March 24, 2025

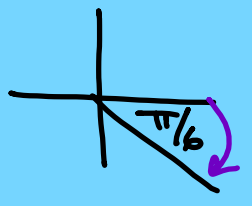
Inverse Trig Functions & Trig Equations

$\sin^{-1} x$ Arcsin x

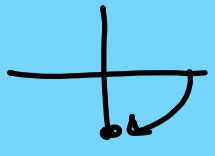
$\cos^{-1} x$, $\sec^{-1} x$, $\cot^{-1} x$	All (+)
$\csc^{-1} x$, $\sin^{-1} x$, $\tan^{-1} x$	(−)

Angles must be in rads!

$\tan^{-1}\left(-\frac{\sqrt{3}}{3}\right) = -\frac{\pi}{6}$

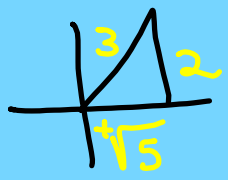


$\sin^{-1}(-1) = -\frac{\pi}{2}$



$\text{Arcsec}(-\sqrt{2}) = \frac{3\pi}{4}$

$\cot\left(\sin^{-1}\frac{2}{3}\right)$ $\frac{y}{r}$

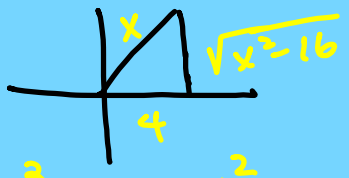


$x^2 + 4 = 9$

$x^2 = \sqrt{5}$

$\cot\theta = \frac{x}{y} = \frac{\sqrt{5}}{2}$

$\csc\left(\cos^{-1}\frac{4}{x}\right)$ $\frac{x}{r}$



$y^2 + 16 = x^2$

$\sqrt{y^2} = \sqrt{x^2 - 16}$

$y = \sqrt{x^2 - 16}$

$\csc\theta = \frac{r}{y} = \frac{x}{\sqrt{x^2-16}}$

$\cos\left(2\,\text{Arctan}\left(\frac{-3}{5}\right)\right)$ $\frac{y}{x}$

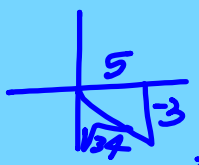
$\cos(2\theta) =$

$2\cos^2\theta - 1$

$2\left(\frac{5}{\sqrt{34}}\right)^2 - 1$

$2\left(\frac{25}{34}\right) - 1$

$\frac{25}{17} - \frac{17}{17} = \frac{8}{17}$



$25 + 9 = r^2$

$\sqrt{34} = \sqrt{r^2}$

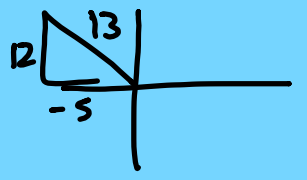
$\sin\left(\text{Arccos}\left(\frac{-5}{13}\right) - \text{Arcsec}\left(\frac{25}{24}\right)\right)$

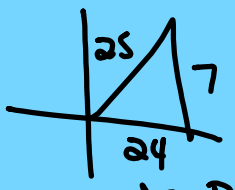
$\sin(A - B)$

$\sin A - \sin B$

$\frac{12}{13} - \frac{7}{25}$

NO!!!





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

$\sin\left(\frac{12}{13}\right)\cos\left(\frac{24}{25}\right)$

$\left(\frac{12}{13}\right)\left(\frac{24}{25}\right) - \left(\frac{-5}{13}\right)\left(\frac{7}{25}\right)$

Solve for x.

$$\cot^{-1}x + 2\cos^{-1}\left(\frac{1}{2}\right) = \frac{5\pi}{6}$$

$$\cot^{-1}x + 2\cdot\frac{\pi}{3} = \frac{5\pi}{6}$$

$$\cot^{-1}x = \frac{5\pi}{6} - \frac{2\pi}{3}$$

$$\cot^{-1}x = \pi/6$$

$$\cot\frac{\pi}{6} = x$$

$$\frac{\sqrt{3}}{1} = x$$

$$\boxed{\sqrt{3} = x}$$

1) Isolate trig func. with variable

2) Switch

tan with

Trig Equations

$$2\cos\theta = \sin\left(\frac{\theta}{2}\right)$$

$$(2\cos\theta)^2 = \left(\pm\sqrt{\frac{1-\cos\theta}{2}}\right)^2$$

$$2\left[4\cos^2\theta = \frac{1-\cos\theta}{2}\right]$$

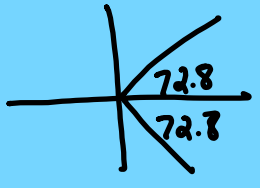
$$8\cos^2\theta = 1-\cos\theta$$

$$8\cos^2\theta + \cos\theta - 1 = 0$$

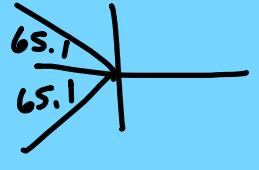
$$\cos\theta = \frac{-1 \pm \sqrt{1-4(8)(-1)}}{2(8)}$$

$$= \frac{-1 \pm \sqrt{33}}{16}$$

$\cos\theta = 0.2965$



$\cos\theta = -0.9215$



$\theta = 72.8°, 287.2°, 114.9°, 245.1°$

Squared both sides – Must check all answers in original problem:

Check: $2\cos 72.8° = \sin\left(\frac{72.8°}{2}\right)$

$0.5914 = 0.5934$ ✓

Do same for all other solutions.

1) Check angles first.
$\theta, 2\theta, \frac{\theta}{2}$
Use identities to change if there is a mixture of angles.

2) Check if different trig functions. Use identities to change

3) Solve:
1) UNFOIL
2) Pull out common factor
3) Quadratic formula

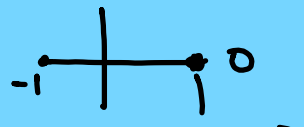
Trig Equations

$5\cos 3x + 2 = 3\cos 3x$

$-3\cos 3x$

$\frac{2\cos 3x}{2} = \frac{-2}{2}$

$\cos 3x = -1$



$3x = 180°, 540°, 900°$

$+360°$

$x = 60°, 180°, 300°$

$[0°, 360°)$

1) All same trig func

2) All same angle.

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