Mr. Wright's Math Extravaganza

Precalculus
Trigonometry

Level 2.0: 70% on test, Level 3.0: 80% on test, Level 4.0: level 3.0 and success on applications

| Score	I Can Statements
4.0	☐ I can demonstrate in-depth inferences and applications that go beyond what was taught.
3.5	In addition to score 3.0 performance, partial success at score 4.0 content.
3.0	☐ I can use radians. ☐ I can evaluate trigonometric functions. ☐ I can graph trigonometric functions. ☐ I can use inverse trigonometric functions.
2.5	No major errors or omissions regarding score 2.0 content, and partial success at score 3.0 content.
2.0	☐ I can draw angles in standard position. ☐ I can convert between degrees and radians. ☐ I can use the unit circles to evaluate trigonometric functions. ☐ I can use right triangles to evaluate trigonometric functions. ☐ I can use basic trigonometric identities. ☐ I can evaluate trigonometric functions using reference angles. ☐ I can evaluate compositions of inverse functions. ☐ I can solve problems with right triangles and trigonometry.
1.5	Partial success at score 2.0 content, and major errors or omissions regarding score 3.0 content.
1.0	With help, partial success at score 2.0 content and score 3.0 content.
0.5	With help, partial success at score 2.0 content but not at score 3.0 content.
0.0	Even with help, no success.

Richard Wright

Precalculus

4-01 Angle Measures

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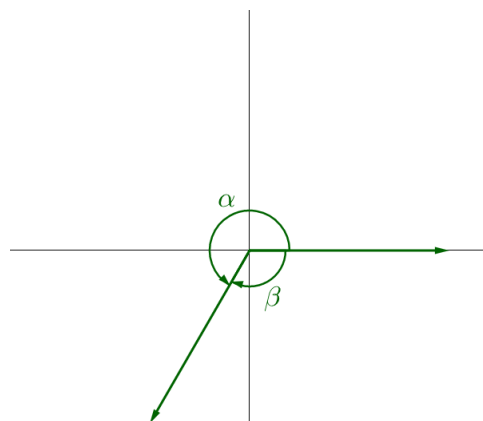
Angles in standard position

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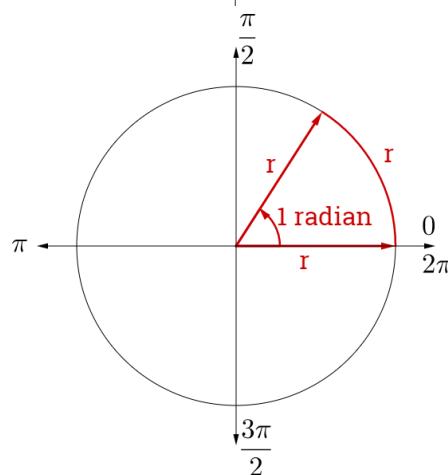- Initial side on positive _____
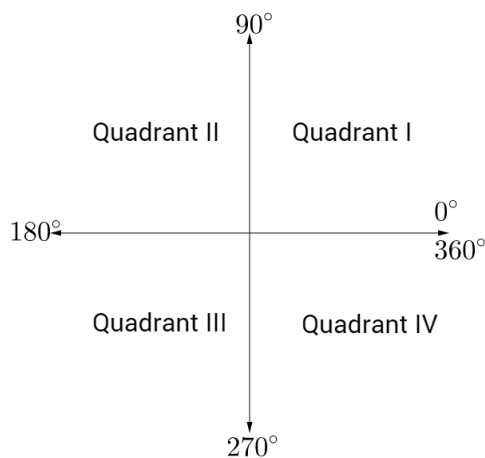- Terminal side rotates _____
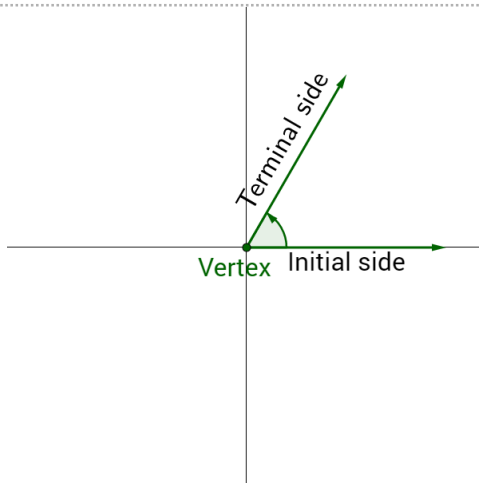
Coterminal Angles

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

Angle Measures

- Degree Measures

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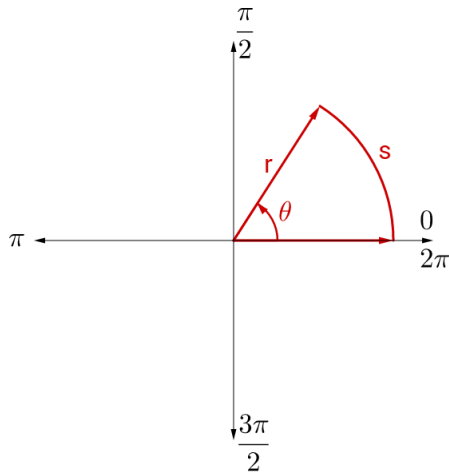- Supplementary → $\alpha + \beta =$ _____

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

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

Convert radians to degrees: 180° = π   Convert 120° to radians

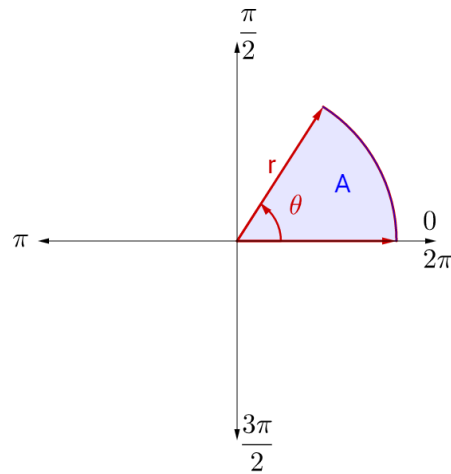## Applications

- 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.

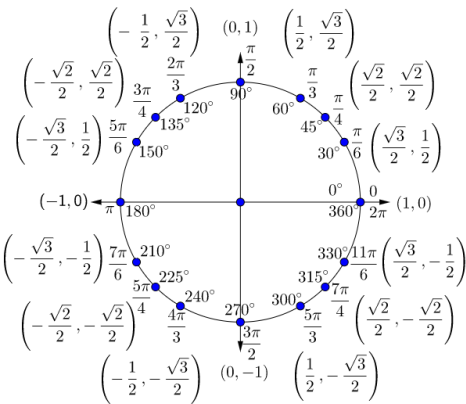How fast is a tooth at the edge of the gear moving in in./s?

Precalculus

4-02 Unit Circle

Unit circle

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

Trigonometric Functions (Unit circle)

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

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

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

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

Evaluate

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

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

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

Evaluate

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

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

Name: _____

Precalculus
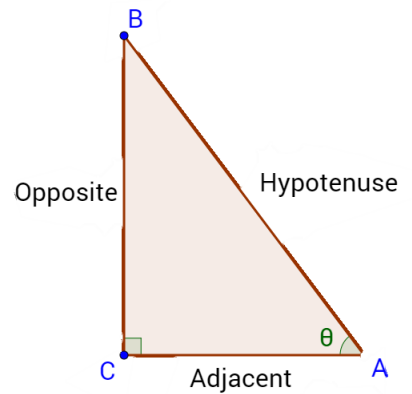
4-03 Right Triangle Trigonometry

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

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

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

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

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

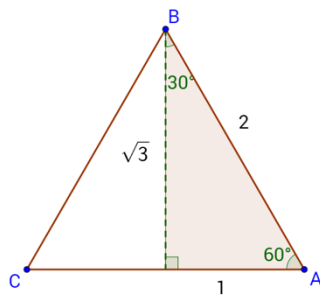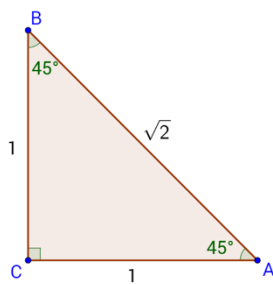$$\cot A = \frac{adj}{opp}$$

Find the values of the six trig functions
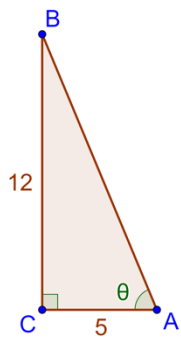
Special right triangles

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

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

$\tan 30°$

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

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4-04 Right Triangle Trigonometry and Identities

Basic Identities

Reciprocal

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

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

Quotient

$\tan u = \dfrac{\sin u}{\cos u}$ $\qquad\qquad$ $\cot u = \dfrac{\cos u}{\sin u}$

Pythagorean

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

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

Cofunction Identities

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

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

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

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

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

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

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

Angles of Elevation and Depression

- Both are measured from the _____

Angle of Depression
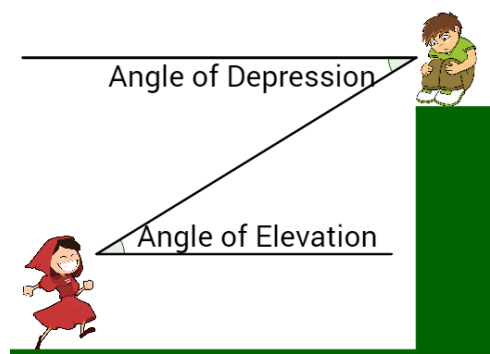
Angle of Elevation

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

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4-05 Trigonometric Functions of Any Angle

Circular Trig Functions

$\sin \theta =$_____ $\csc \theta =$_____
$\cos \theta =$_____ $\sec \theta =$_____
$\tan \theta =$_____ $\cot \theta =$_____
$r = \sqrt{x^2 + y^2}$
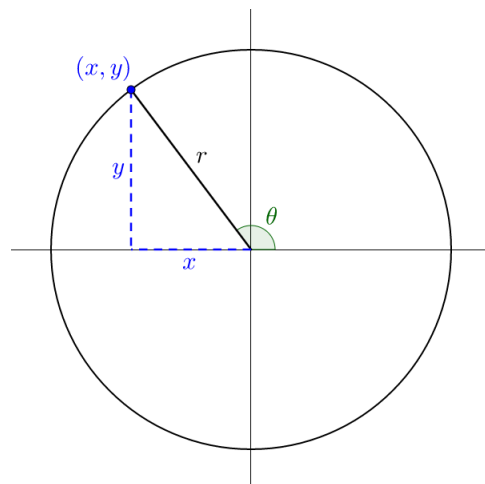
Let $(-2, 3)$ be a point on the terminal side of θ. Find sine, cosine, and tangent of θ.

Given $\sin \theta = \frac{4}{5}$ and $\tan \theta < 0$, find $\cos \theta$ and $\csc \theta$.
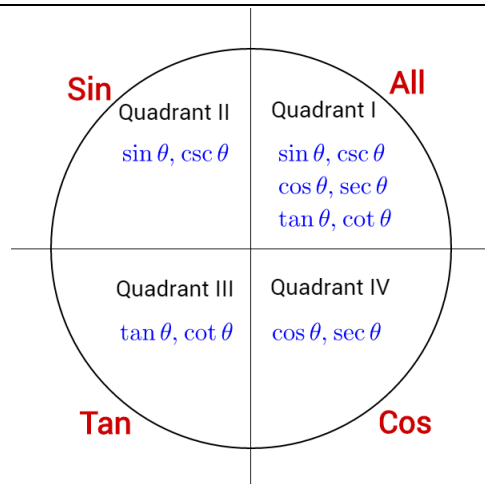
Evaluate $\sin \pi$ $\tan \frac{\pi}{2}$
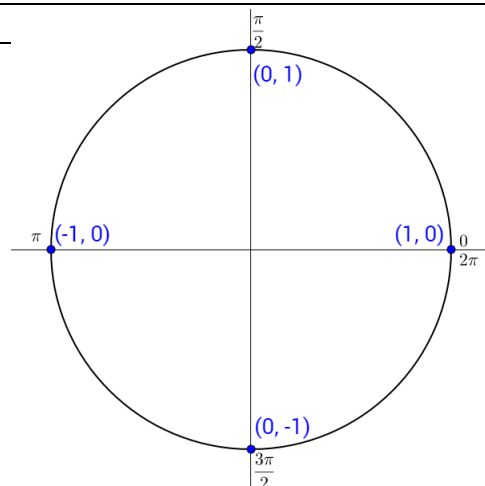
Reference Angle

- 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

$y = \sin x$	$y = \cos x$

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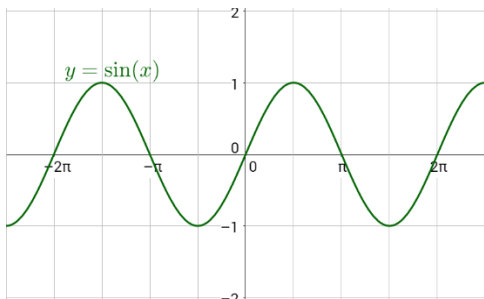
- Starts at _____
- Amplitude = _____
- Period = _____
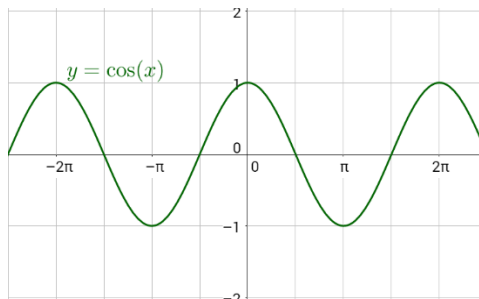
Transformations

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

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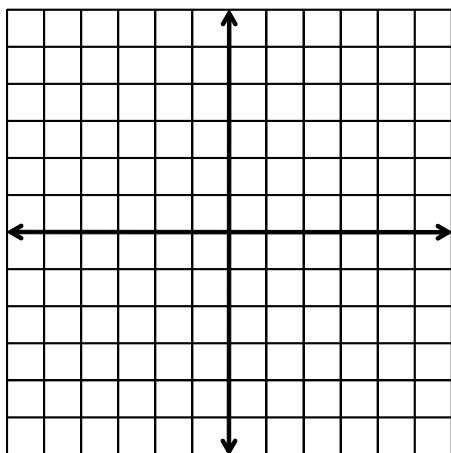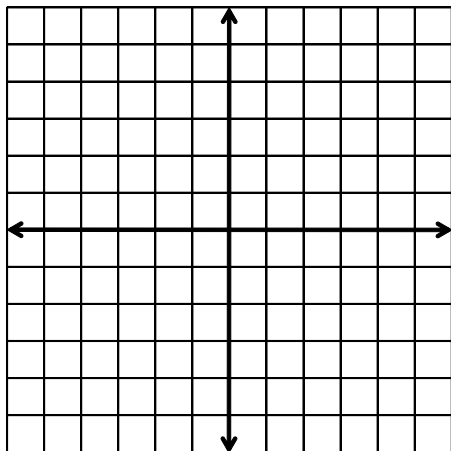- d = vertical _____
  - **Midline** _____

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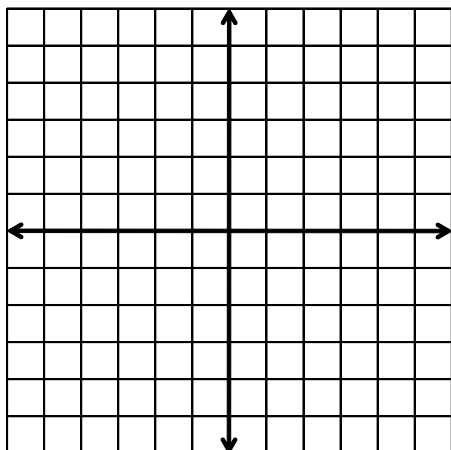
Graph $y = \cos\frac{x}{2}$
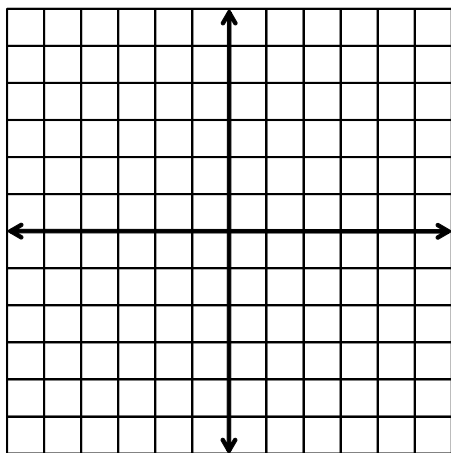
Graph $y = 2\sin\left(x - \frac{\pi}{2}\right)$

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

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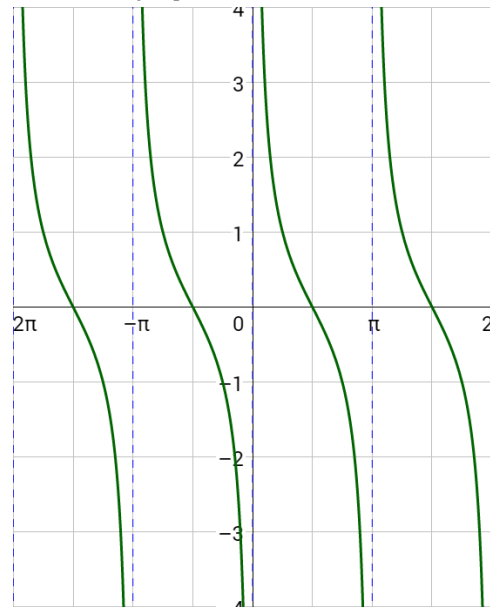## 4-07 Graphs of Other Trigonometric Functions

$y = \tan x$

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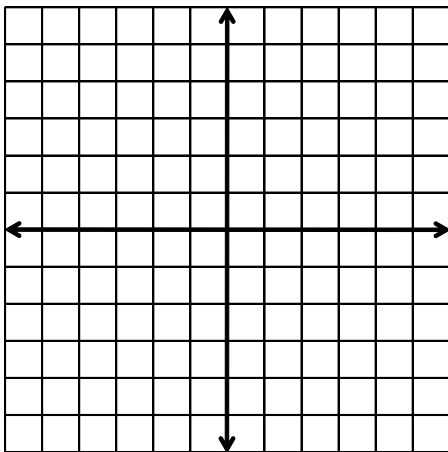- Asymptotes where tangent undefined, $x =$ _____

$y = \cot x$
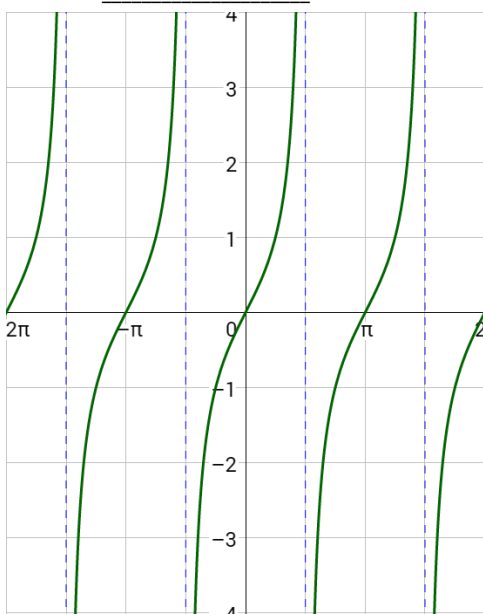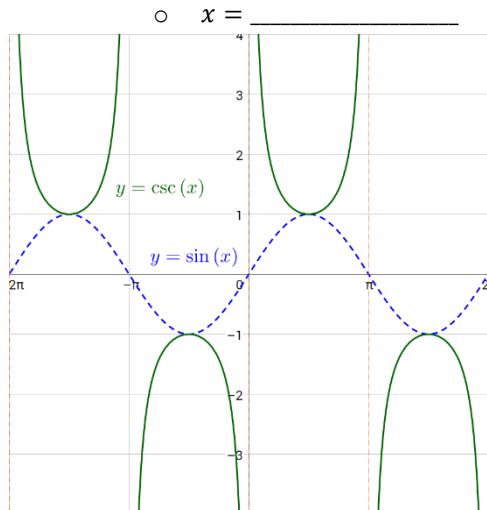
- Period = _____
  - _____
- Asymptotes at $x =$ _____
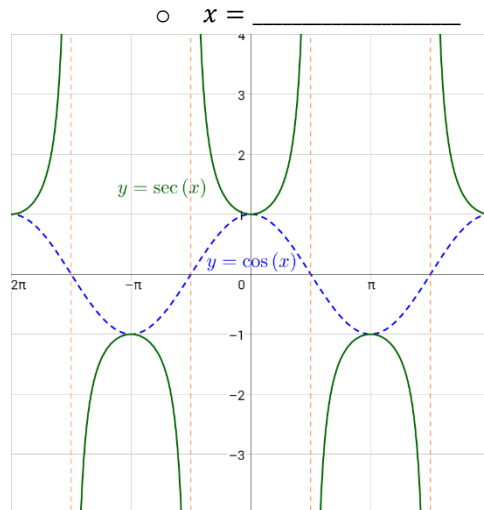

Graph $y = \tan \frac{x}{4}$

$y = \csc x$	$y = \sec x$

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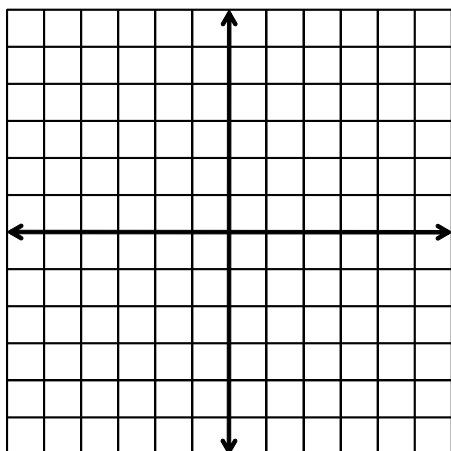 - $x = $ _____

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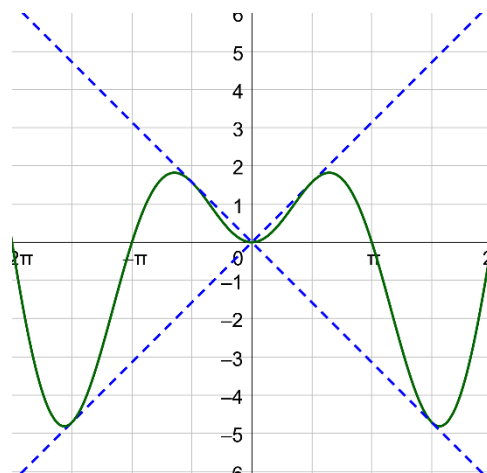 - $x = $ _____

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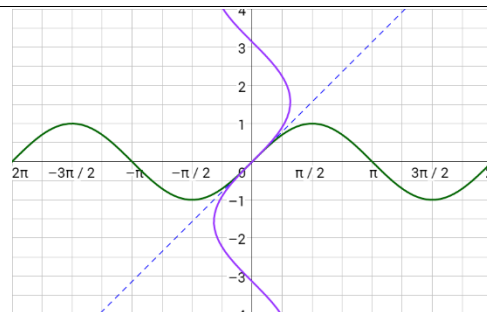

Damped Trig Functions

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

Precalculus

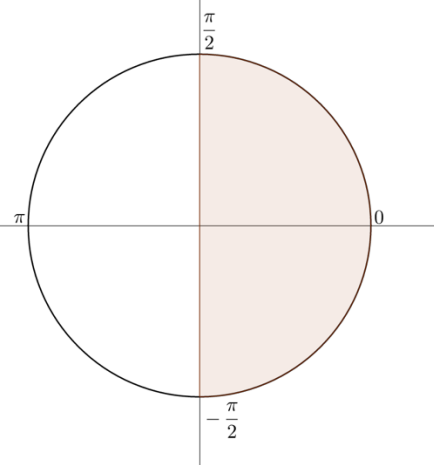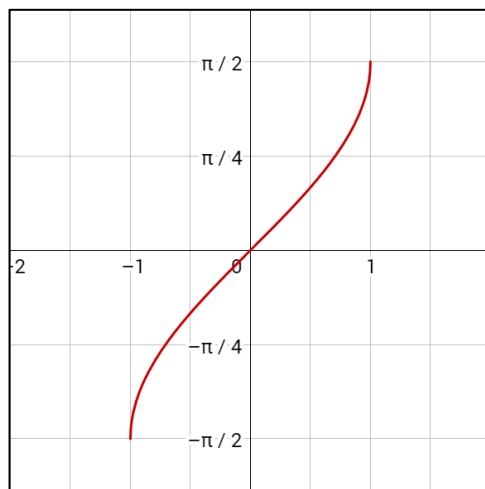## 4-08 Inverse Trigonometric Functions

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

Inverse Sine

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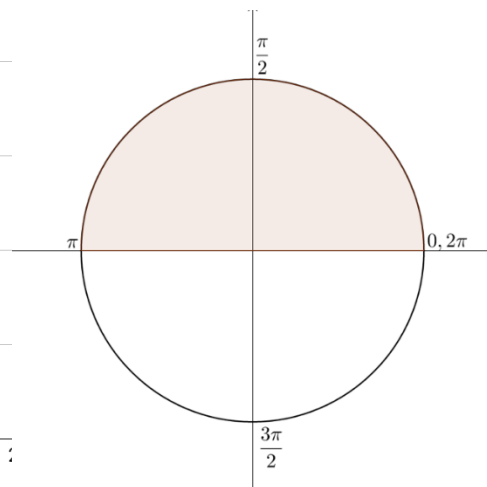- $y = \arcsin x$
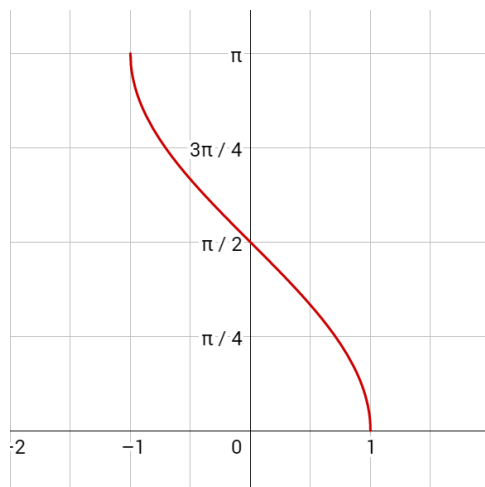- Domain: _____
- Range: _____
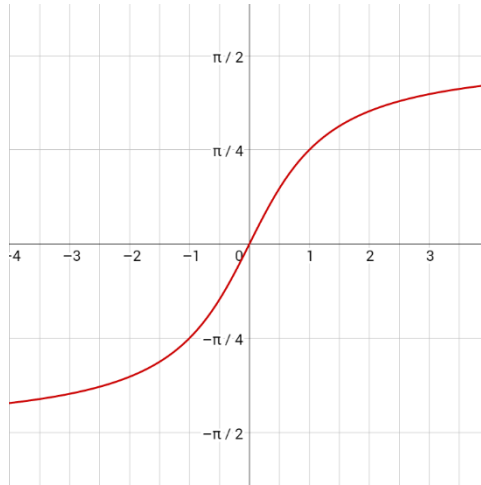
arcsin(-1)

Inverse Cosine

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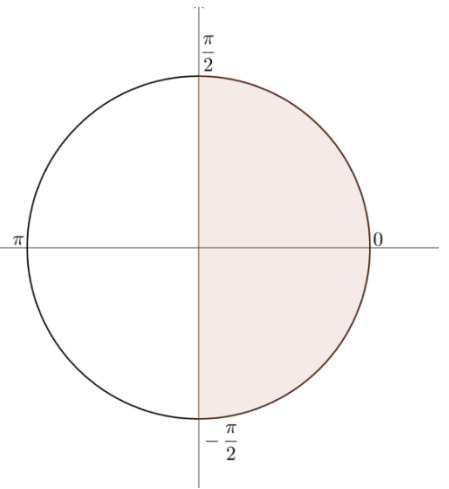- Domain: _____
- Range: _____

arccos$\frac{1}{2}$

Inverse Tangent

Name: _____

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

Evaluate

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

$\arcsin \sqrt{3}$

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

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

To be used with Richard Wright's Precalculus

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4-09 Compositions involving Inverse Trigonometric Functions

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

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

$\sin(\arcsin \pi)$

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

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

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

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

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

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

$\sec(\arctan x)$

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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?
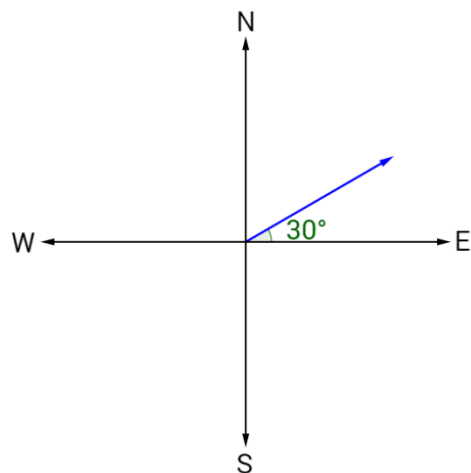
Precalculus

4-11 Bearings and Simple Harmonic Motion

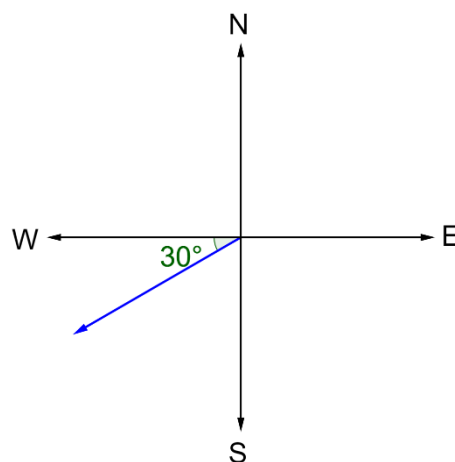## Bearings

- Bearings show _____

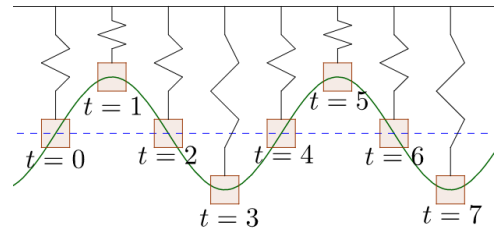_____ 30° _____   _____ 30° _____

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.

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 $d = 0$