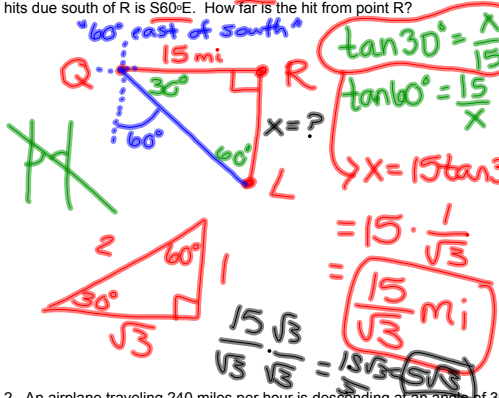Review: Applications of right triangles

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?
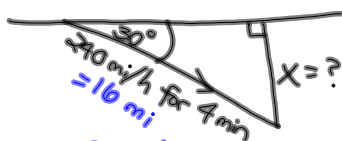
"60° east of south"

Q · · · · 15 mi · · · · R
30°
60°   60°
X = ?
L

$\tan 30° = \frac{x}{15}$

$\tan 60° = \frac{15}{x}$

$X = 15 \tan 30$

2   60°   1
30°
$\sqrt{3}$

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

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

$\boxed{\frac{15}{\sqrt{3}} \text{ mi}}$

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

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

30°
240 mi/h for 4min
= 16 mi
X = ?

$v = \frac{s}{t}$ $s = vt$

$= \frac{240 mi}{h} \cdot \frac{4 min}{1} \cdot \frac{1 h}{60 min}$

$= 16 mi$

$\sin 30° = \frac{x}{16}$

$X = 16 \sin 30°$

$= 16 \cdot \frac{1}{2} = \boxed{8 \text{ mi}}$

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

79. $r = 39 in$; $\theta = ? rad$; $t = 12 s$;

$V = 22 mi/h$

$S = r\theta$

$V = \frac{S}{t}$

$\therefore V = \frac{r\theta}{t}$

$\theta = \frac{tv}{r} = \frac{12 s \cdot 22 mi}{1} \cdot \frac{1}{h} \cdot \frac{1}{39 in}$

5.5 Circular Functions

Reflections on the Unit Circle

$(x,y) = (\cos\theta, \sin\theta)$
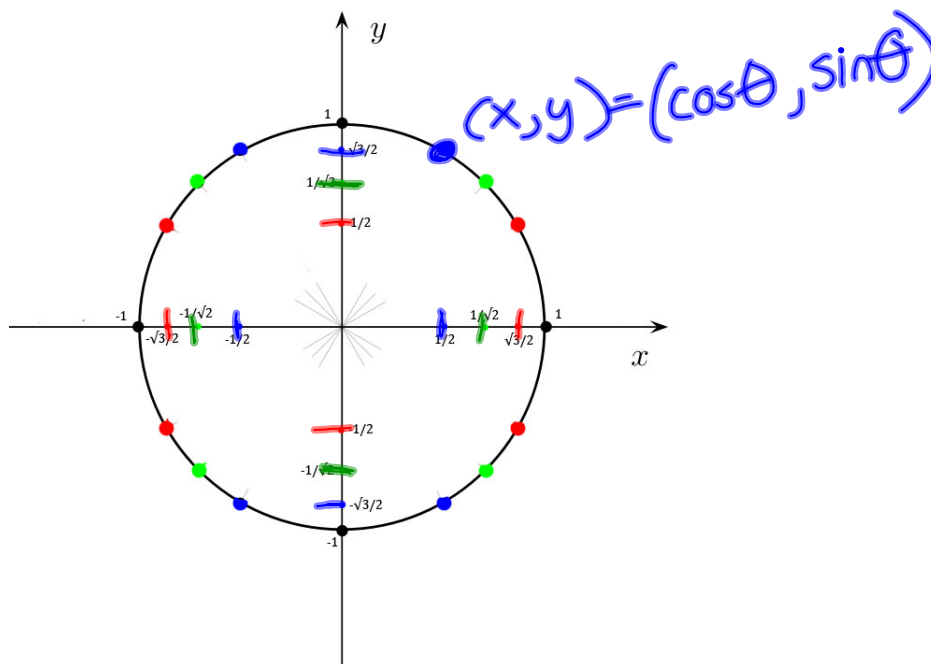
Even/Odd Functions

A function f is <u>even</u> if $f(-x) = f(x)$

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

A function f is <u>odd</u> if $f(-x) = -f(x)$

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

cosine, secant – even

all others – odd

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

$= -\tan x$

Odd-Even Identities

even   odd

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

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

Domain/Range

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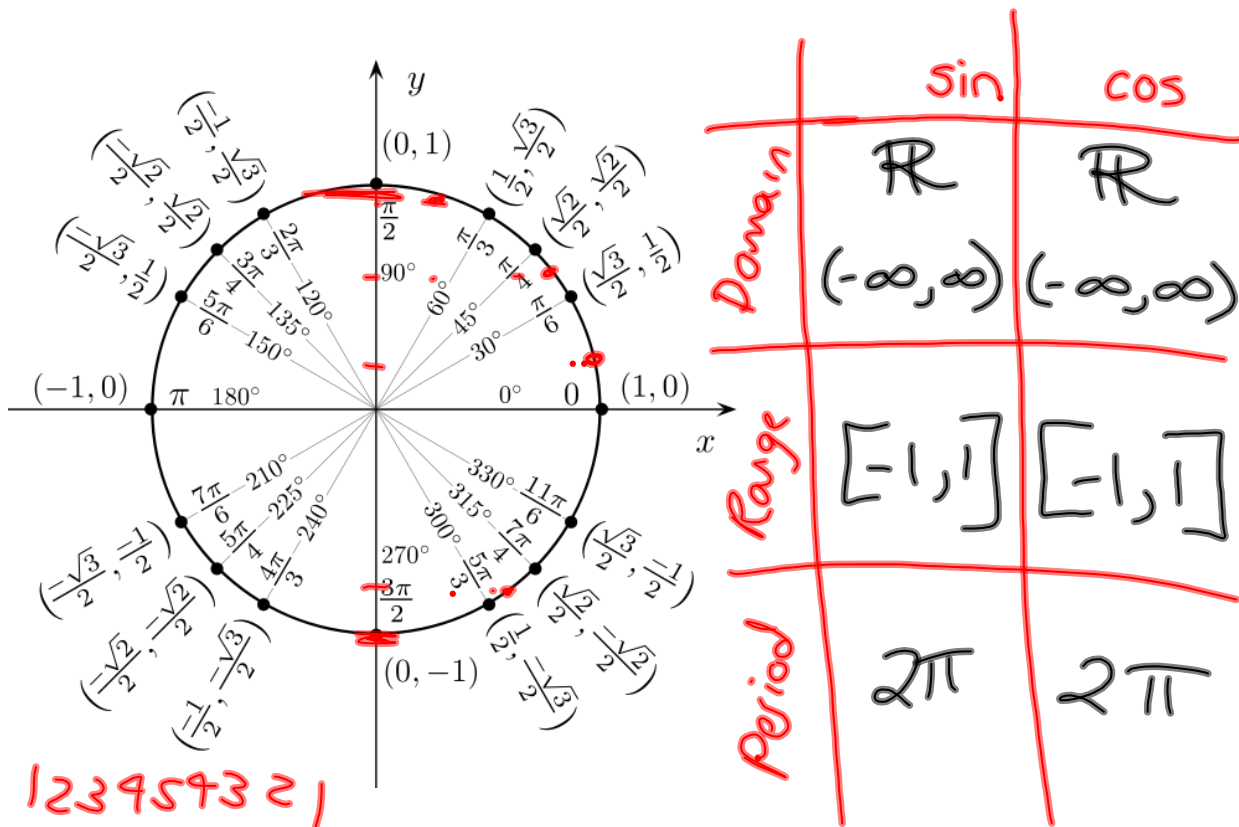
The <u>range</u> of a function is the output of the domain (all the y-values that the function takes on)

Periodicity

The <u>period</u> of a function is the smallest interval over which the function repeats itself

1234, 1 2 3 4 1 2 3 4 1 2 3 4 . . .

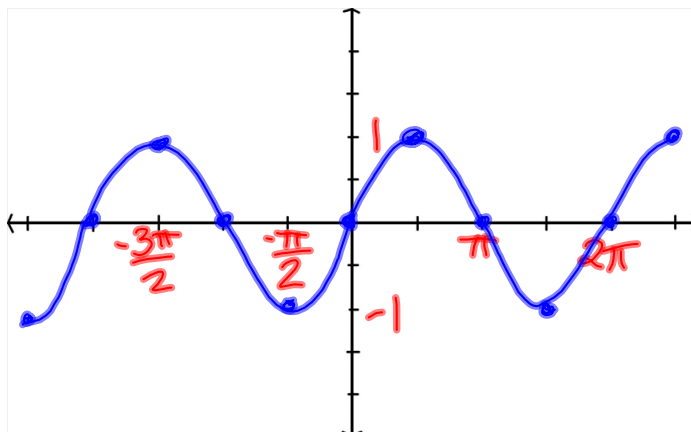Determining domain, range and period for the Sine & Cosine functions

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

123454321

Graphs of the sine and cosine functions

y=sinx

domain : $\mathbb{R}$

range : $[-1,1]$

period : 2π

odd

y=cosx

domain : $\mathbb{R}$

range : $[-1,1]$

period : 2π

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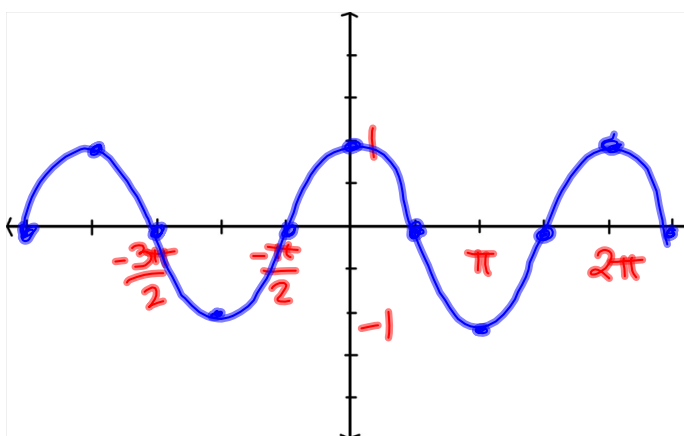
Domain/Range/Period/Graphs of the other 4 Trig functions?

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
$y = \sec x$	$\{x \mid x \text{ is not an odd multiple of } \frac{\pi}{2}\}$	$(-\infty, -1] \cup [1, \infty)$	2π
$y = \tan x$	$\{x \mid x \text{ is not an odd multiple of } \frac{\pi}{2}\}$	$(-\infty, \infty)$	π
$y = \cot x$	$\{x \mid x \text{ is not an integer multiple of } \pi\}$	$(-\infty, \infty)$	π

Why?

$$\sec x = \frac{1}{\cos x} \qquad \tan x = \frac{\sin x}{\cos x}$$

$$\csc x = \frac{1}{\sin x} \qquad \cot x = \frac{\cos x}{\sin x}$$

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

Homework:

<u>5.5</u> #1-6; 43-44; 49-54

and

Test #1 Practice Problems (handout)

Tomorrow (Tuesday) - Review

Wednesday - **Test #1**

Friday - Graphing