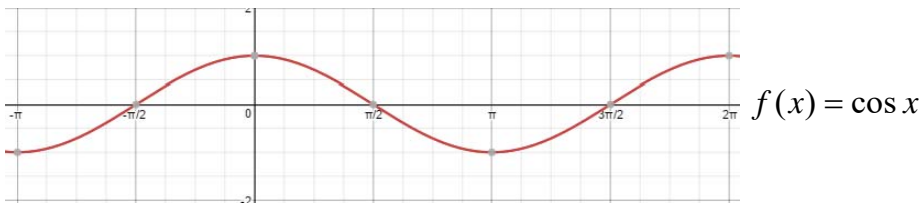
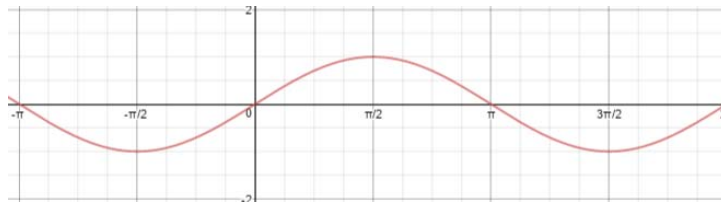


4-4: GRAPHS OF SINE AND COSINE: SINUSOIDS

I. SINE AND COSINE GRAPHS

-In radian mode

$$f(x) = \sin x$$



II. SINUSOIDS AND TRANSFORMATIONS

Def- Any function $f(x) = a \sin(bx + c) + d$

or $f(x) = a \cos(bx + c) + d$

where a , b , c , and d are constants and $b \neq 0$

Vocabulary associated with sinusoids include
AMPLITUDE, PERIOD, FREQUENCY, and PHASE
SHIFT

III. AMPLITUDE OF A SINUSOID

One half the height of the wave of a sinusoid. The amplitude of any sinusoid is $|a|$.

Ex.- Find the amplitude and describe the transformation for each of the following sinusoids.

A.) $y = 2 \sin x$

$a = 2$

-Vertical stretch by a factor of 2

B.) $y = -\frac{1}{3} \cos x$

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

-Reflect over the x -axis
-Vertical shrink by a factor of $\frac{1}{3}$

IV. PERIOD OF A SINUSOID

The length of one full cycle of the graph of a sinusoid.

$$\text{The period} = \frac{2\pi}{|b|}$$

Ex.- Find the period of each sinusoid and describe the transformations.

$$\text{A.) } y = -2 \cos\left(-\frac{x}{4}\right)$$

$$\text{B.) } y = \frac{1}{2} \sin(3x)$$

$$\text{pd} = \frac{2\pi}{\left|-\frac{1}{4}\right|} = 8\pi$$

$$\text{pd} = \frac{2\pi}{|3|} = \frac{2\pi}{3}$$

- Reflect over the x and y -axes.
- Vertical stretch by a factor of 2.
- Horizontal stretch by a factor of 4.

- Vertical shrink by a factor of $\frac{1}{2}$
- Horizontal shrink by a factor of $\frac{1}{3}$.

V. FREQUENCY OF A SINUSOID

The number of complete cycles the sinusoid wave completes in a unit interval.

$$\text{The frequency} = \frac{|b|}{2\pi}$$

Ex.- Find the frequency of the following function and interpret its meaning graphically.

$$y = 2 \cos\left(\frac{2x}{5}\right)$$

$$\text{fq} = \frac{\left|\frac{2}{5}\right|}{2\pi} = \frac{2}{10\pi} = \frac{1}{5\pi}$$

The graph completes 1 full cycle per interval length of 5π .

VI. PHASE SHIFTS OF A SINUSOID

The equivalence of a horizontal translation. The phase shift is represented by c .

Ex- Write the sine function as a phase shift of the cosine function.

$$\sin x = \cos\left(x - \frac{\pi}{2}\right) \text{ or } \cos\left(x + \frac{3\pi}{2}\right)$$