

# Graphs & Inverses of Trig Functions

## 10.1 – Parent Graphs of Sine & Cosine

### Periodic Function

A function in which for some real number  $\alpha$ ,  $f(x + \alpha) = f(x)$  for each  $x$  in the domain of  $f$ .

$$y = A \sin[b(\theta - h)] + k$$

$$y = A \cos[b(\theta - h)] + k$$

$$b = 2\pi \cdot \frac{1}{p}$$

**Vertical Displacement:**  $k$

**Phase Shift:**  $h$

**Midline:**  $y = k$

**Period:**  $2\pi \cdot \frac{1}{b}$

**Frequency:**  $\frac{1}{\text{period}}$

**Amplitude:**  $|A|$

**Reflected over midline?** If  $A < 0$ , then yes.

### A

$A$  = the coefficient of the trig function. This determines the vertical stretching and shrinking of a graph. It also determines if the graph is reflected over the midline.

### Amplitude

Amplitude of Sine and Cosine =  $|A|$  = half the distance between the minimum and maximum values of the range of a periodic function with a bounded range.

### Vertical Displacement

$k$  = the vertical translation

### Midline

The horizontal axis used as the reference line about which the graph of a periodic function oscillates.

### Period

$P$  = the horizontal length of the unique part of the graph.

### Frequency

The reciprocal of period. The number of cycles the graph completes after one  $\theta$  value.

### Phase Shift

$h$  = the horizontal translation.

### Domain for trig functions

all the angles that can be put into the function (all the numbers included from left to right).

### Range for trig functions

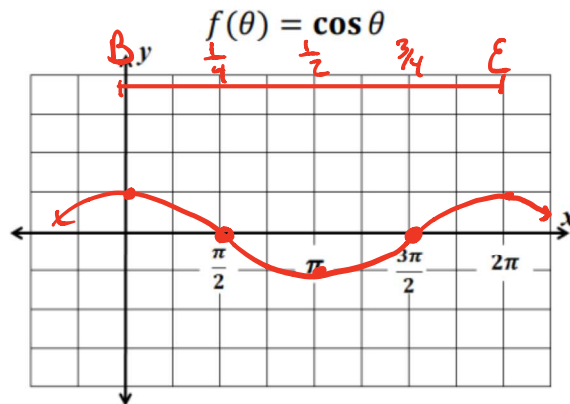
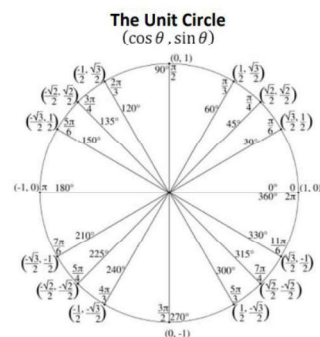
all the values that come out of the function (all the numbers included from bottom to top).

$$f(\theta) = \cos \theta$$

$\theta$	$f(\theta)$
0	1
$\frac{\pi}{2}$	0
$\pi$	-1
$\frac{3\pi}{2}$	0
$2\pi$	1

$$f(\theta) = \sin \theta$$

$\theta$	$f(\theta)$
0	0
$\frac{\pi}{2}$	1
$\pi$	0
$\frac{3\pi}{2}$	-1
$2\pi$	0

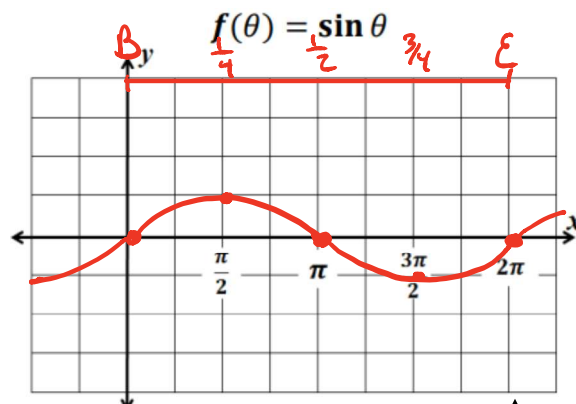


Domain =  $\mathbb{R}$

Range =  $[-1, 1]$

Period =  $2\pi$

Midline =  $y = 0$



Domain =  $\mathbb{R}$

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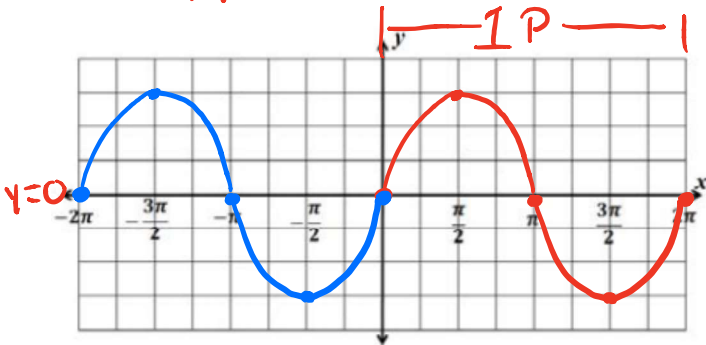
$$P = 2\pi \cdot \frac{1}{6}$$

#1)  $f(\theta) = 3 \sin \theta$

Vertical Displacement: 0  
\*Midline:  $y=0$

\*Phase Shift: 0  
\*Period:  $2\pi$   
Frequency:  $\frac{1}{2\pi}$

\*A: 3  
\*Reflected over midline? NO  
Amplitude:  $|3|=3$

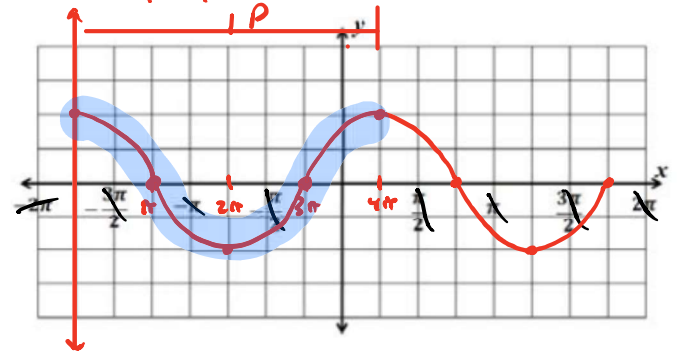


#3)  $f(\theta) = 2 \cos \frac{1}{2} \theta$

Vertical Displacement: 0  
\*Midline:  $y=0$

\*Phase Shift: 0  
\*Period:  $2\pi \cdot 2 = 4\pi$   
Frequency:  $\frac{1}{2\pi}$

\*A: 2  
\*Reflected over midline? NO  
Amplitude:  $|2|=2$

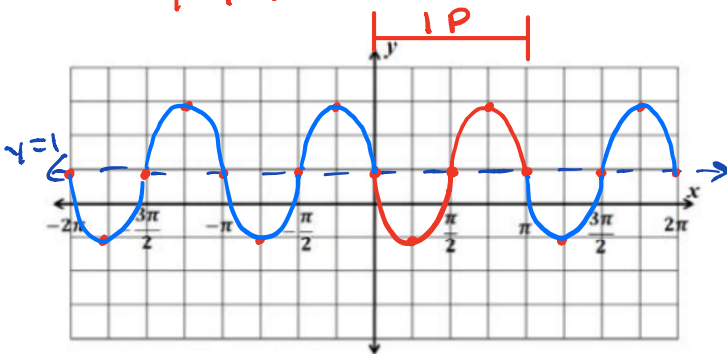


#2)  $f(\theta) = -2 \sin[2\theta] + 1$

Vertical Displacement: 1  
\*Midline:  $y=1$

\*Phase Shift: 0  
\*Period:  $2\pi \cdot \frac{1}{2} = \pi$   
Frequency:  $\frac{1}{\pi}$

\*A: -2  
\*Reflected over midline? YES  
Amplitude:  $|-2|=2$

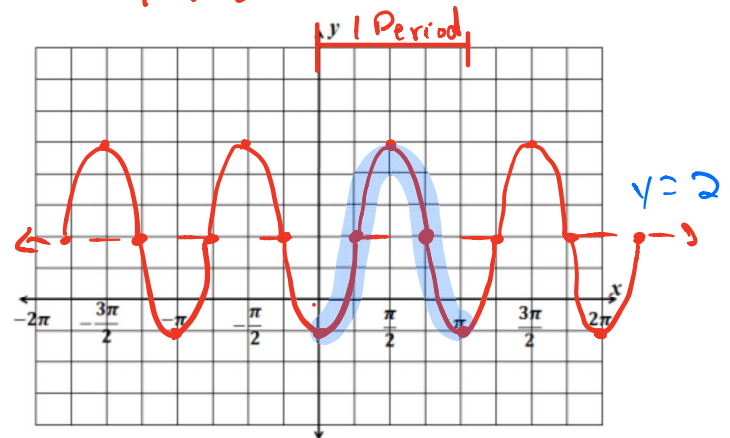


#4)  $f(\theta) = 2 - 3 \cos[2\theta]$

Vertical Displacement: 2  
\*Midline:  $y=2$

\*Phase Shift: 0  
\*Period:  $2\pi \cdot \frac{1}{2} = \pi$   
Frequency:  $\frac{1}{\pi}$

\*A: -3  
\*Reflected over midline? YES  
Amplitude:  $|-3|=3$



# Graphs & Inverses of Trig Functions

## 10.1 – Parent Graphs of Sine & Cosine

Use the information to create a sine function.

#5) Amplitude: 5

Period:  $4\pi$

Vertical Shift: down 4

Horizontal Shift: right  $\frac{\pi}{2}$

$$b = 2\pi \cdot \frac{1}{4\pi} = \frac{1}{2}$$

$$y = \pm 5 \sin \left[ \frac{1}{2} \left( \theta - \frac{\pi}{2} \right) \right] - 4$$

#6) Amplitude: 2

Frequency:  $\frac{1}{6\pi}$

Midline:  $y = 2$

Horizontal Shift: left  $\frac{\pi}{2}$

$$P = 6\pi$$

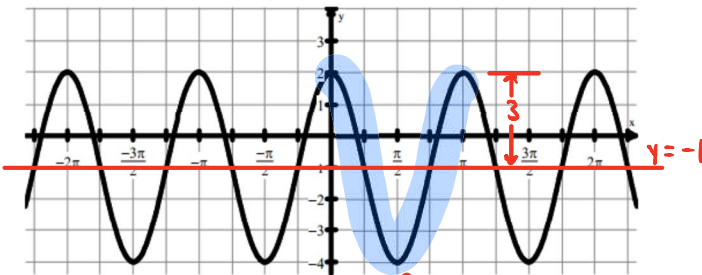
$$b = 2\pi \cdot \frac{1}{6\pi}$$

$$b = \frac{1}{3}$$

$$y = \pm 2 \sin \left[ \frac{1}{3} \left( \theta + \frac{\pi}{2} \right) \right] + 2$$

#7) Write a cosine function of the graph. Make the phase shift as small as possible and make A positive.

$$y = 3 \cos(2\theta) - 1$$



$$b = 2\pi \cdot \frac{1}{\pi}$$

$$b = 2$$

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