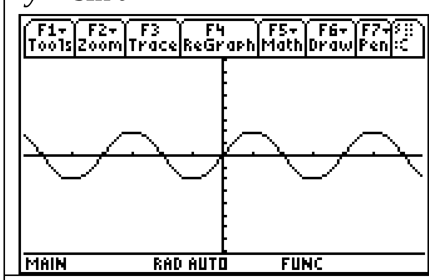
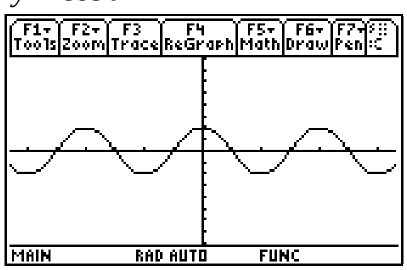
Radians	Degrees θ	y/r	x/r	$y/x = \sin\theta/\cos\theta$	$x/y = 1/\tan\theta$	$r/x = 1/\cos\theta$	$r/y = 1/\sin\theta$
		$\sin\theta$	$\cos\theta$	$\tan\theta$	$\cot\theta$	$\sec\theta$	$\csc\theta$
0	0°	0	1	0	∞	1	∞
$\pi/6$	30°	$1/2$	$\sqrt{3}/2$	$\sqrt{3}/3$	$\sqrt{3}$	$2\sqrt{3}/3$	2
$\pi/4$	45°	$\sqrt{2}/2$	$\sqrt{2}/2$	1	1	$\sqrt{2}$	$\sqrt{2}$
$\pi/3$	60°	$\sqrt{3}/2$	$1/2$	$\sqrt{3}$	$\sqrt{3}/3$	2	$2\sqrt{3}/3$
$\pi/2$	90°	1	0	∞	0	∞	1
$2\pi/3$	120°	$\sqrt{3}/2$	$-1/2$	$-\sqrt{3}$	$-\sqrt{3}/3$	-2	$2\sqrt{3}/3$
$3\pi/4$	135°	$\sqrt{2}/2$	$-\sqrt{2}/2$	-1	-1	$-\sqrt{2}$	$\sqrt{2}$
$5\pi/6$	150°	$1/2$	$-\sqrt{3}/2$	$-\sqrt{3}/3$	$-\sqrt{3}$	$-2\sqrt{3}/3$	2
π	180°	0	-1	0	∞	-1	∞
$7\pi/6$	210°	$-1/2$	$-\sqrt{3}/2$	$\sqrt{3}/3$	$\sqrt{3}$	$-2\sqrt{3}/3$	-2
$5\pi/4$	225°	$-\sqrt{2}/2$	$-\sqrt{2}/2$	1	1	$-\sqrt{2}$	$-\sqrt{2}$
$4\pi/3$	240°	$-\sqrt{3}/2$	$-1/2$	$\sqrt{3}$	$\sqrt{3}/3$	-2	$-2\sqrt{3}/3$
$3\pi/2$	270°	-1	0	∞	0	∞	-1
$5\pi/3$	300°	$-\sqrt{3}/2$	$1/2$	$-\sqrt{3}$	$-\sqrt{3}/3$	2	$-2\sqrt{3}/3$
$7\pi/4$	315°	$-\sqrt{2}/2$	$\sqrt{2}/2$	-1	-1	$\sqrt{2}$	$-\sqrt{2}$
$11\pi/6$	330°	$-1/2$	$\sqrt{3}/2$	$-\sqrt{3}/3$	$-\sqrt{3}$	$2\sqrt{3}/3$	-2
2π	360°	0	1	0	∞	1	∞

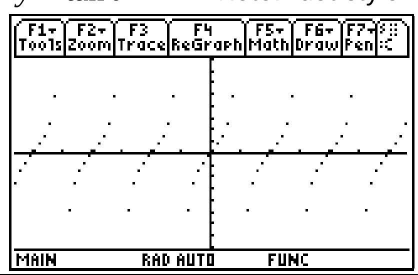
$y = \sin\theta$



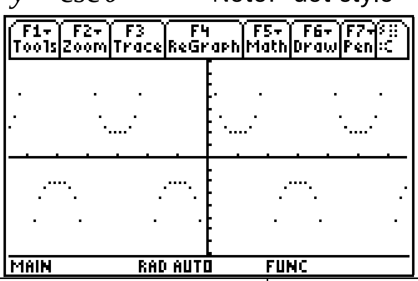
$y = \cos\theta$



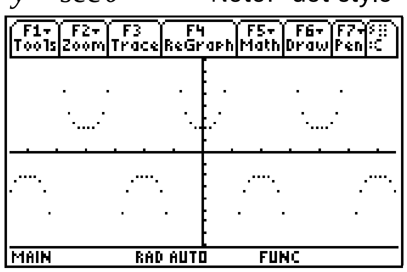
$y = \tan\theta$ Note: dot style



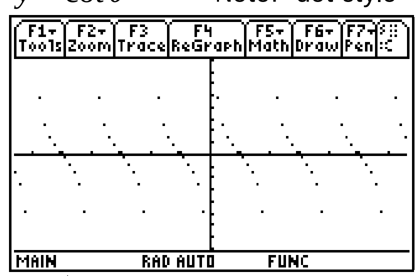
$y = \csc\theta$ Note: dot style



$y = \sec\theta$ Note: dot style



$y = \cot\theta$ Note: dot style



Degrees to Radians
multiply by $\pi/180$

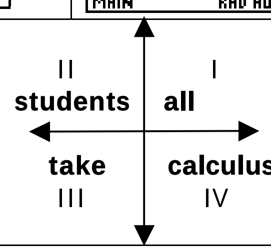
Radians to Degrees
multiply by $180/\pi$

Right Triangles (Oliver Had A Hairy Old Arm)

$\sin\theta = \frac{opp}{hyp}$ $\csc\theta = \frac{hyp}{opp}$

$\cos\theta = \frac{adj}{hyp}$ $\sec\theta = \frac{hyp}{adj}$

$\tan\theta = \frac{opp}{adj}$ $\cot\theta = \frac{adj}{opp}$



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Law of Sines
$$\frac{\sin A}{a}=\frac{\sin B}{b}=\frac{\sin C}{c}$$

Law of Cosines
$$c^2=a^2+b^2-2ab\cos C$$

Area btw. Two Lines
$$\tan\theta=\frac{m_1-m_2}{1+m_1m_2}$$

Area of a Triangle
$$A=\tfrac{1}{2}(side)(side)(\sin\ of\ included\ \angle)$$

Sector of a Circle
$s=r\theta$ — $s=arclength$

$k=\tfrac{1}{2}r^2\theta$ — $\theta=central\ \angle\ in\ radians$

$k=\tfrac{1}{2}rs$ — $r=radius$

$k=area$

Reduction Formula
$$\sin(-\theta)=-\sin\theta \qquad \cot(-\theta)=-\cot\theta$$
$$\cos(-\theta)=\cos\theta \qquad \sec(-\theta)=\sec\theta$$
$$\tan(-\theta)=-\tan\theta \qquad \csc(-\theta)=-\csc\theta$$

Pythagorean Relations
$$\sin^2\theta+\cos^2\theta=1$$
$$\tan^2\theta+1=\sec^2\theta$$
$$1+\cot^2\theta=\csc^2\theta$$

Double-Angle
$$\sin 2\theta=2\sin\theta\cos\theta$$
$$\tan 2\theta=\frac{2\tan\theta}{1-\tan^2\theta}$$
$$\cos 2\theta=\cos^2\theta-\sin^2\theta=2\cos^2\theta-1=1-2\sin^2\theta$$
$$\sin^2\theta=\tfrac{1}{2}(1-\cos 2\theta)$$
$$\cos^2\theta=\tfrac{1}{2}(1+\cos 2\theta)$$

Half-Angle
$$\sin\frac{\theta}{2}=\pm\sqrt{\frac{1-\cos\theta}{2}}$$
$$\cos\frac{\theta}{2}=\pm\sqrt{\frac{1+\cos\theta}{2}}$$
$$\tan\frac{\theta}{2}=\frac{\sin\theta}{1+\cos\theta}=\frac{1-\cos\theta}{\sin\theta}$$

Sum and Difference of Two Angles
$$\sin(\alpha+\beta)=\sin\alpha\cos\beta+\cos\alpha\sin\beta$$
$$\sin(\alpha-\beta)=\sin\alpha\cos\beta-\cos\alpha\sin\beta$$
$$\cos(\alpha+\beta)=\cos\alpha\cos\beta-\sin\alpha\sin\beta$$
$$\cos(\alpha-\beta)=\cos\alpha\cos\beta+\sin\alpha\sin\beta$$
$$\tan(\alpha+\beta)=\frac{\tan\alpha+\tan\beta}{1-\tan\alpha\tan\beta}$$
$$\tan(\alpha-\beta)=\frac{\tan\alpha-\tan\beta}{1+\tan\alpha\tan\beta}$$

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

Complement
$$\sin\theta=\cos(\pi/2-\theta) \qquad \csc\theta=\sec(\pi/2-\theta)$$
$$\cos\theta=\sin(\pi/2-\theta) \qquad \sec\theta=\csc(\pi/2-\theta)$$
$$\tan\theta=\cot(\pi/2-\theta) \qquad \cot\theta=\tan(\pi/2-\theta)$$

Supplement
$$\sin(\pi-\theta)=\sin\theta \qquad \csc(\pi-\theta)=\csc\theta$$
$$\cos(\pi-\theta)=-\cos\theta \qquad \sec(\pi-\theta)=-\sec\theta$$
$$\tan(\pi-\theta)=-\tan\theta \qquad \cot(\pi-\theta)=-\cot\theta$$

$$\sin(\pi+\theta)=-\sin\theta \qquad \csc(\pi+\theta)=-\csc\theta$$
$$\cos(\pi+\theta)=-\cos\theta \qquad \sec(\pi+\theta)=-\sec\theta$$
$$\tan(\pi+\theta)=\tan\theta \qquad \cot(\pi+\theta)=\cot\theta$$

Inverse Trigonometric Functions
$\sin^{-1}x=y$ if and only if $-\frac{\pi}{2}\le y\le\frac{\pi}{2}$

$\cos^{-1}x=y$ if and only if $0\le y\le\pi$

$\tan^{-1}x=y$ if and only if $-\frac{\pi}{2}\le y\le\frac{\pi}{2}$

Rectangular to Polar
$$r=\pm\sqrt{x^2+y^2}$$
$$\tan\theta=\frac{y}{x},\quad for\ x\neq 0$$

Polar to Rectangular
$$x=r\cos\theta$$
$$y=r\sin\theta$$

Graphing Sine and Cosine Functions
$f(x)=A\sin(Bx+C)+D$ *and* $f(x)=A\cos(Bx+C)+D$ use

$D=new\ center\ line$

$|A|=amplitude$

$-\frac{C}{B}=phase\ shift$

$\frac{2\pi}{B}=period$

Special Right Triangles
$30^\circ:60^\circ:90^\circ$ — $1:\sqrt{3}:2$

$45^\circ:45^\circ:90^\circ$ — $1:1:\sqrt{2}$

Graphing Tangent and Cotangent Functions
$f(x)=A\tan(Bx+C)$ *and* $f(x)=A\cot(Bx+C)$ use

$-\frac{C}{B}=phase\ shift$

$\frac{\pi}{B}=period$

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