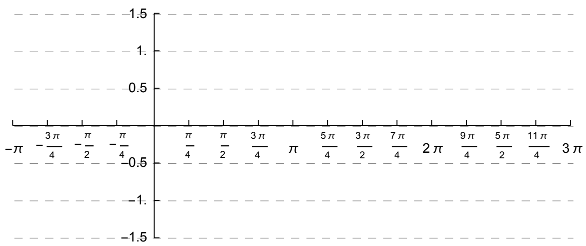
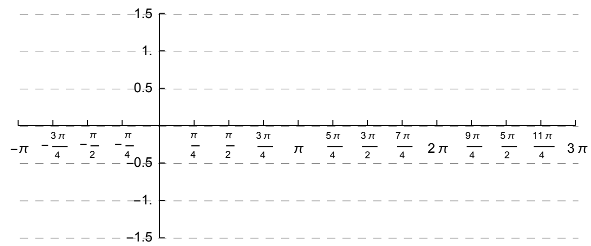
5.3a Graphs of Sine and Cosine Functions

Objective: (1) Graph functions of the form $y = \sin(\omega x)$ and $y = \cos(\omega x)$ (2) Use transformations to graph sinusoidal functions.

Graphs of $y = \sin(x)$ and $y = \cos(x)$

Example 1 Use the unit circle to make an accurate sketch of $y = \sin(x)$ and $y = \cos(x)$.





Transformations of Trigonometric Functions

Our goal is to be able to sketch a function in the form $f(x) = a\sin[b(x - c)] + d$. First, let's look at the affects of the transformation parameters *a* and *b.*

Amplitude of a Sinusoidal Function

The **amplitude** of a sinusoidal function is the distance from the center line of the function to the maximum (or minimum) value of the function. For $f(x) = a\sin(x)$, the amplitude is the value $|a|$. Note: If $a < 0$ it is also a *vertical reflection*.

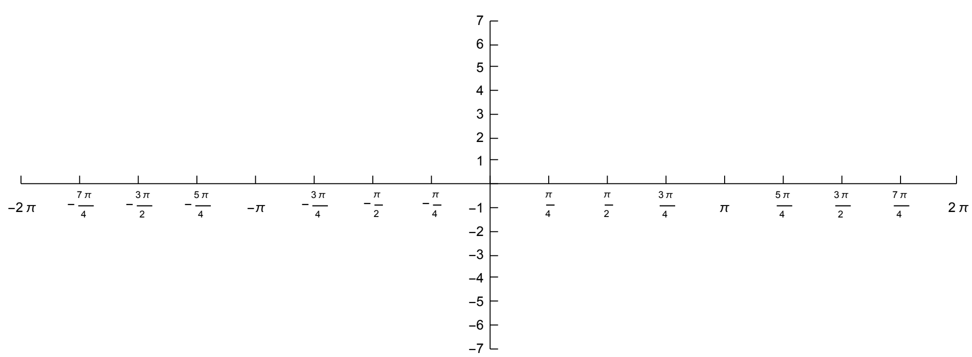
The Period of a Sinusoidal Function

Recall that the transformation $f(b\,x)$ is a horizontal *compression* when $b > 1$. This means the **period** is affected when b changes. Since the period of $\sin(x)$ is $0 \le x \le 2\pi$, the period of $\sin(b\,x)$ is $0 \le b\,x \le 2\pi$, or $0 \le x \le \frac{2\pi}{b}$.

The **period** of $f(x) = \sin(b\,x)$ or $f(x) = \cos(b\,x)$ is

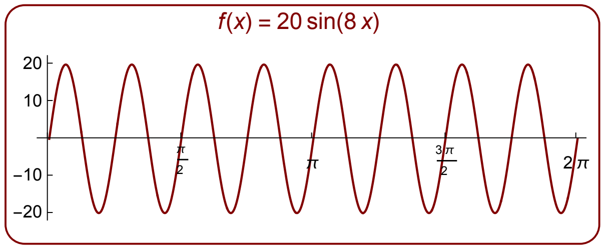
$$p = \frac{2\pi}{b}$$

Example 2 Graph the function $f(x) = 5\sin(2\,x)$



Example 3 Graph the function $f(x) = 3\cos\left(\frac{\pi x}{4}\right)$

Another way to interpret b, is that there are b "cycles" from 0 to 2π, e.g., the graph of $f(x) = 20\sin(8x)$ has 8 cycles from 0 to 2π.



Example 4 Graph the function $f(x) = 12\cos(5x)$.

Example 5 Find the equation of the function whose graph is: