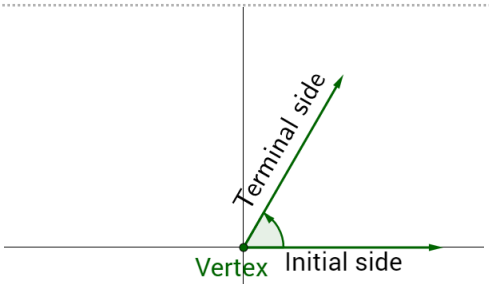
Precalculus

4-01 Angle Measures

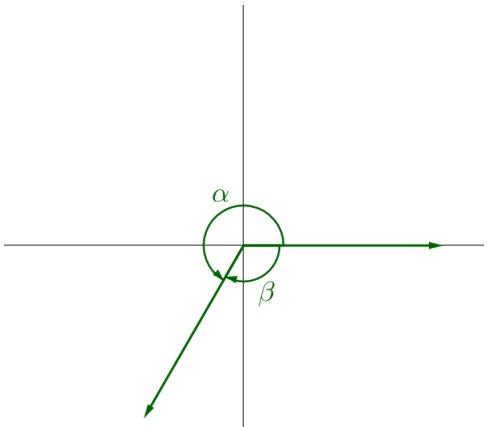
Angles in standard position

- Vertex at _____
- Initial side on positive _____
- Terminal side rotates _____



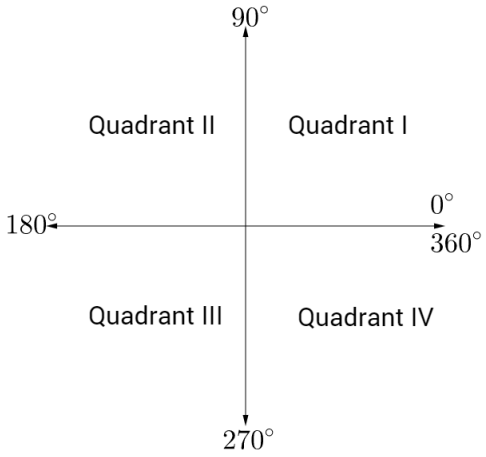
Coterminal Angles

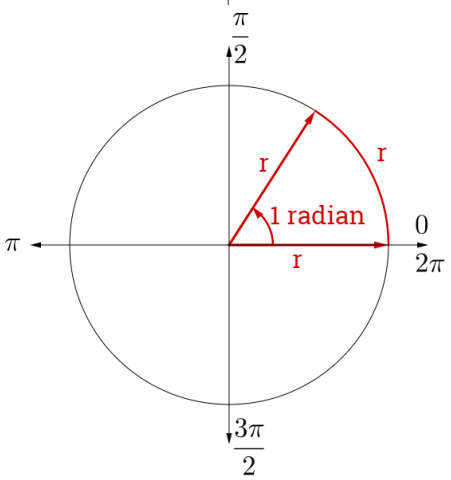
- 2 angles with same sides, but different _____
- To find coterminal angles
  - _____



Angle Measures

- Degree Measures
- Radian Measures
  - Angle where radius = _____
- Acute → _____
- Obtuse → _____
- Complementary → $\alpha + \beta =$_____
- Supplementary → $\alpha + \beta =$_____





Find a coterminal angle with $\theta = -\frac{\pi}{8}$

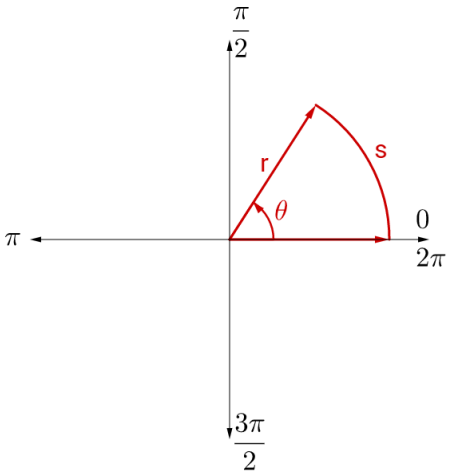
Find the supplement of $\theta = \frac{\pi}{4}$

Convert radians to degrees: 180° = π

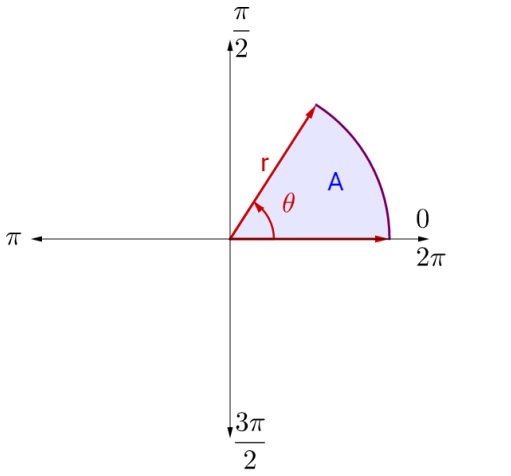
Convert 120° to radians

Applications

- Arc Length
  - _____
  - Where θ is in _____



- Area of Sector
  - A = fraction of circle × πr²
  - $A = \frac{\theta}{2\pi} \times \pi r^2$
  - _____
  - Where θ is in _____



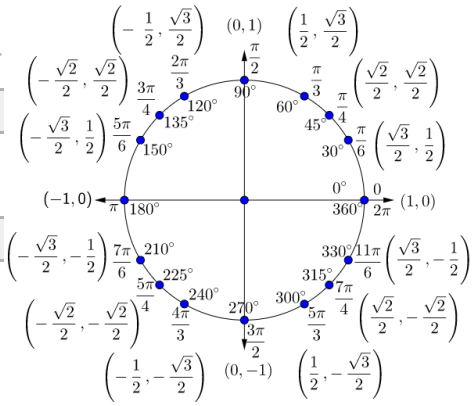
- Speeds
  - Angular speed: _____
  - Linear speed (tangential): _____
  - _____

A 6-inch diameter gear makes 2.5 revolutions per second. Find the angular speed in radians per second.

How fast is a tooth at the edge of the gear moving in in./s?

Precalculus

4-02 Unit Circle



Unit circle

$r = 1$ $\qquad x^2 + y^2 = 1$

Trigonometric Functions (Unit circle)

$\sin t =$_____ $\qquad \csc t =$_____

$\cos t =$_____ $\qquad \sec t =$_____

$\tan t =$_____ $\qquad \cot t =$_____

Evaluate 6 trig functions of $t = \frac{2\pi}{3}$

Evaluate

$\sec\frac{4\pi}{3}$ $\qquad \sin 2\pi$

$\tan\frac{\pi}{2}$ $\qquad \csc\frac{11\pi}{6}$

$\cot\frac{3\pi}{4}$ $\qquad \cos 0$

Evaluate

$\sin\left(-\frac{2\pi}{3}\right)$ $\qquad \cos\frac{9\pi}{3}$

$\sin\left(-\frac{11\pi}{2}\right)$

Name: _____

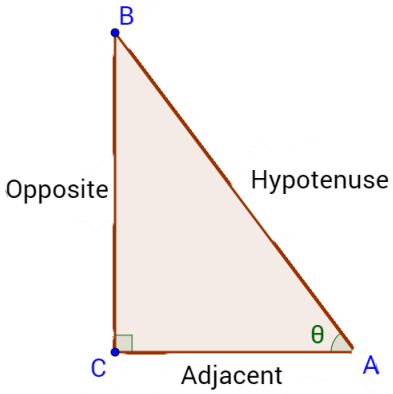
Precalculus

4-03 Right Triangle Trigonometry

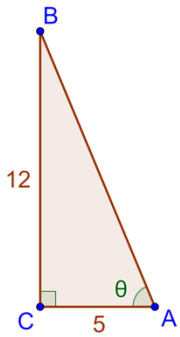
$$\sin A = \frac{opp}{hyp} \qquad \csc A = \frac{hyp}{opp}$$

$$\cos A = \frac{adj}{hyp} \qquad \sec A = \frac{hyp}{adj}$$

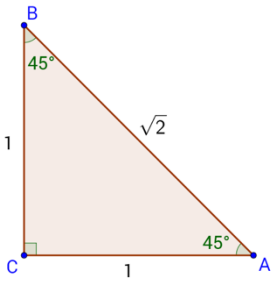
$$\tan A = \frac{opp}{adj} \qquad \cot A = \frac{adj}{opp}$$

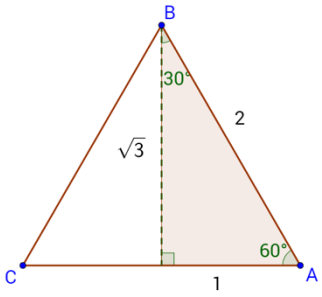


Find the values of the six trig functions



Special right triangles





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

$\tan 30°$

Sketch a triangle and find the other 5 trig functions: $\tan\theta = 3$

Precalculus

4-04 Right Triangle Trigonometry and Identities

Basic Identities

Reciprocal

$\sin u = \frac{1}{\csc u}$ $\cos u = \frac{1}{\sec u}$ $\tan u = \frac{1}{\cot u}$

$\csc u = \frac{1}{\sin u}$ $\sec u = \frac{1}{\cos u}$ $\cot u = \frac{1}{\tan u}$

Quotient

$\tan u = \frac{\sin u}{\cos u}$ $\cot u = \frac{\cos u}{\sin u}$

Pythagorean

$\sin^2 u + \cos^2 u = 1$ $1 + \tan^2 u = \sec^2 u$ $\cot^2 u + 1 = \csc^2 u$

Note: $\sin^2 u = (\sin u)^2$

Cofunction Identities

$\sin(90° - u) = \cos u$ $\cos(90° - u) = \sin u$

$\sec(90° - u) = \csc u$ $\csc(90° - u) = \sec u$

$\tan(90° - u) = \cot u$ $\cot(90° - u) = \tan u$

Let θ be an acute angle such that $\cos\theta = 0.96$

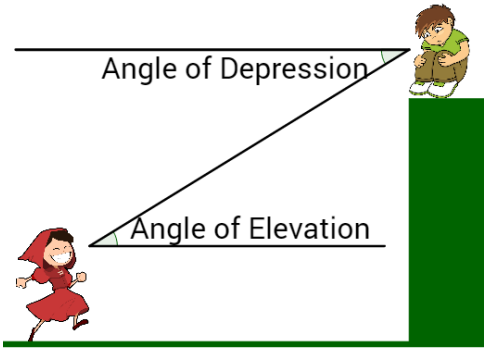
Find $\sin\theta$ $\tan\theta$

Let β be an acute angle such that $\tan\beta = 4$

Find $\cot\beta$ $\sec\beta$

Angles of Elevation and Depression

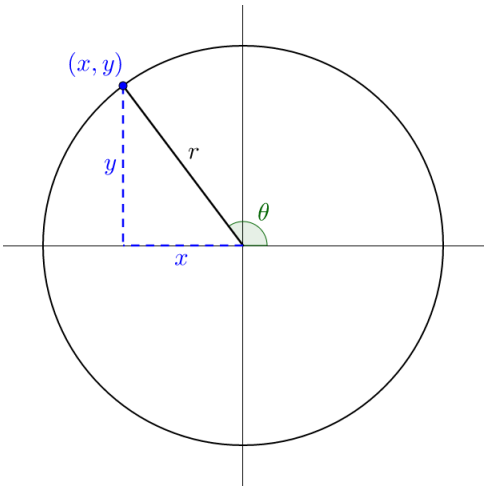
- Both are measured from the _____



A 12-meter flagpole casts a 6-meter shadow. Find the angle of elevation of the sun.

Precalculus

4-05 Trigonometric Functions of Any Angle



Circular Trig Functions

$\sin\theta =$_____ $\csc\theta =$_____

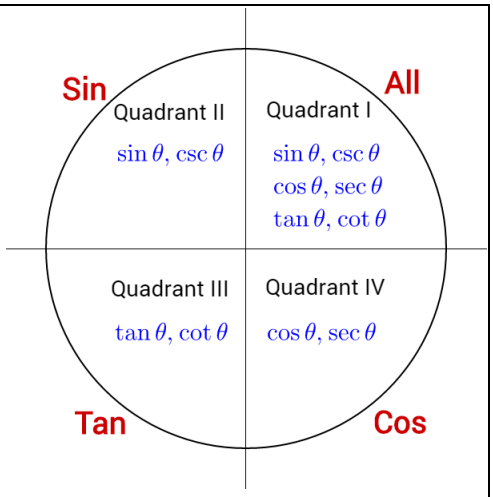
$\cos\theta =$_____ $\sec\theta =$_____

$\tan\theta =$_____ $\cot\theta =$_____

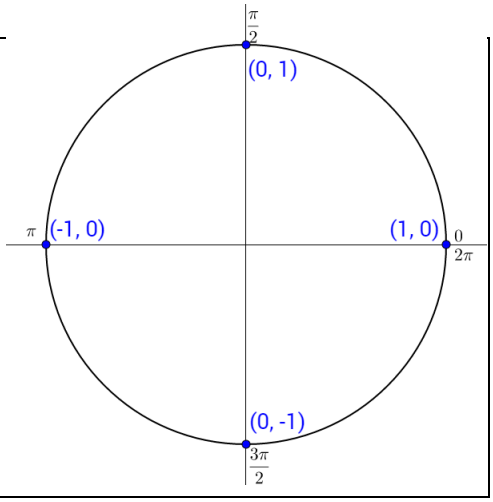
$r = \sqrt{x^2 + y^2}$

Let $(-2, 3)$ be a point on the terminal side of θ. Find sine, cosine, and tangent of θ.

Given $\sin\theta = \frac{4}{5}$ and $\tan\theta < 0$, find $\cos\theta$ and $\csc\theta$.



Evaluate $\sin\pi$ $\tan\frac{\pi}{2}$



Reference Angle

- Angle between _____side and nearest _____

Find the reference angle for $\frac{5\pi}{4}$

Find the reference angle for $\frac{5\pi}{3}$

Use a reference angle to evaluate $\cos\frac{5\pi}{3}$ $\sin 150°$

Use a reference angle to evaluate $\tan\frac{11\pi}{6}$

Let θ be an angle in quadrant III such that $\sin\theta = -\frac{5}{13}$. Find

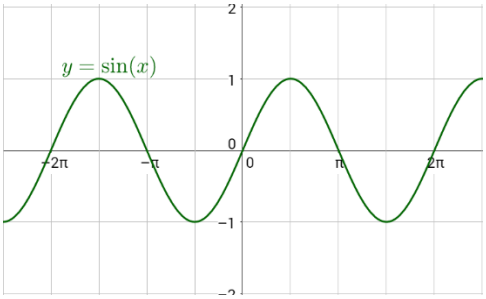
$\sec\theta$ $\tan\theta$

Precalculus

4-06 Graphs of Sine and Cosine

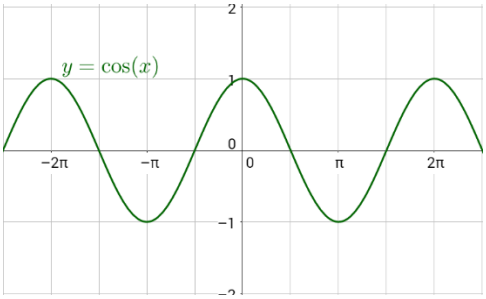
$y = \sin x$

- Starts at _____
- Amplitude = _____
- Period = _____



$y = \cos x$

- Starts at _____
- Amplitude = _____
- Period = _____

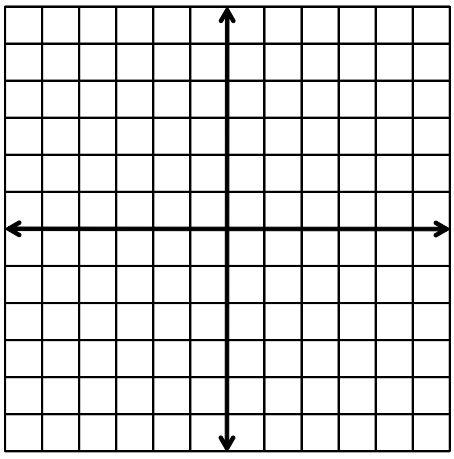


Transformations

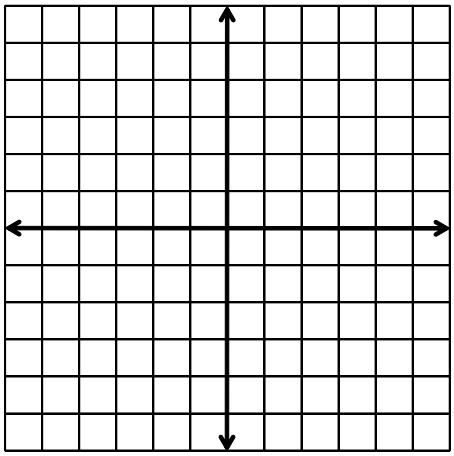
$$y = a\sin(bx - c) + d$$

- a = vertical _____
  - **Amplitude** = _____
- b = horizontal _____
  - **Period** _____
- c = horizontal _____
  - **Phase shift** _____ (Right if c is positive)
- d = vertical _____
  - **Midline** _____

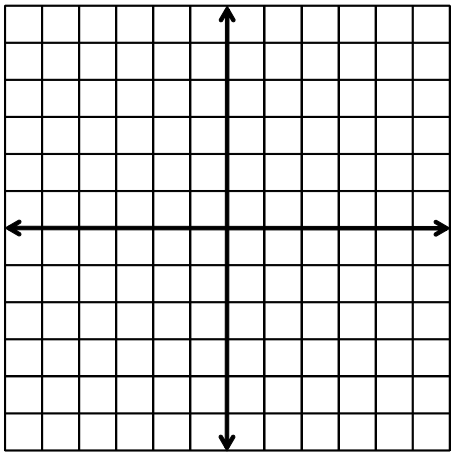
Graph $f(x) = 2\sin x$



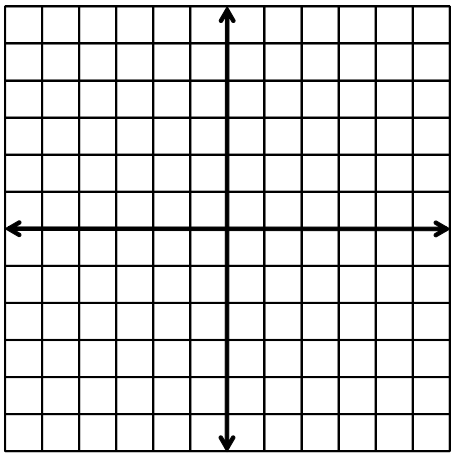
Graph $y = \cos\frac{x}{2}$



Graph $y = 2\sin\left(x - \frac{\pi}{2}\right)$



Graph $y = -\frac{1}{2}\sin(\pi x + \pi) + 1$

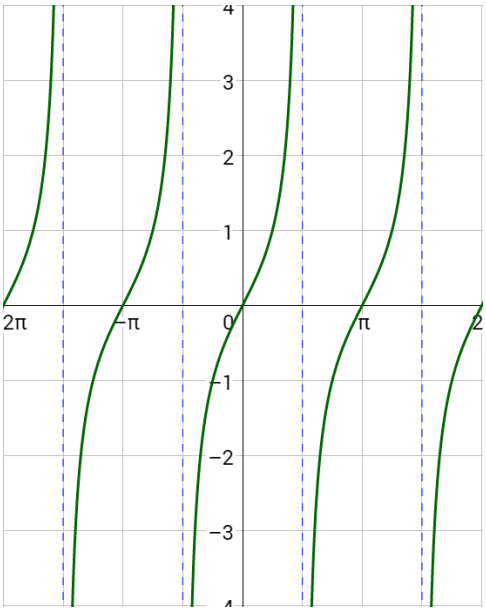


Precalculus

4-07 Graphs of Other Trigonometric Functions

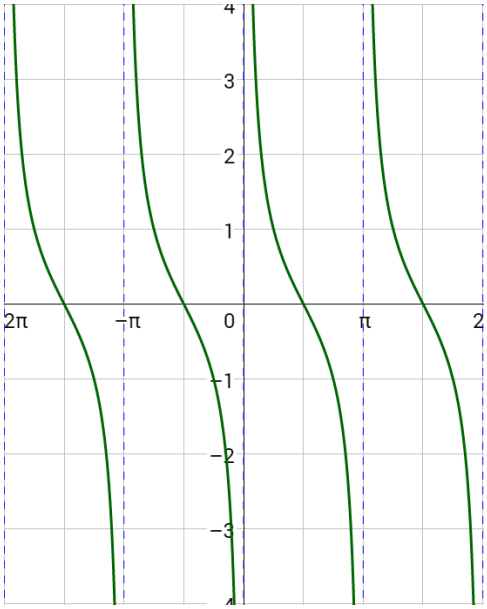
$y = \tan x$

- Period = _____
  - _____
- Asymptotes where tangent undefined, $x =$ _____

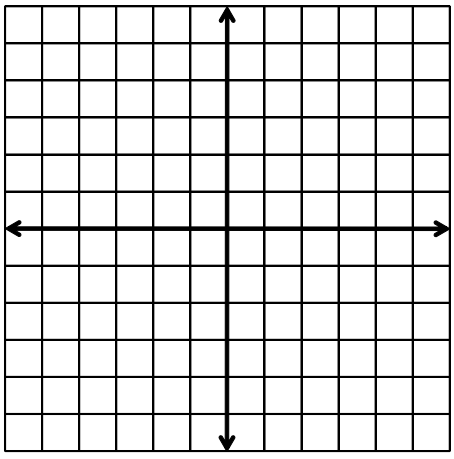


$y = \cot x$

- Period = _____
  - _____
- Asymptotes at x = _____

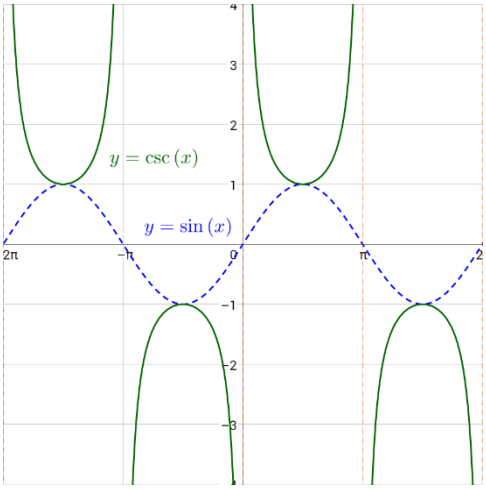


Graph $y = \tan\frac{x}{4}$



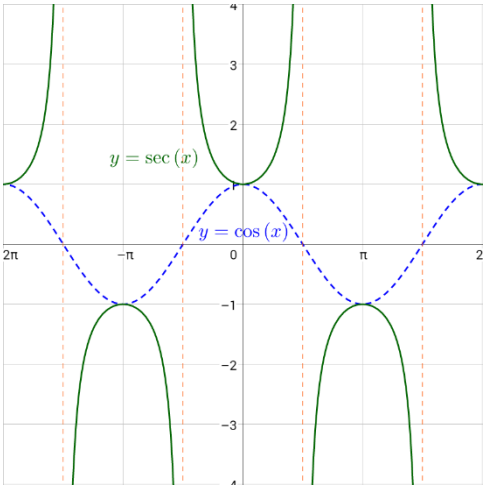
$y = \csc x$

- Period = _____
- Asymptotes where sine = 0
  - $x =$ _____

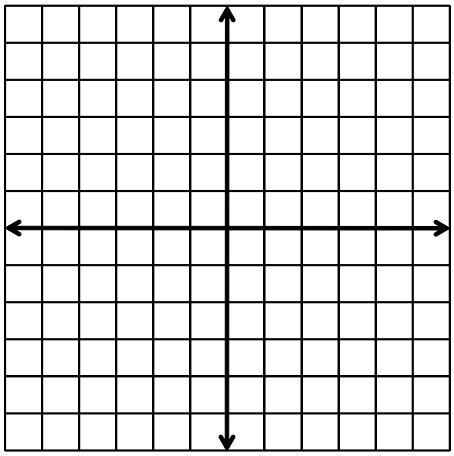


$y = \sec x$

- Period = _____
- Asymptotes where cosine = 0
  - $x =$ _____

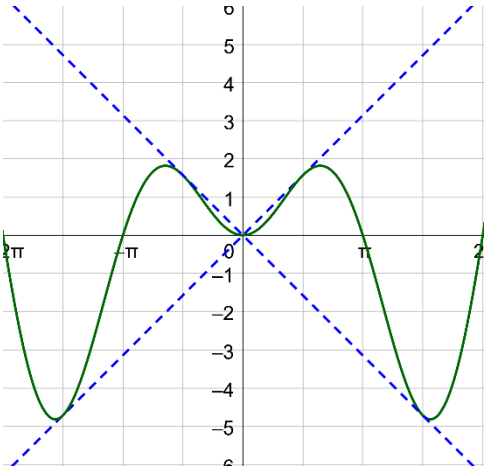


Graph $y = 2\csc\left(x + \frac{\pi}{2}\right)$



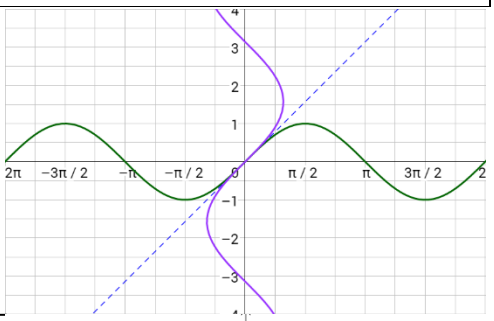
Damped Trig Functions

- $y = \boxed{x}\sin x$
- The x is the _____function
- Graph the _____function and its _____over x-axis
- Graph the trig _____



Precalculus

4-08 Inverse Trigonometric Functions

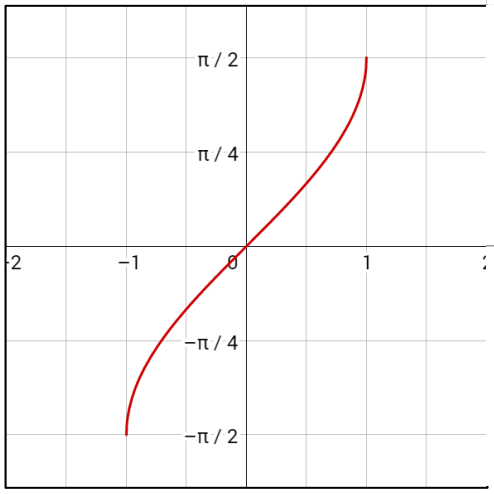


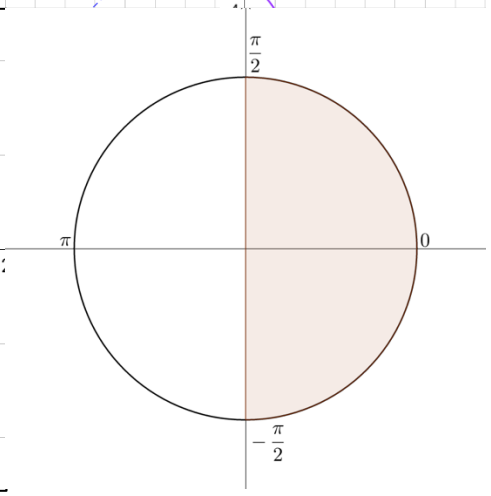
- Inverses switch _____
- _____graph over $y = x$
- $y = \sin x \leftrightarrow x = \sin^{-1} y$
- Inverse trig functions give the _____

Inverse Sine

- $y = \sin^{-1} x$
- $y = \arcsin x$
- Domain: _____
- Range: _____

$\arcsin(-1)$

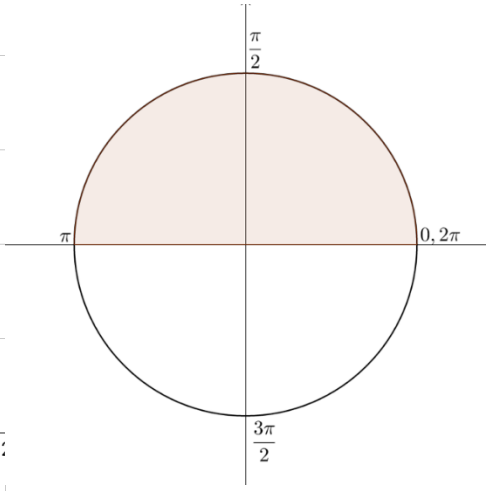




Inverse Cosine

- $y = \cos^{-1} x$
- $y = \arccos x$
- Domain: _____
- Range: _____

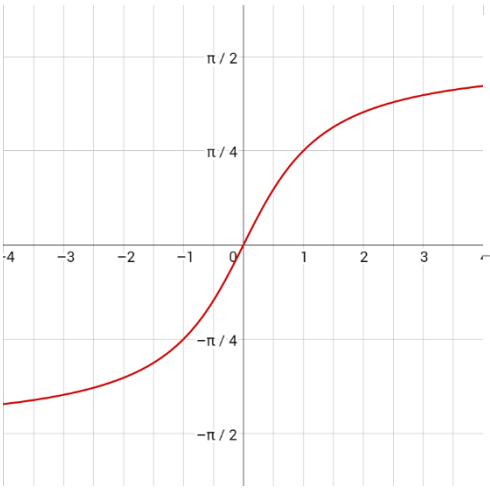
$\arccos \frac{1}{2}$

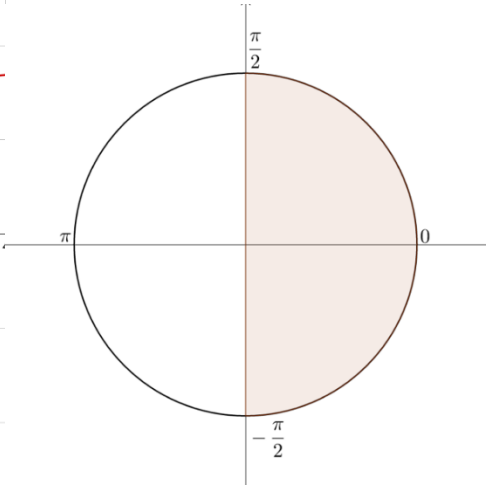


Precalculus 4-08 Name: _____

Inverse Tangent

- $y = \tan^{-1} x$
- $y = \arctan x$
- Domain: _____
- Range: _____





Evaluate

$\sin^{-1}\left(\frac{1}{2}\right)$

$\arcsin\sqrt{3}$

$\cos^{-1}\frac{\sqrt{3}}{2}$

$\arctan\frac{\sqrt{3}}{3}$

Precalculus

4-09 Compositions involving Inverse Trigonometric Functions

- If _____ and _____, then
  - $\sin(\arcsin x) =$ _____ and $\arcsin(\sin y) =$ _____

$\tan(\arctan(-14))$

$\sin(\arcsin \pi)$

$\arcsin\left(\sin\frac{5\pi}{3}\right)$

$\arccos\left(\cos\frac{7\pi}{6}\right)$

$\tan^{-1}(\cos \pi)$

$\cos^{-1}\left(\sin\left(\frac{\pi}{6}\right)\right)$

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

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

$\sec(\arctan x)$

Precalculus

4-10 Applications of Right Triangle Trigonometry

Right triangle trigonometry

1. Draw a _____and label it
2. _____

A ladder leaning against a house reaches 24 ft up the side of the house. The ladder makes a 60° angle with the ground. How far is the base of the ladder from the house?

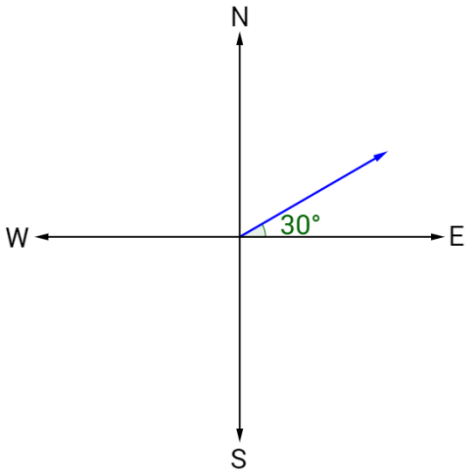
Precalculus

4-11 Bearings and Simple Harmonic Motion

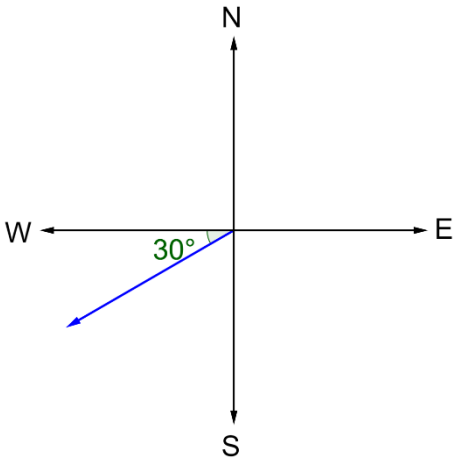
Bearings

- Bearings show _____

_____ 30° _____



_____ 30° _____

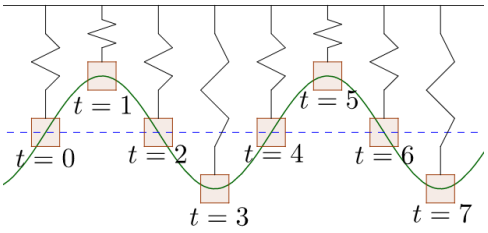


A sailboat leaves a pier and heads due west at 8 knots. After 15 minutes the sailboat tacks, changing course to N 16° W at 10 knots. Find the sailboat's bearing and distance from the pier after 12 minutes on this course.

Precalculus 4-11 Name: _____

Simple Harmonic Motion (SHM)

- $y = a \sin \omega x$
- $y = a \cos \omega x$
- Period _____
- Frequency (cycles per second) _____
- Equilibrium is the _____



Find a model for simple harmonic motion with displacement at $t = 0$ is 0, amplitude of 4 cm, and period of 6 sec.

Given the equation for simple harmonic motion $d = 4 \cos 6\pi t$

Find maximum displacement

Find frequency

Find value of d when $t = 4$

Find the least positive value of t for which $d = 0$