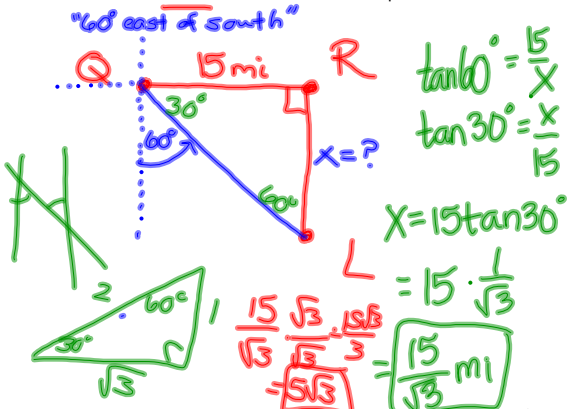
Review: Applications of right triangles

1. A lightning detector at point Q is situated 15 miles west of a central fire station at point R. The bearing from Q to where lightning hits due south of R is S60°E. How far is the hit from point R?



$\tan 60° = \frac{15}{x}$

$\tan 30° = \frac{x}{15}$

$x = 15\tan 30°$

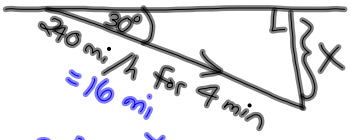
$= 15 \cdot \frac{1}{\sqrt{3}}$

$\frac{15}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{15\sqrt{3}}{3} = 5\sqrt{3}$

$= \frac{15}{\sqrt{3}}$ mi

2. An airplane traveling 240 miles per hour is descending at an angle of 30°. Through how many vertical miles will the plane descend in 4 minutes?

*angles of elevation, depression, descent, etc. are always measured from the horizontal



distance = rate · time $v = \frac{s}{t}$ $s = vt$

$\frac{240 \text{ mi}}{1 \text{ hr}} \cdot \frac{4 \text{ min}}{1} \cdot \frac{1 \text{ hr}}{60 \text{ min}} = 16$ mi

$\sin 30° = \frac{x}{16}$

$x = 16\sin 30° = 16 \cdot \frac{1}{2} = 8$ mi

Quiz #2 Solutions

1. $\cos 225° = -\frac{1}{\sqrt{2}}$
2. $\csc(-240°) = \frac{2}{\sqrt{3}}$
3. $\cot 180° =$ *undefined*
4. $\sin 720° = 0$
5. $\csc 135° = \sqrt{2}$
6. $\tan 330° = -\frac{1}{\sqrt{3}}$
7. A ***reference angle*** α is the acute angle between the terminal side of the given angle θ and **the x-axis**.
8. Two angles are considered to be ***coterminal*** if they differ by integer multiples of $360°$ *or* 2π.
9. The function value of an angle is equal to the ***cofunction*** value of its **complement**.

Bonus:

A. $\sin 3\pi = 0$

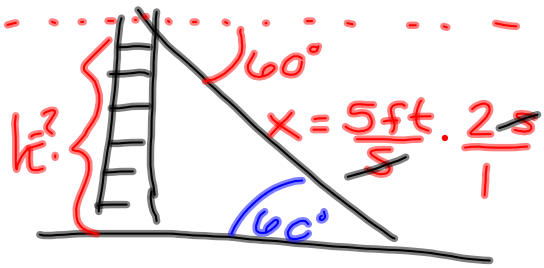
B. $\cos\frac{7\pi}{6} = -\frac{\sqrt{3}}{2}$

C. $\tan\left(-\frac{3\pi}{4}\right) = 1$

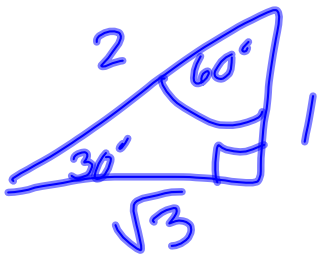
60° ∠ of dep.

5 ft/s for 2 s

h = ? ft



$x = 5\text{ft} \cdot \frac{2\text{s}}{1\text{s}} = 10$ ft



$\sin 60° = \frac{h}{10\text{ft}}$

$h = 10\sin 60°$ ft

$= 10 \cdot \frac{\sqrt{3}}{2} = 5\sqrt{3}$ ft

3. $r = 24$ in ; $v = 8$ mi/h ; $\omega = ?$ rev/min

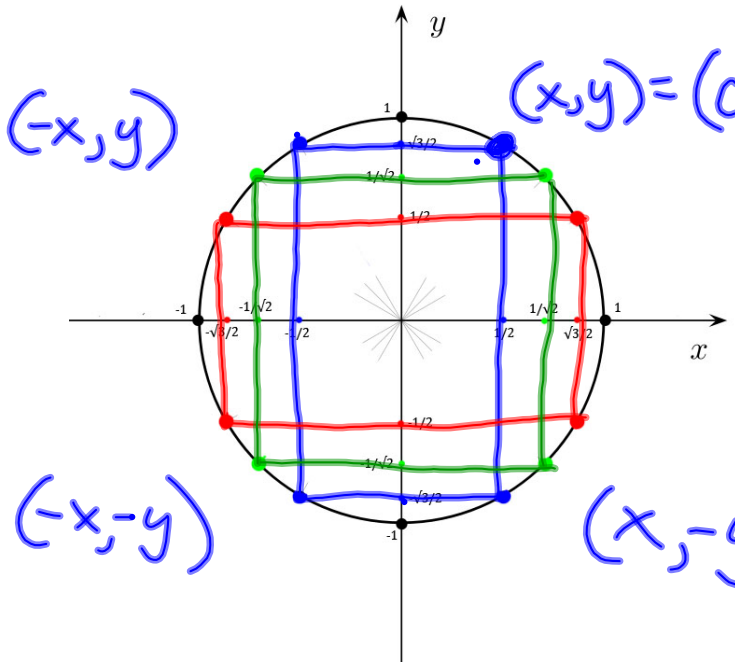
$\frac{v}{r} = \frac{rw}{r}$ $\omega = \frac{v}{r} = \frac{v}{1} \cdot \frac{1}{r}$

$\omega = \frac{8\text{ mi}}{\text{h}} \cdot \frac{1}{24\text{ in}} \cdot \frac{1\text{ h}}{60\text{ min}} \cdot \frac{5280\text{ ft}}{1\text{ mi}} \cdot \frac{12\text{ in}}{1\text{ ft}} \cdot \frac{1\text{ rev}}{2\pi}$

$= \frac{176}{\pi}$ rev/min

5.5 Circular Functions

Reflections on the Unit Circle



Even/Odd Functions

A function f is even if $f(-x)=f(x)$

even functions are symmetric w.r.t. the y-axis

A function f is odd if $f(-x)=-f(x)$

odd functions are symmetric w.r.t. the origin

cosine & secant are even

other 4 are odd

$\tan(-x)=\frac{\sin(-x)}{\cos(-x)}=\frac{-\sin x}{\cos x}=-\tan x$

Odd-Even Identities

$\cos(-x)=\cos x$, $\sin(-x)=-\sin x$, $\tan(-x)=-\tan x$

$\sec(-x)=\sec x$, $\csc(-x)=-\csc x$, $\cot(-x)=-\cot x$

Domain/Range

The domain of a function is the set of all input values for which the function is defined (all the x-values that "make sense" when plugged into the function)

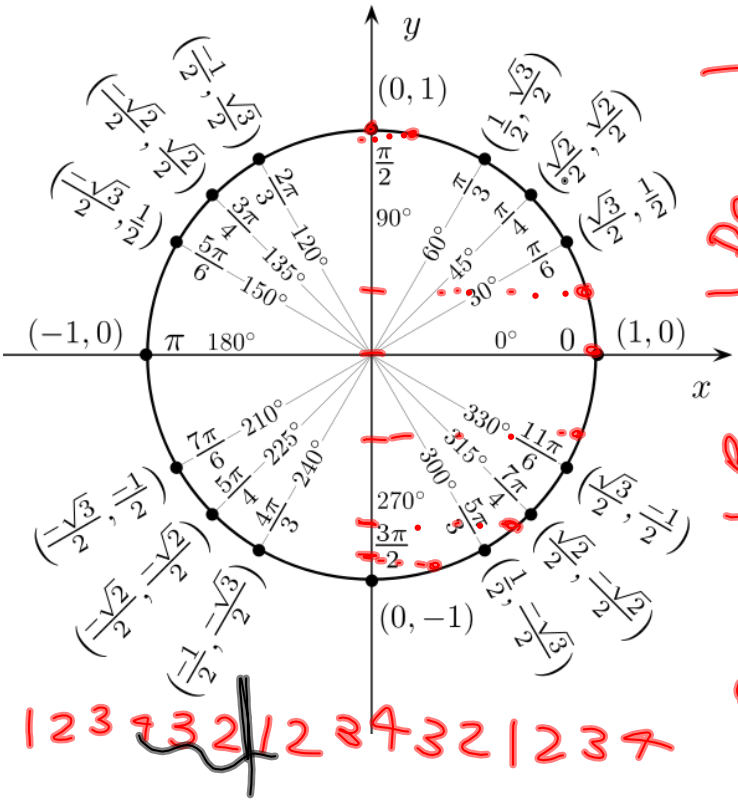
The range of a function is the output of the domain (all the y-values that the function takes on)

Periodicity

The period of a function is the smallest interval over which the function repeats itself

1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 . . .

Determining domain, range and period for the Sine & Cosine functions



	sin	cos
Domain	$\mathbb{R}$ $(-\infty, \infty)$	$\mathbb{R}$ $(-\infty, \infty)$
Range	$[-1, 1]$	$[-1, 1]$
Period	2π	2π

1 2 3 4 3 2 1 2 3 4 3 2 1 2 3 4

Graphs of the sine and cosine functions

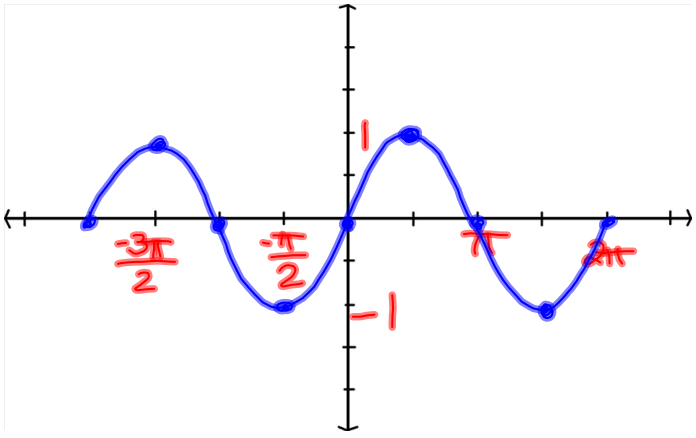
y=sinx

domain: $(-\infty, \infty)$

range: $[-1, 1]$

period: 2π

odd



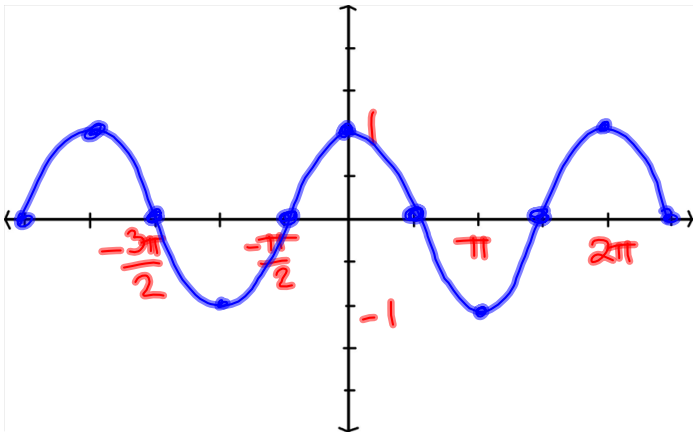
y=cosx

domain : $(-\infty, \infty)$

range : $[-1, 1]$

period : 2π

even



Domain/Range/Period/Graphs of the other 4 Trig functions?

Function	Domain	Range	Period
$y = \sin x$	$(-\infty, \infty)$	$[-1,1]$	2π
$y = \cos x$	$(-\infty, \infty)$	$[-1,1]$	2π
$y = \csc x$	$\{x \mid x \text{ is not an integer multiple of } \pi\}$	$(-\infty, -1] \cup [1, \infty)$	2π
$y = \sec x$	$\left\{x \mid x \text{ is not an odd multiple of } \frac{\pi}{2}\right\}$	$(-\infty, -1] \cup [1, \infty)$	2π
$y = \tan x$	$\left\{x \mid x \text{ is not an odd multiple of } \frac{\pi}{2}\right\}$	$(-\infty, \infty)$	π
$y = \cot x$	$\{x \mid x \text{ is not an integer multiple of } \pi\}$	$(-\infty, \infty)$	π

Why?

$\csc x = \frac{1}{\sin x}$

$\sec x = \frac{1}{\cos x}$

$\frac{1}{1}\ \frac{1}{2}\ \frac{1}{3}\ \frac{1}{4}\ \frac{1}{1}\ \frac{1}{2}\ \frac{1}{3}\ \frac{1}{4}$

$\tan x = \frac{\sin x}{\cos x}$

$\cot x = \frac{\cos x}{\sin x}$

Homework:

5.5 #1-6; 43-44; 49-54

and

Test #1 Practice Problems (handout)

Tomorrow (Tuesday) - Review

Wednesday - **Test #1**

Friday - Graphing