Identities

$\sin^2(a)+\cos^2(a)=1,\ \sec^2(a)-\tan^2(a)=1,\ \csc^2(a)-\cot^2(a)=1$

$\cos(a\mp b)=\cos(a)\cos(b)\pm\sin(a)\sin(b),\ \sin(a\pm b)=\sin(a)\cos(b)\pm\cos(a)\sin(b)$

$$\sin(2a)=2\sin(a)\cos(a),\ \cos(2a)=\begin{cases}\cos^2(a)-\sin^2(a)\\ 1-2\sin^2(a)\\ 2\cos^2(a)-1\end{cases},\ \tan(2a)=\frac{2\tan(a)}{1-\tan^2(a)}$$

$$\sin^2 x=\frac{1-\cos 2x}{2},\ \cos^2 x=\frac{1+\cos 2x}{2},\ \sin\left(\frac{x}{2}\right)=\pm\sqrt{\frac{1-\cos x}{2}},\ \cos\left(\frac{x}{2}\right)=\pm\sqrt{\frac{1+\cos x}{2}};$$

Inverse Functions

$y=\sin^{-1}x,\ \ -\pi/2\le y\le\pi/2,\qquad y=\csc^{-1}x=\sin^{-1}1/x,\ \ -\pi/2<y<\pi/2, y\ne 0$

$y=\cos^{-1}x,\ \ 0\le y\le\pi\qquad y=\sec^{-1}x=\cos^{-1}1/x,\ \ 0<y<\pi, y\ne\pi/2$

$y=\tan^{-1}x,\ \ -\pi/2<y<\pi/2\qquad y=\cot^{-1}x=\dfrac{\pi}{2}-\tan^{-1}x,\ \ 0<y<\pi$

The Inverse functions formulas show the way the functions are restricted.
Examples:

Find $\sin^{-1}1/2$. This problem asks for the angle whose sine is ½. Since the sine is restricted from $-\pi/2\le x\le\pi/2$ and the sine is positive in the first quadrant, $y=\sin^{-1}1/2=\pi/6$ is the angle desired.

Find $\sin^{-1}-\sqrt{3}/2$. This problem asks for the angle whose sine is $-\sqrt{3}/2$. Since the sine is restricted from $-\pi/2\le x\le\pi/2$ and the sine is negative in the fourth quadrant, $\sin^{-1}-\sqrt{3}/2=-\pi/3$ is the angle desired

Find $\cos^{-1}1/2$. This problem asks for the angle whose cosine is ½. Since the cosine is restricted from $0\le x\le\pi$ and the cosine is positive in the first quadrant, $\cos^{-1}1/2=\pi/3$ is the angle desired.

Find $\cos^{-1}-\sqrt{3}/2$. This problem asks for the angle whose cosine is $-\sqrt{3}/2$. Since the cosine is restricted from $0\le x\le\pi$ and the cosine is negative in the second quadrant, $y=\cos^{-1}-\sqrt{3}/2=5\pi/6$ is the angle desired. Note that $5\pi/6$ has a reference angle of $\pi/6$

Find $\cot^{-1}-\sqrt{3}$. To find the angle whose cotangent is $-\sqrt{3}$, we use the formula $\cot^{-1}-\sqrt{3}=\dfrac{\pi}{2}-\tan^{-1}-\sqrt{3}$. Since the tangent is restricted from $-\pi/2<x<\pi/2$ and the tangent is negative in the fourth quadrant, $\tan^{-1}-\sqrt{3}=\dfrac{\pi}{3}$, so $\cot^{-1}-\sqrt{3}=\dfrac{\pi}{2}-\tan^{-1}-\sqrt{3}=\dfrac{\pi}{2}-(-\dfrac{\pi}{3})=\dfrac{5\pi}{6}$

Find $\sec^{-1}-2$. To find the angle whose secant is -2, we use the formula $y=\sec^{-1}-2=\cos^{-1}-1/2=2\pi/3$, since the cosine is negative in the second quadrant.

Find $\csc^{-1}-2$. To find the angle whose cosecant is -2, we use the formula $y=\csc^{-1}-2=\sin^{-1}-1/2=-\pi/6$, since the sin is negative in the fourth quadrant.