)]$$

$$\cos \alpha \sin \beta = \frac{1}{2} [\sin(\alpha + \beta) - \sin(\alpha - \beta)]$$

$$\sin \alpha \sin \beta = \frac{1}{2} [\cos(\alpha - \beta) - \cos(\alpha + \beta)]$$

$$\cos \alpha \cos \beta = \frac{1}{2} [\cos(\alpha + \beta) + \cos(\alpha - \beta)]$$

Parent Functions

Parent Function	Graph	Parent Function	Graph
$y = x$ Linear, Odd Domain: $(-\infty, \infty)$ Range: $(-\infty, \infty)$ End Behavior: $x \rightarrow -\infty, y \rightarrow -\infty$ $x \rightarrow \infty, y \rightarrow \infty$		$y = x $ Absolute Value, Even Domain: $(-\infty, \infty)$ Range: $[0, \infty)$ End Behavior: $x \rightarrow -\infty, y \rightarrow \infty$ $x \rightarrow \infty, y \rightarrow \infty$	
$y = x^2$ Quadratic, Even Domain: $(-\infty, \infty)$ Range: $[0, \infty)$ End Behavior: $x \rightarrow -\infty, y \rightarrow \infty$ $x \rightarrow \infty, y \rightarrow \infty$		$y = \sqrt{x}$ Radical, Neither Domain: $[0, \infty)$ Range: $[0, \infty)$ End Behavior: $x \rightarrow 0, y \rightarrow 0$ $x \rightarrow \infty, y \rightarrow \infty$	
$y = x^3$ Cubic, Odd Domain: $(-\infty, \infty)$ Range: $(-\infty, \infty)$ End Behavior: $x \rightarrow -\infty, y \rightarrow -\infty$ $x \rightarrow \infty, y \rightarrow \infty$		$y = \sqrt[3]{x}$ Cube Root, Odd Domain: $(-\infty, \infty)$ Range: $(-\infty, \infty)$ End Behavior: $x \rightarrow -\infty, y \rightarrow -\infty$ $x \rightarrow \infty, y \rightarrow \infty$	
$y = b^x, b > 1$ Exponential, Neither Domain: $(-\infty, \infty)$ Range: $(0, \infty)$ End Behavior: $x \rightarrow -\infty, y \rightarrow 0$ $x \rightarrow \infty, y \rightarrow \infty$		$y = \log_b(x), b > 1$ Log, Neither Domain: $(0, \infty)$ Range: $(-\infty, \infty)$ End Behavior: $x \rightarrow 0^+, y \rightarrow -\infty$ $x \rightarrow \infty, y \rightarrow \infty$	
$y = \frac{1}{x}$ Rational (Inverse), Odd Domain: $(-\infty, 0) \cup (0, \infty)$ Range: $(-\infty, 0) \cup (0, \infty)$ End Behavior: $x \rightarrow 0, y \rightarrow \pm \infty$ $x \rightarrow \pm \infty, y \rightarrow 0$		$y = \frac{1}{x^2}$ Rational (Inverse Squared), Even Domain: $(-\infty, 0) \cup (0, \infty)$ Range: $(0, \infty)$ End Behavior: $x \rightarrow 0, y \rightarrow \infty$ $x \rightarrow \pm \infty, y \rightarrow 0$	
$y = \lfloor x \rfloor$ Greatest Integer, Neither Domain: $(-\infty, \infty)$ Range: $\{y y \in \mathbb{Z}\}$ End Behavior: $x \rightarrow -\infty, y \rightarrow -\infty$ $x \rightarrow \infty, y \rightarrow \infty$		$y = \lceil x \rceil$ Least Integer, Neither Domain: $(-\infty, \infty)$ Range: $\{y y \in \mathbb{Z}\}$ End Behavior: $x \rightarrow -\infty, y \rightarrow -\infty$ $x \rightarrow \infty, y \rightarrow \infty$	

Exponentials and logarithms

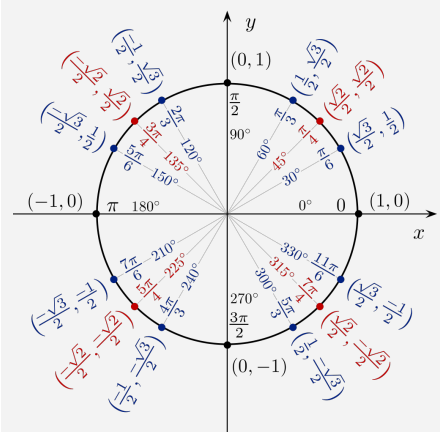
Logarithmic

$$y = \ln x$$

Exponential

$$y = b^x$$

Unit Circle



Interval Notation

Interval notation

$$D: [1, +\infty)$$

Set Notation

$$D: \{x | x \geq 1\}$$

All quadratic functions (e.g. $y = x^2$) have their domain defined as:

$$D: [-\infty, +\infty)$$

$$D: \{x | x \text{ all Real numbers}\}$$

A quadratic function that opens downward with the vertex at (0,3):

$$R: [-\infty, 3]$$

$$R: \{y | y \leq 3\}$$

For a quadratic function that opens upward with a vertex at (0,2):

$$R: [2, +\infty)$$

$$R: \{x | x \geq 2\}$$

Domain and range

Domain: The domain of a function is the set of all possible input values (often the "x" variable), which produce a valid output from a particular function. It is the set of all real numbers for which a function is mathematically defined.

Range: The range is the set of all possible output values (usually the variable y, or sometimes expressed as $f(x)$), which result from using a particular function.

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