# Graphs & Inverses of Trig Functions
## 7 – Inverse Trig Functions

Arc Relation:
The inverse of the trig function. The trig function is the set of all ordered pairs *(x, trig x)*. Thus, the arc relation is the set of all ordered pairs *(trig x, x)*.

Inverse of the Trig Functions:
The inverse of *sin x* is *arcsin x* or *sin$^{-1}$ x.*
The inverse of *cos x* is *arccos x* or *cos$^{-1}$ x.*
The inverse of *tan x* is *arctan x* or *tan$^{-1}$ x.*
The inverse of *csc x* is *arccsc x* or *csc$^{-1}$ x.*
The inverse of *sec x* is *arcsec x* or *sec$^{-1}$ x.*
The inverse of *cot x* is *arctcot x* or *cot$^{-1}$ x.*

Write each equation in the form of an inverse relation.

#1)    $y = \sin\theta$

$$\sin^{-1}(y) = \theta$$

#2)    $\cos\beta = \frac{1}{2}$

$$\beta = \cos^{-1}\left(\frac{1}{2}\right)$$

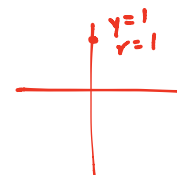#3)    $tan\varphi = 0.566$

$$\varphi = \tan^{-1}(0.566)$$

Find the values of x in the interval $0° \le x < 360°$ that satisfy each equation.

#1)    $\theta = \arcsin(0)$

$$\theta = \arcsin\left(\frac{0}{1}\right)$$
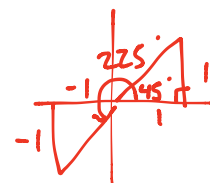$$\theta = \arcsin\left(\frac{y}{r}\right)$$
$$\theta = 90°$$

#2)    $x = \tan^{-1} 1$

$$\theta = \tan^{-1}\left(\frac{1}{1}\right)$$
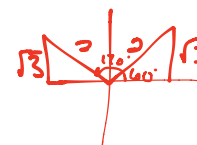$$\theta = \tan^{-1}\left(\frac{y}{x}\right)$$
$$\theta = 45°, 225°$$

#3)    $x = \arcsin\frac{\sqrt{3}}{2}$

$$\theta = \arcsin\left(\frac{y}{r}\right)$$
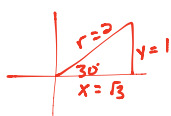$$\theta = 60°, 120°$$

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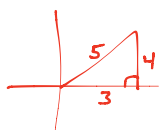## 7 – Inverse Trig Functions

Evaluate each expression.  Assume that all angles are in Quadrant I.

#1)  $\cos\left(\arccos\frac{4}{5}\right) = \frac{4}{5}$

#2)  $\sin\left(\cos^{-1}\frac{\sqrt{3}}{2}\right) = \frac{1}{2}$

$r=2$, $y=1$, $30°$, $x=\sqrt{3}$

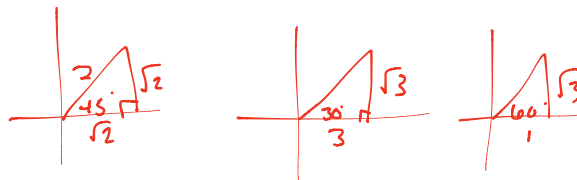#3)  $\tan\left(\cos^{-1}\frac{3}{5}\right) = \frac{4}{3}$

$5$, $4$, $3$

Verify each equation.  Assume that all angles are in Quadrant I.

#1) $\sin^{-1}\left(\frac{\sqrt{2}}{2}\right) + \cos^{-1}\left(\frac{\sqrt{2}}{2}\right) = \tan^{-1}\left(\frac{\sqrt{3}}{3}\right) + \tan^{-1}(\sqrt{3})$

$45° + 45° = 30° + 60°$

$90° = 90°$

$2$, $45°$, $\sqrt{2}$, $\sqrt{2}$    $30°$, $\sqrt{3}$, $3$    $60°$, $\sqrt{3}$, $1$

#2)  $\arcsin\left(\frac{\sqrt{2}}{2}\right) + \arccos\left(\frac{\sqrt{3}}{2}\right) = 75°$

$45° + 30° = 75$

$75° = 75°$

$2$, $45°$, $\sqrt{2}$    $2$, $30°$, $1$, $\sqrt{3}$

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