Unit 4: Trigonometric Functions

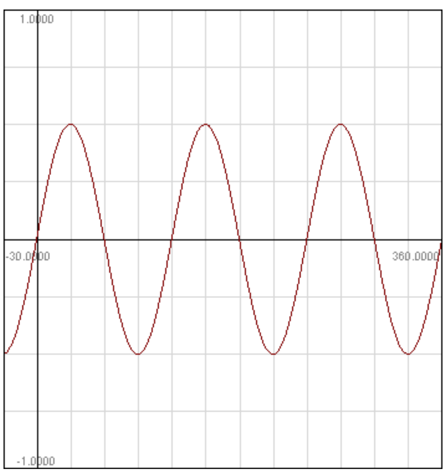
Activity 5: Properties & Transformations of Sinusoidal Functions

Homework/Formative Assessment

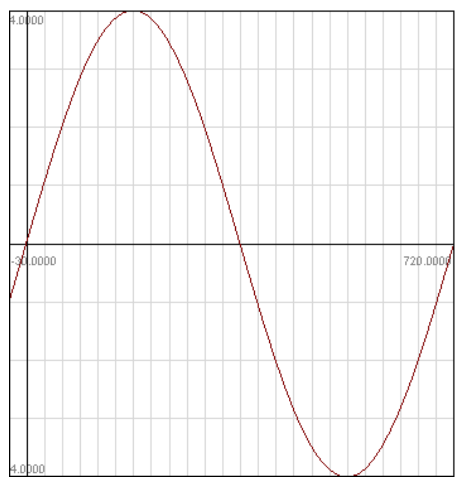
1. State the equation of the sine function with an amplitude of 2, a period of π, a phase shift of $\frac{\pi}{2}$ left, and a vertical displacement of 3.

2. State a possible sine equation and a possible cosine equation for each of the functions below: Scale horizontally goes up by 30 units.

a)



b)



3. How are the functions of $y = \sin x$, and $y = \cos x$ alike and how are they different? What transformations can be applied to the graph of $y = \sin x$ to create $y = \cos x$?

4. Sketch the graph of $y = 2\sin\left(\frac{1}{2}x + \frac{\pi}{4}\right)$ on the domain $\{x \in \mathbb{R} \mid -2\pi \le x \le 2\pi\}$.

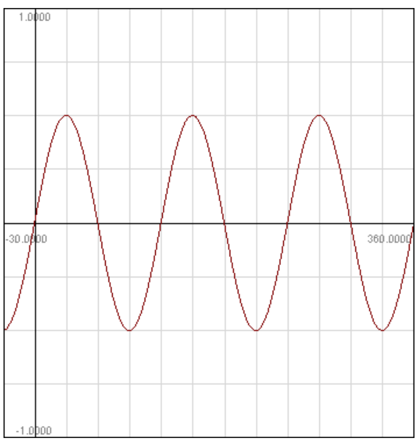
Homework/Formative Assessment SOLUTIONS

1. State the equation of the sine function with an amplitude of 2, a period of π, a phase shift of $\frac{\pi}{2}$ left, and a vertical displacement of 3.

$$a = 2, b = 2, c = -\frac{\pi}{2}, d = 3$$
$$\therefore f(x) = 2\sin\left[2\left(x + \frac{\pi}{2}\right)\right] + 3$$

2. State a possible sine equation and a possible cosine equation for each of the functions below: Scale horizontally goes up by 30 units.

a)



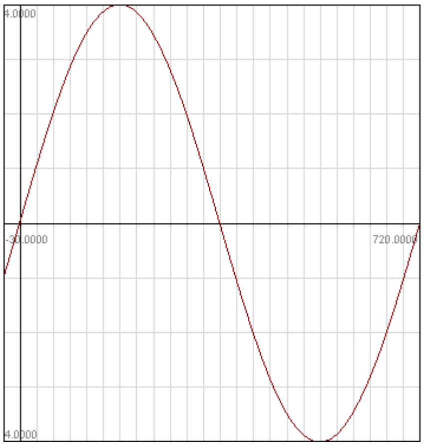
If $f(x)$ is a sine function, you have:

$$a = 0.5, b = \frac{2\pi}{120} = \frac{\pi}{60}, c = 0, d = 0$$
$$\therefore f(x) = 0.5\sin\left(\frac{\pi}{60}x\right)$$

If $f(x)$ is a cosine function, you have:

$$a = 0.5, b = \frac{2\pi}{120} = \frac{\pi}{60}, c = 30, d = 0$$
$$\therefore f(x) = 0.5\cos\left[\frac{\pi}{60}(x - 30)\right]$$

b)



If $f(x)$ is a sine function, you have:

$$a = 4, b = \frac{2\pi}{720} = \frac{\pi}{360}, c = 0, d = 0$$
$$\therefore f(x) = 4\sin\left(\frac{\pi}{360}x\right)$$

If $f(x)$ is a cosine function, you have:

$$a = 4, b = \frac{2\pi}{720} = \frac{\pi}{360}, c = 180, d = 0$$
$$\therefore f(x) = 4\cos\left[\frac{\pi}{360}(x - 180)\right]$$

3. How are the functions of $y = \sin x$, and $y = \cos x$ alike and how are they different? What transformations can be applied to the graph of $y = \sin x$ to create $y = \cos x$?

Both the sine function and the cosine function have an amplitude of 1 and a period of 2π. The difference is that the sine function starts at $y = 0$ and begins by increasing and the cosine function starts at $y = 1$, and begins by decreasing. To create the cosine curve using the sine curve, you would have to move $y = \sin x$ to the left with a horizontal translation of $\frac{\pi}{2}$. Therefore you would have:

$$y = \cos x = \sin\left(x + \frac{\pi}{2}\right)$$

4. Sketch the graph of $y = 2\sin\left(\frac{1}{2}x + \frac{\pi}{4}\right)$ on the domain $\{x \in \square \mid -2\pi \le x \le 2\pi\}$.

First you must factor the internal portion of the function:

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

This function has an amplitude of 2, a period of 4π, and a phase shift of $-\frac{\pi}{2}$. Graphing you have: