

Section 13.4 Graphing Circular Functions

The Sine Function

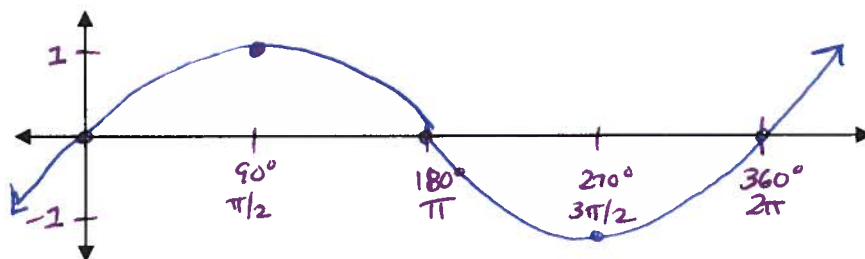
Equation: $y = \sin(x)$

Domain: All Reals

Range: $[-1, 1]$

x (angle)	y = sin(x)
0° (0)	0
90° ($\pi/2$)	1
180° (π)	0
270° ($3\pi/2$)	-1
360° (2π)	0

Graph:



Vocabulary Terms

Period: the x -distance it takes to complete one cycle.

Cycle: one period of a function

Frequency: The number of cycles completed over 2π (x -direction)

Amplitude: The distance between the midline and the maximum or minimum (always positive)

For $y = \sin(x)$, the period is 2π and the amplitude is 1.

The Cosine Function

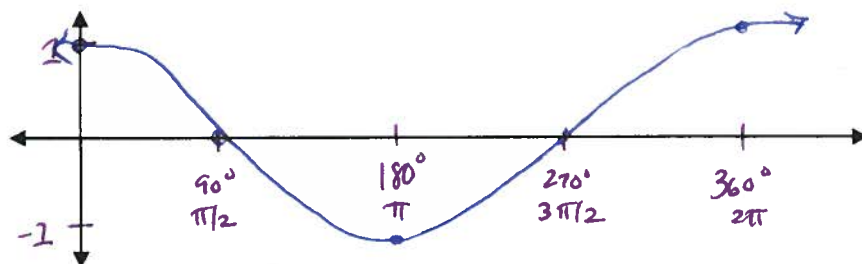
Equation: $y = \cos(x)$

Domain: All Reals

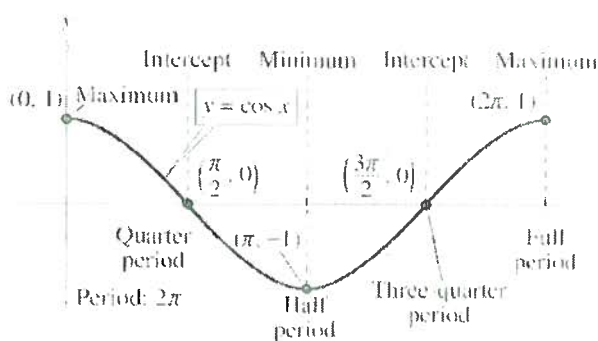
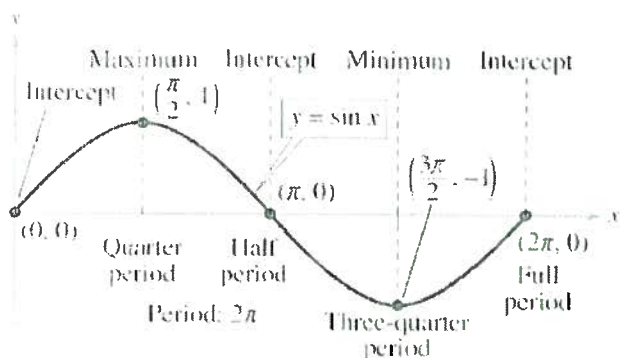
Range: $[-1, 1]$

x (angle)	y = cos(x)
0° (0)	1
90° ($\pi/2$)	0
180° (π)	-1
270° ($3\pi/2$)	0
360° (2π)	1

Graph:



For $y = \cos(x)$, the period is 2π and the amplitude is 1.



To graph one period of a sine or cosine curve, plot the five key points

The Tangent Function

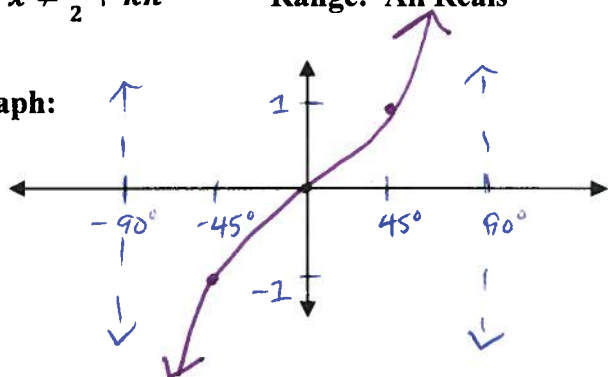
Equation: $y = \tan(x)$

Domain: $x \neq 90^\circ + k180^\circ$ or $x \neq \frac{\pi}{2} + k\pi$

Range: All Reals

x (angle)	y = sin (x)	y = cos (x)	y = tan(x)
-90° ($-\pi/2$)	-1	0	undefined
-45° ($-\pi/4$)	$-\sqrt{2}/2$	$\sqrt{2}/2$	-1
0° (0)	0	1	0
45° ($\pi/4$)	$\sqrt{2}/2$	$\sqrt{2}/2$	1
90° ($\pi/2$)	1	0	undefined

Graph:



For $y = \tan(x)$, the period is π and there is no amplitude.
There are asymptotes at $x = 90^\circ + k180^\circ$ or $x = \frac{\pi}{2} + k\pi$ (wherever $\sin x = 0$)

The five key points apply here as well.

We will graph by hand later (and do transformations). For now we will use the graphing calculator to solve trigonometry equations (either in degrees or radians).

Example: Solve each of the following for the given domain. Give your answers to the nearest degree or to three significant figures (for radians).

a. $\sin \theta = 0.4$, $-360 \leq \theta \leq 360$

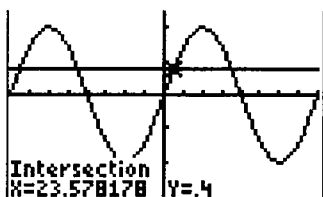
Graph both sides in the appropriate mode

```
Plot1 Plot2 Plot3
Y1=sin(X)
Y2=0.4
```

Use an appropriate window

```
WINDOW
Xmin=-360
Xmax=360
Xscl=45
Ymin=-1.5
Ymax=1.5
Yscl=.5
```

Use CALC / INTERSECT to find all the intersection points



$\theta = -336^\circ, -204^\circ, 24^\circ, 156^\circ$

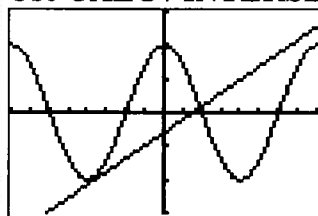
b. $\cos x = 0.25x - 0.3$,
 $-2\pi \leq x \leq 2\pi$

Graph both sides in RADIANS

Use an appropriate window

```
WINDOW
Xmin=-6.283185...
Xmax=6.2831853...
Xscl=pi/4
Ymin=-1.5
Ymax=1.5
Yscl=.5
```

Use CALC / INTERSECT



Only one intersection point...

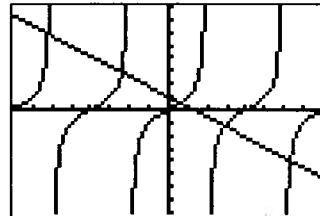
$x = 1.50$

c. $\tan \theta = 1 - x$,
 $-2\pi \leq \theta \leq 2\pi$

Increase the y-scale...

```
WINDOW
Xmin=-6.283185...
Xmax=6.2831853...
Xscl=pi/4
Ymin=-8
Ymax=8
Yscl=1
```

Use CALC / INTERSECT



5 intersection points

$x = -4.88, -1.90, 0.480, 2.25, 4.96$

HOMework G & H