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

$\sin\theta = \cos(90° - \theta)$ $\quad \cos\theta = \sin(90° - \theta)$

$\tan\theta = \cot(90° - \theta)$ $\quad \cot\theta = \tan(90° - \theta)$

$\sec\theta = \csc(90° - \theta)$ $\quad \csc\theta = \sec(90° - \theta)$

Opposite Angle Identities

$\sin(-A) = -\sin A$

$\cos(-A) = \cos(A)$

$\tan(-A) = -\tan(A)$

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

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

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

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

Product-Sum Identities

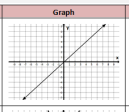
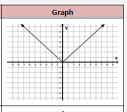
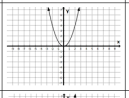
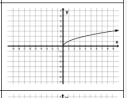
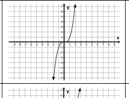
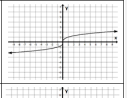
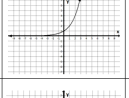
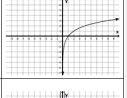
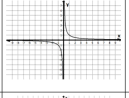
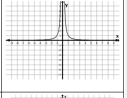
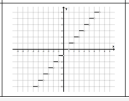
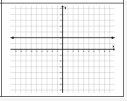
$\sin\alpha\cos\beta = \frac{1}{2}[\sin(\alpha+\beta) + \sin(\alpha-\beta)]$

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

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

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

Parent Functions

Parent Function	Graph	Parent Function	Graph
$y = x$ **Linear**, Odd Domain: $(-\infty,\infty)$ Range: $(-\infty,\infty)$ End Behavior: $x\to-\infty,\ y\to-\infty$ $x\to\infty,\ y\to\infty$		$y = \lvert x\rvert$ **Absolute Value**, Even Domain: $(-\infty,\infty)$ Range: $[0,\infty)$ End Behavior: $x\to-\infty,\ y\to\infty$ $x\to\infty,\ y\to\infty$	
$y = x^2$ **Quadratic**, Even Domain: $(-\infty,\infty)$ Range: $[0,\infty)$ End Behavior: $x\to-\infty,\ y\to\infty$ $x\to\infty,\ y\to\infty$		$y = \sqrt{x}$ **Radical**, Neither Domain: $[0,\infty)$ Range: $[0,\infty)$ End Behavior: $x\to\infty,\ y\to\infty$	
$y = x^3$ **Cubic**, Odd Domain: $(-\infty,\infty)$ Range: $(-\infty,\infty)$ End Behavior: $x\to-\infty,\ y\to-\infty$ $x\to\infty,\ y\to\infty$		$y = \sqrt[3]{x}$ **Cube Root**, Odd Domain: $(-\infty,\infty)$ Range: $(-\infty,\infty)$ End Behavior: $x\to-\infty,\ y\to-\infty$ $x\to\infty,\ y\to\infty$	
$y = b^x,\ b>1$ **Exponential**, Neither Domain: $(-\infty,\infty)$ Range: $(0,\infty)$ End Behavior: $x\to-\infty,\ y\to0$ $x\to\infty,\ y\to\infty$		$y = \log_b(x),\ b>1$ **Log**, Neither Domain: $(0,\infty)$ Range: $(-\infty,\infty)$ End Behavior: $x\to0^+,\ y\to-\infty$ $x\to\infty,\ y\to\infty$	
$y = \frac{1}{x}$ **Rational (Inverse)**, Odd Domain: $(-\infty,0)\cup(0,\infty)$ Range: $(-\infty,0)\cup(0,\infty)$ End Behavior: $x\to-\infty,\ y\to0$ $x\to\infty,\ y\to0$		$y = \frac{1}{x^2}$ **Rational (Inverse Squared)**, Even Domain: $(-\infty,0)\cup(0,\infty)$ Range: $(0,\infty)$ End Behavior: $x\to-\infty,\ y\to0$ $x\to\infty,\ y\to0$	
$y = \text{int}(x) = \lfloor x\rfloor$ **Greatest Integer**, Neither Domain: $(-\infty,\infty)$ Range: $\{y : y\in\mathbb{Z}\}$ (integers) End Behavior: $x\to-\infty,\ y\to-\infty$ $x\to\infty,\ y\to\infty$		$y = C$ ($y = 2$ in the graph) **Constant**, Even Domain: $(-\infty,\infty)$ Range: $\{y : y = C\}$ End Behavior: $x\to-\infty,\ y\to C$ $x\to\infty,\ y\to C$	

Exponentials and logarithms

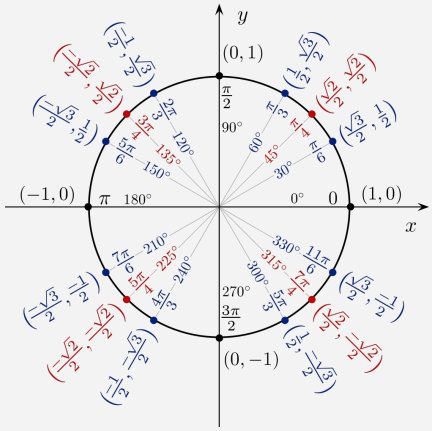
Logarithmic

y = ln x

Exponential

y=b^x

Unit Circle



Interval Notation

	Interval notation	Set Notation
	D: $[1, +\infty)$	D: $\{x \mid x \geq 1\}$

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

	D: $[-\infty, +\infty)$	D: $\{x \mid x \text{ all Real numbers}\}$

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

	R: $[-\infty, 3)$	R: $\{y \mid y \leq 3\}$

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

	R: $[2, +\infty)$	R: $\{x \mid x \geq 2\}$

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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