

# INVERSE TRIG FUNCTIONS

## Section 4.7

Precalculus PreAP/Dual, Revised ©2017

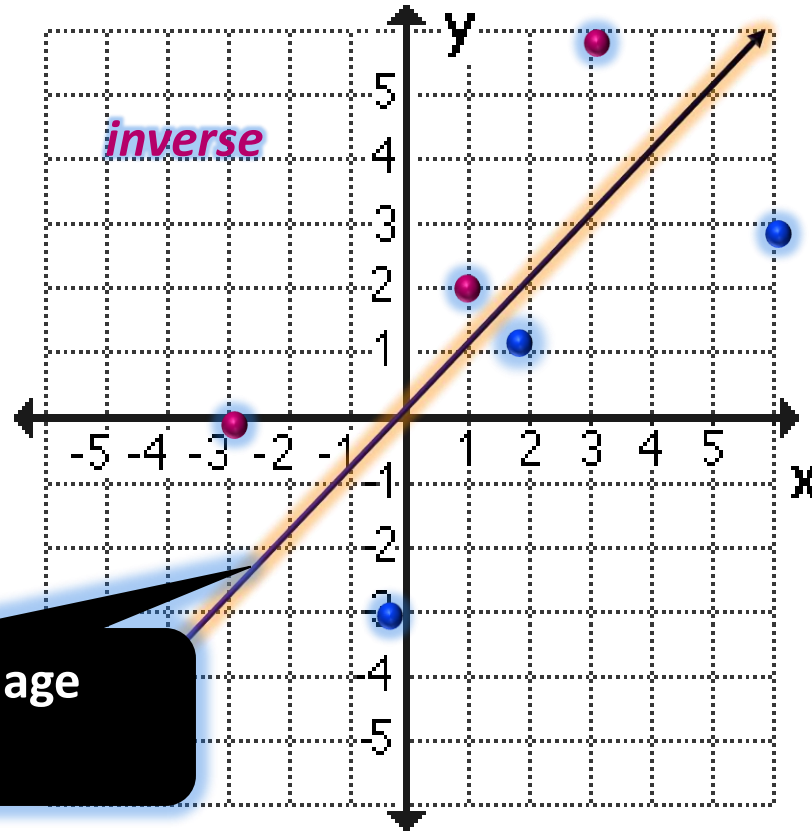
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# REVIEW EXAMPLE 1

Determine the inverse of this relation,  $\{(0, -3), (2, 1), \text{ and } (6, 3)\}$

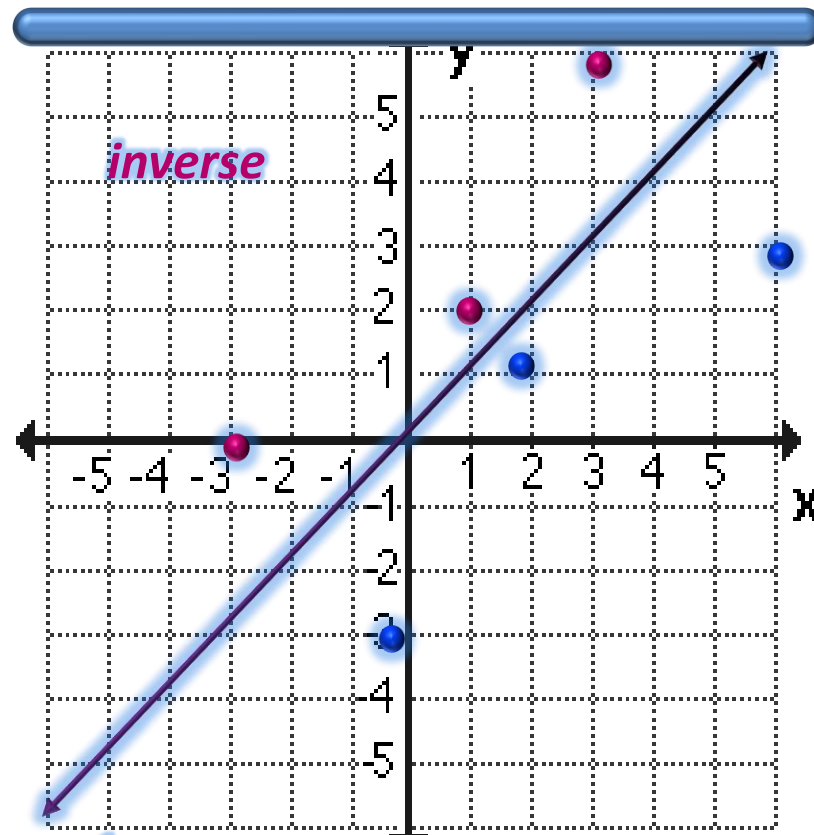
$$\{(-3, 0), (1, 2), (3, 6)\}$$

# REVIEW EXAMPLE 1



# QUESTION

If a function is a relation, is an inverse a function as well?



To find  $f^{-1}(x)$ , we have the **HORIZONTAL LINE TEST**

## REVIEW EXAMPLE 2

Determine the inverse of  $y = 3x - 2$

...to Solve the inverse, switch the  $x$ 's and  $y$ 's

$$y = 3x - 2$$

$$y = 3x - 2$$

$$\frac{3y}{3} = \frac{x + 2}{3}$$

$$f^{-1}(x) = \frac{1}{3}x + \frac{2}{3}$$

# INVERSE DEFINITIONS

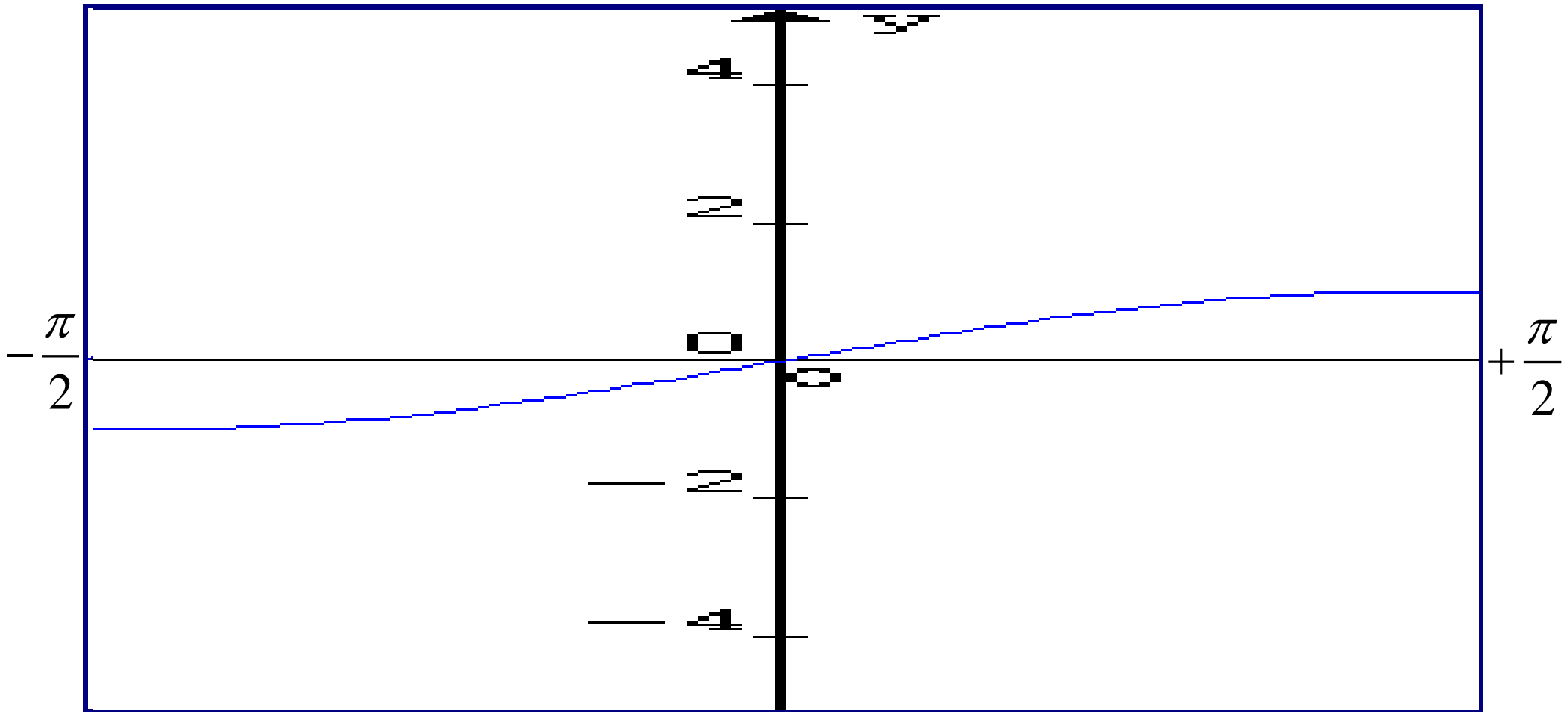
**A.  $\text{Sin}^{-1}$  is read as “the inverse sine”**

- 1. Indicates the inverse of the sine function**
- 2. Cosine’s inverse is  $\text{Cos}^{-1}$ , etc...**
- 3.  $\text{Sin}^{-1}a = \theta$ , where  $\text{Sin } \theta = a$**

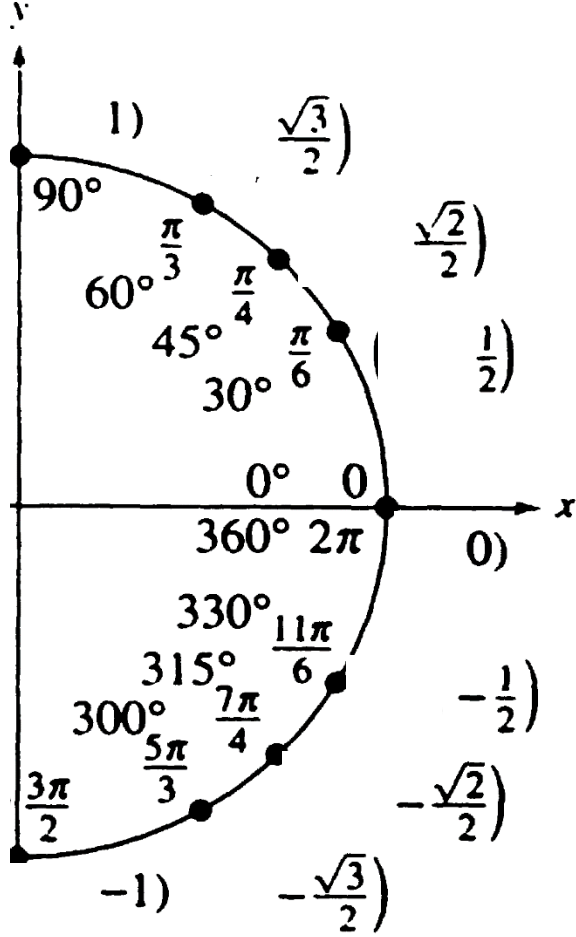
**B. There are two ways of writing inverse functions for sine**

- 1.  $\text{Sin}^{-1}$**
- 2.  $\text{arcsin}$**

# THE INVERSE OF SINE GRAPH



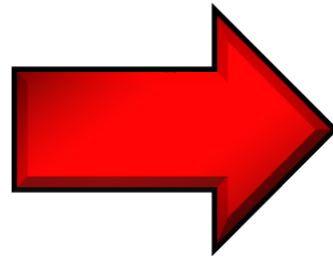
# SINE FUNCTION





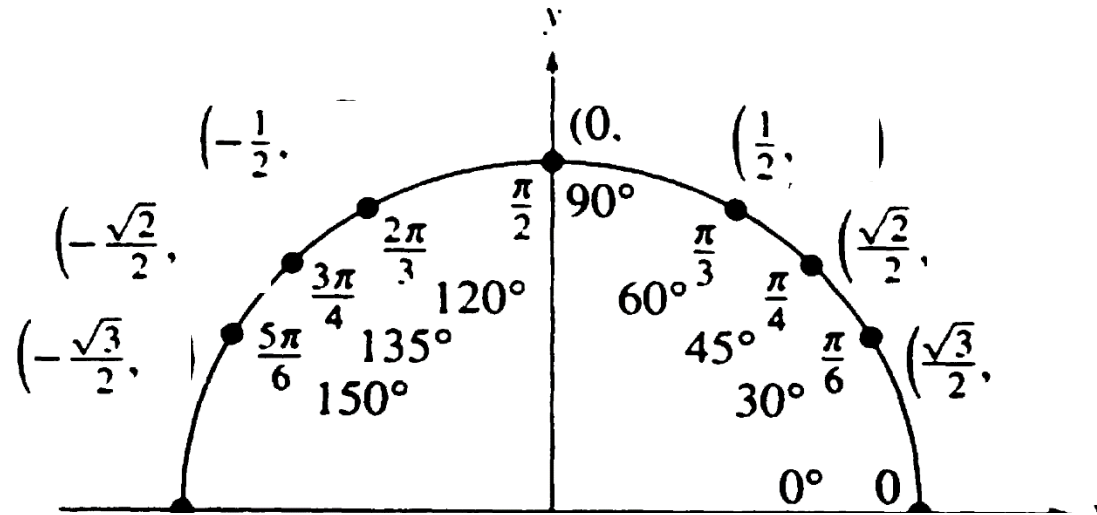
# THE INVERSE OF SINE

$x$	$y$
$0$	$0$
$\pi/2$	$1$
$\pi$	$0$
$3\pi/2$	$-1$
$2\pi$	$0$

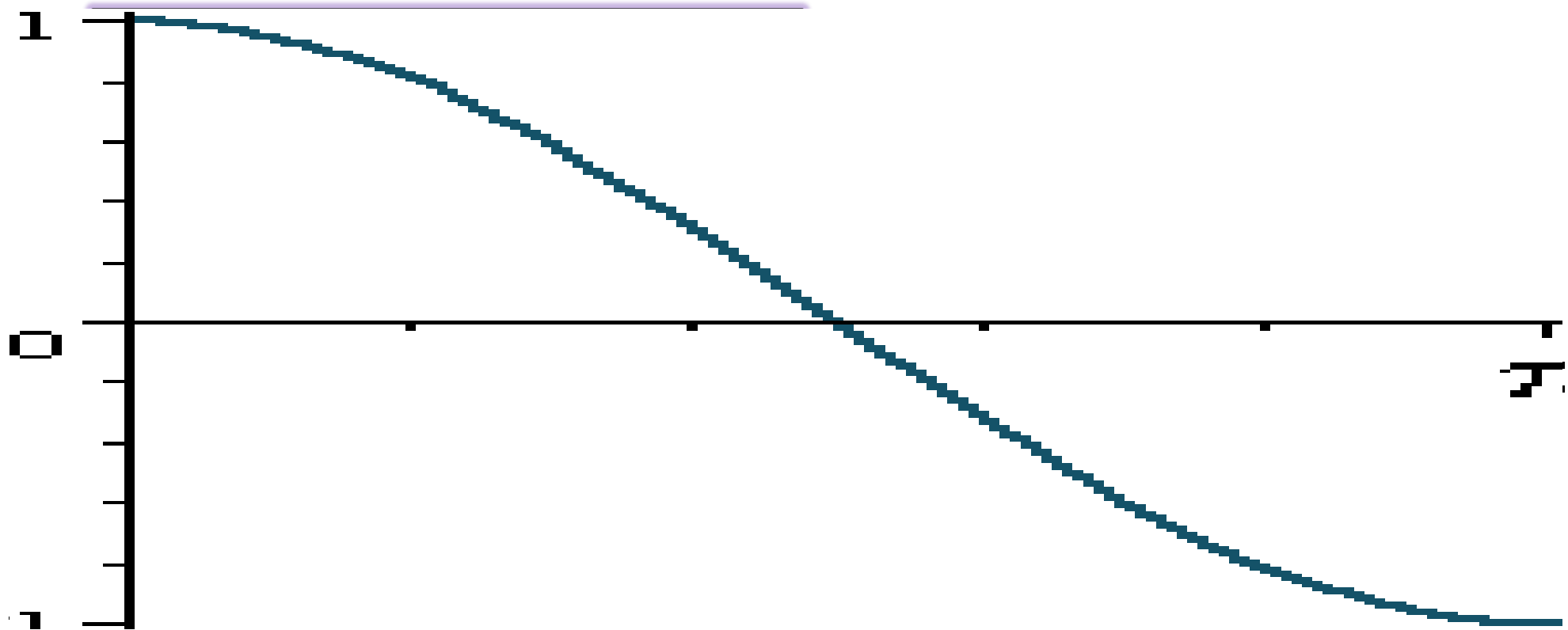


$x$	$y$
$0$	$0$
$1$	$\pi/2$
$0$	$\pi$
$-1$	$3\pi/2$
$0$	$2\pi$

# COSINE FUNCTION

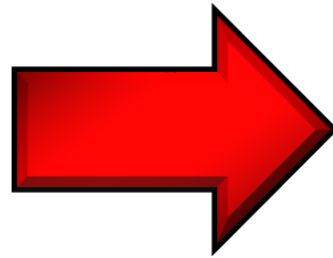


# THE INVERSE OF COSINE GRAPH



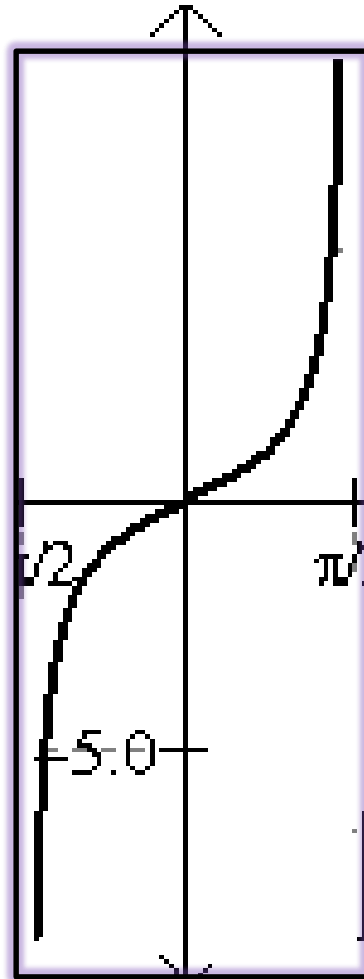
# THE INVERSE OF COSINE

$x$	$y$
$0$	$1$
$\pi/2$	$0$
$\pi$	$-1$
$3\pi/2$	$0$
$2\pi$	$1$

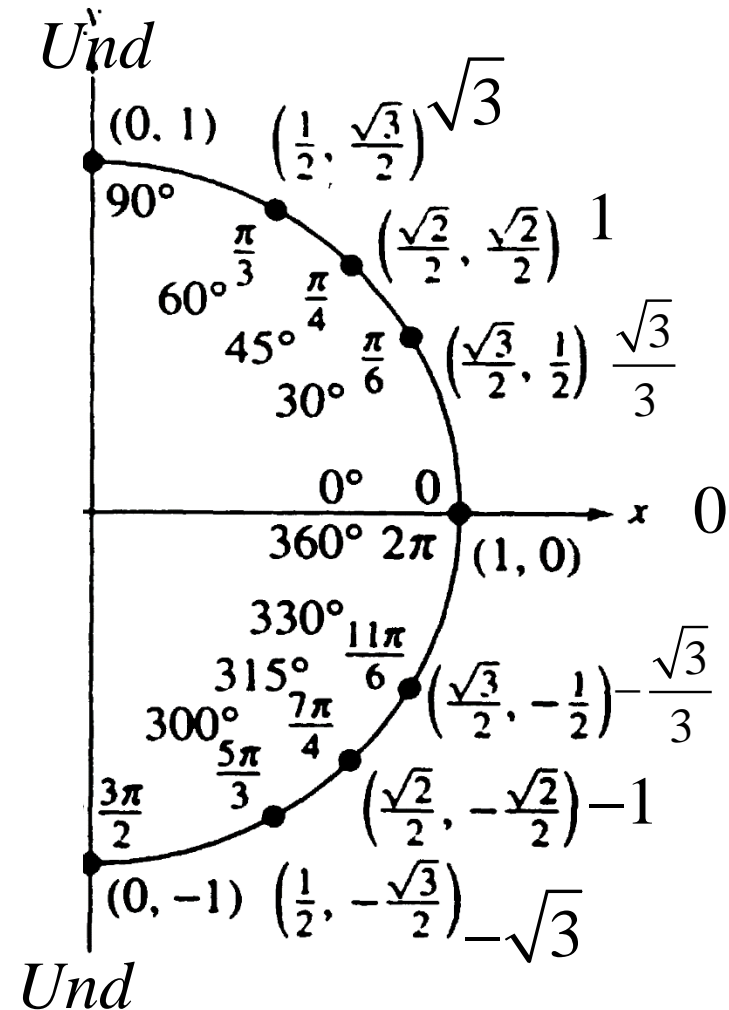


$x$	$y$
$1$	$0$
$0$	$\pi/2$
$-1$	$\pi$
$0$	$3\pi/2$
$1$	$2\pi$

# THE INVERSE OF TANGENT GRAPH

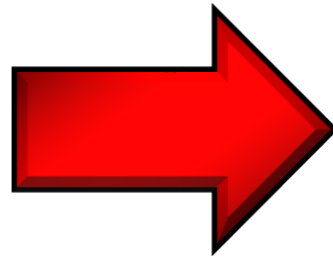


# TANGENT FUNCTION



# THE INVERSE OF TANGENT

$x$	$y$
$0$	$Und$
$\pi/2$	$-1$
$\pi$	$0$
$3\pi/2$	$1$
$2\pi$	$Und$



$x$	$y$
$Und$	$0$
$-1$	$\pi/2$
$0$	$\pi$
$1$	$3\pi/2$
$Und$	$2\pi$

# THE INVERSE GRAPH RESTRICTIONS

- A. The restricted domain for sine function is from  $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$
- B. The restricted domain for cosine function is from  $[0, \pi]$
- C. The restricted domain for tangent function is from  $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$



# REVIEW

Find the exact value of  $\cos\left(\frac{3\pi}{4}\right)$

$$\cos\left(\frac{3\pi}{4}\right) = -\frac{\sqrt{2}}{2}$$

# EXAMPLE 1

Find the exact value of  $\text{Cos}^{-1}\left(-\frac{\sqrt{2}}{2}\right)$

$$\text{Cos}^{-1}\left(\frac{3\pi}{4}\right) = \left(-\frac{\sqrt{2}}{2}\right)$$

$$\frac{3\pi}{4}$$

## EXAMPLE 2

Find the exact value of  $\arcsin\left(\frac{1}{2}\right)$

$$\frac{\pi}{6}$$

# YOUR TURN

Find the exact value of  $\text{Cos}^{-1}\left(\frac{\sqrt{2}}{2}\right)$

$$\frac{\pi}{4}$$

## EXAMPLE 3

Find the exact value of  $\text{Tan}^{-1}(\sqrt{3})$

$$\frac{\pi}{3}$$

# EXAMPLE 4

Find the exact value of  $\arcsin\left(-\frac{\sqrt{3}}{2}\right)$

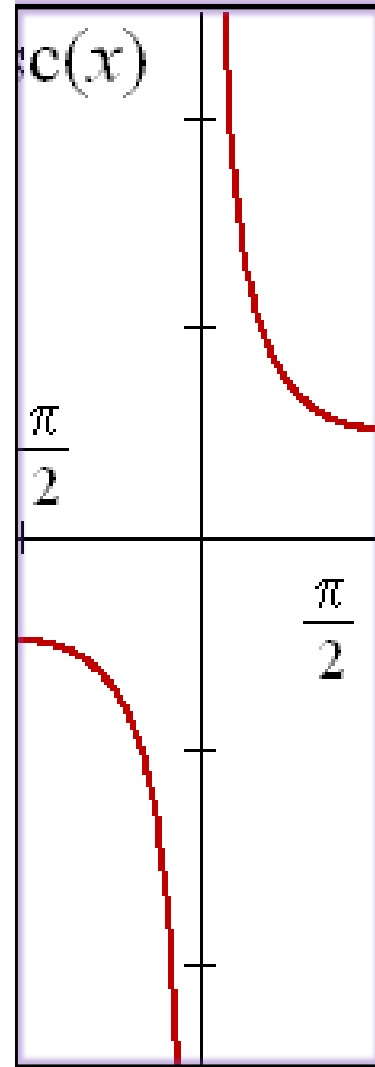
$$-\frac{\pi}{3}$$

# YOUR TURN

Find the exact value of  $\text{Tan}^{-1}\left(-\frac{\sqrt{3}}{3}\right)$

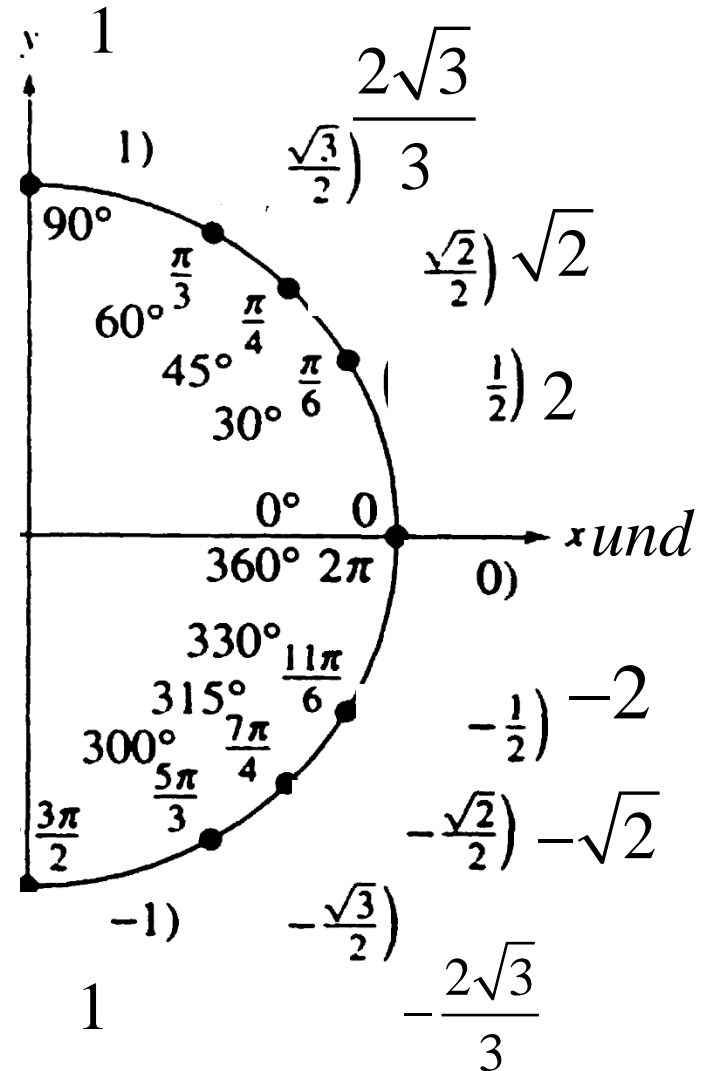
$$-\frac{\pi}{6}$$

# THE INVERSE OF COSECANT GRAPH

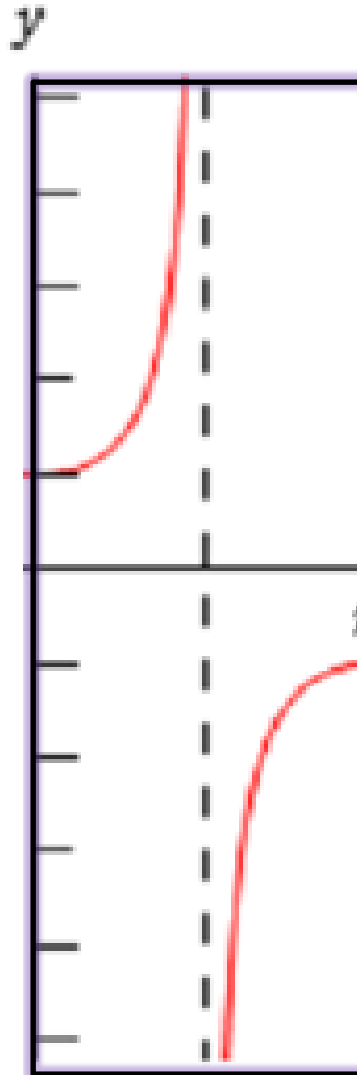




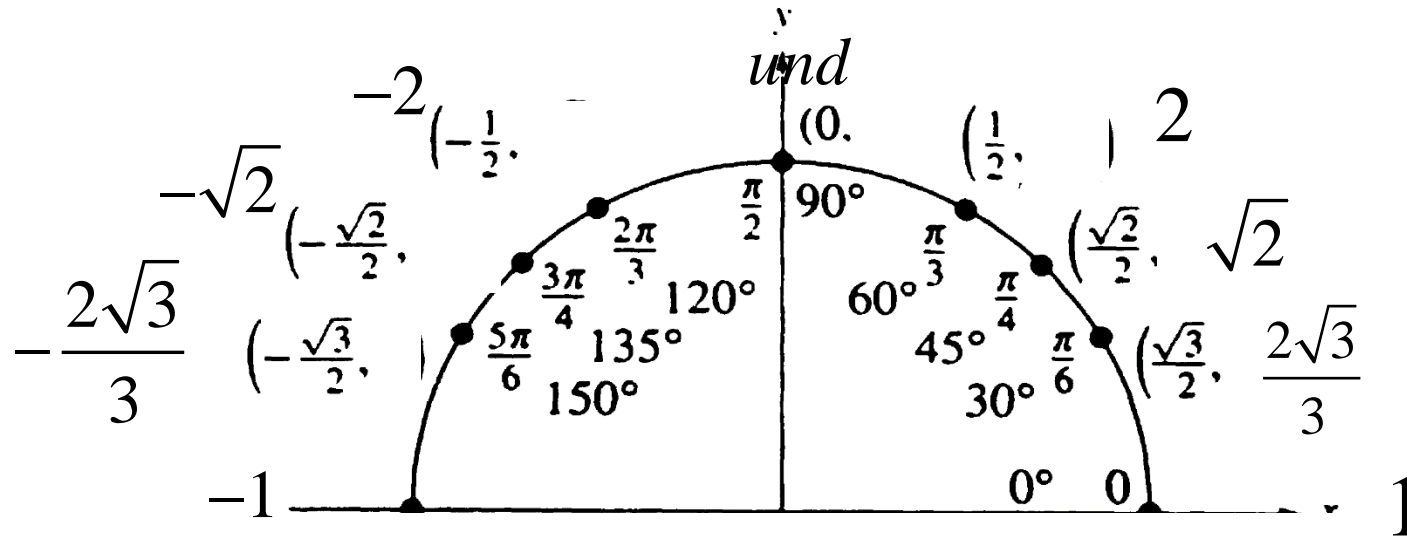
# COSECANT FUNCTION



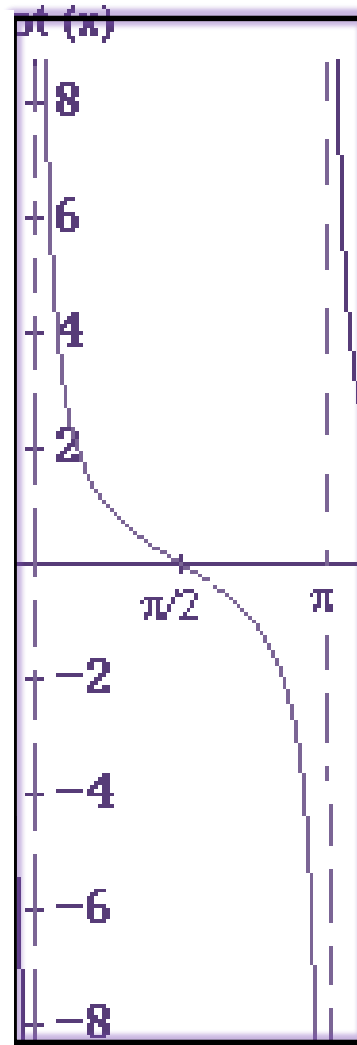
# THE INVERSE OF SECANT GRAPH



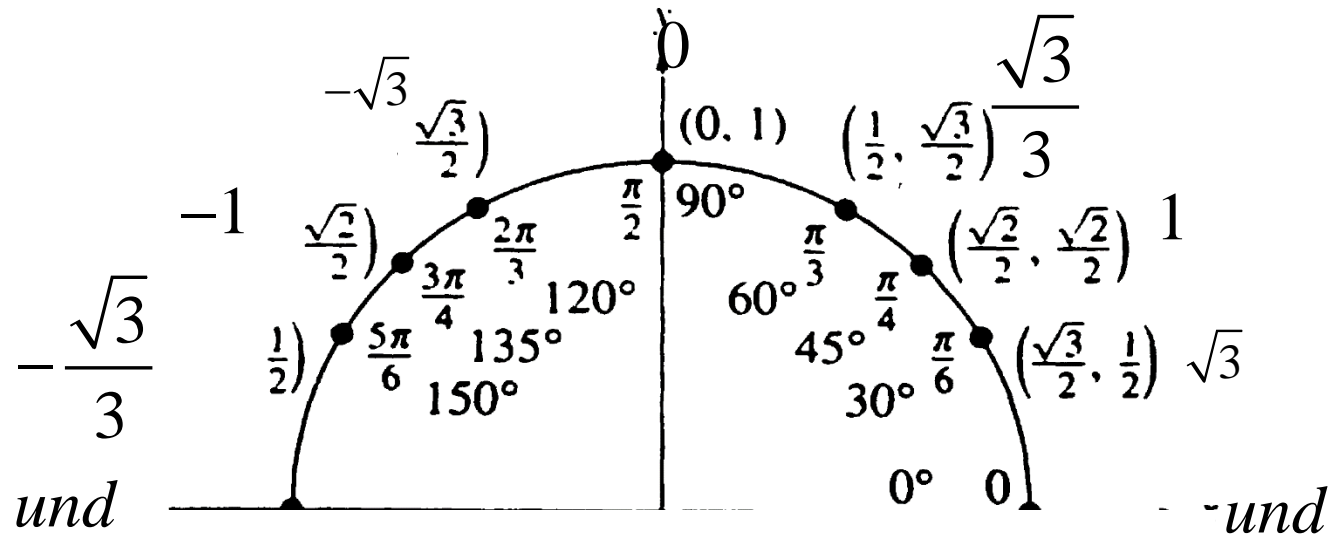
# SECANT FUNCTION



# THE INVERSE OF COTANGENT GRAPH



# COTANGENT FUNCTION



0

# THE INVERSE RECIPROCAL GRAPHS

- A. The restricted domain for cosecant function is from  $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$
- B. The restricted domain for secant function is from  $[0, \pi]$
- C. The restricted domain for cotangent function is from  $(0, \pi)$

# STEPS

- A. Take the reciprocal of the trig function**
- B. Take the reciprocal of the answer**
- C. Switch and solve**

## EXAMPLE 5

Find the exact value of  $\text{Sec}^{-1}(-\sqrt{2})$

$$\text{Sec}^{-1}\left(\frac{3\pi}{4}\right) = \left(-\frac{1}{\sqrt{2}}\right)$$

$$\frac{3\pi}{4}$$



## EXAMPLE 6

Find the exact value of  $\operatorname{arcsec}\left(-\frac{2\sqrt{3}}{3}\right)$

$$\frac{5\pi}{6}$$

## EXAMPLE 7

Find the exact value of  $\text{Cot}^{-1}(-\sqrt{3})$

$$\frac{5\pi}{6}$$

# YOUR TURN

Find the exact value of  $\text{Csc}^{-1}(-\sqrt{2})$

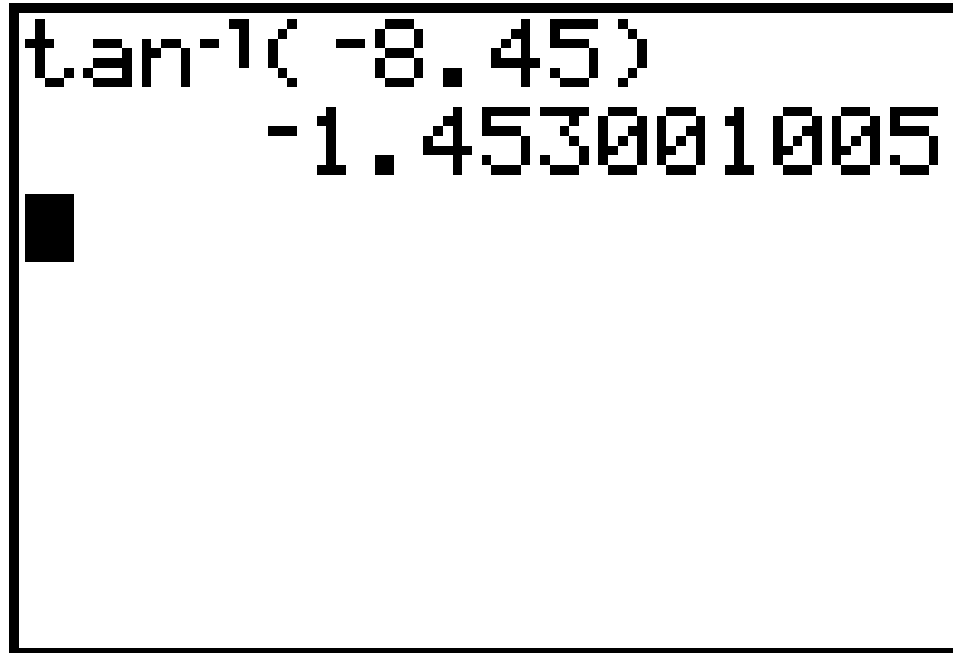
$$-\frac{\pi}{4}$$

# INVERSES IN THE CALCULATOR

- A. Make sure that it is in the appropriate mode
- B. It is the  $Trig^{-1}$  feature in the graphing calculator
- C. For reciprocal functions, type in the  $Trig^{-1} \left( \frac{1}{ans} \right)$

## EXAMPLE 8

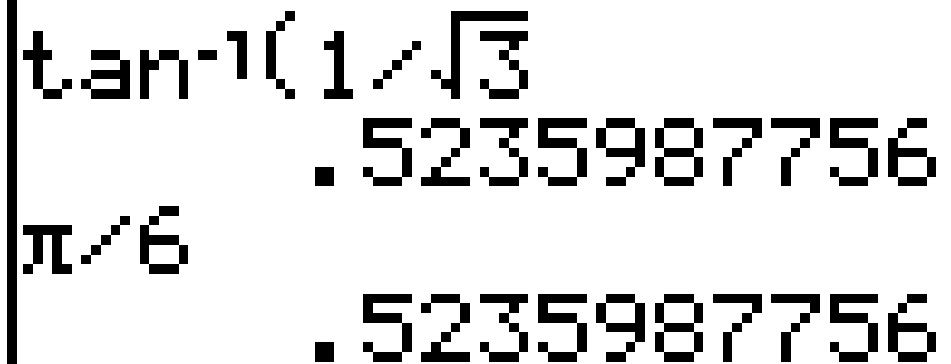
Use the calculator to approximate  $\arctan(-8.45)$



$$\approx -1.4530$$

## EXAMPLE 9

Use the calculator to approximate  $\text{Cot}^{-1}(\sqrt{3})$



A calculator display showing the calculation of  $\text{Cot}^{-1}(\sqrt{3})$  using the  $\tan^{-1}$  function. The display shows two lines of input and their corresponding numerical outputs.

$\tan^{-1}(1/\sqrt{3})$	.5235987756
$\pi/6$	.5235987756

$$\approx 0.5236$$

# YOUR TURN

Use the calculator to approximate  $\operatorname{arccsc}(-12)$

$$\approx -0.0834$$

# ASSIGNMENT

**Page 326**

**5-17 odd (without a calculator), 21-37 EOO (with a calculator), 119-125 all (without), 126-134 all (Round for 4 decimal places)**