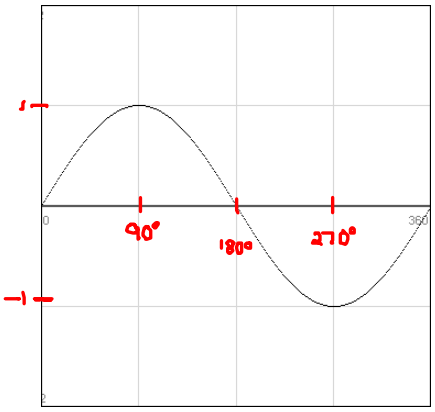
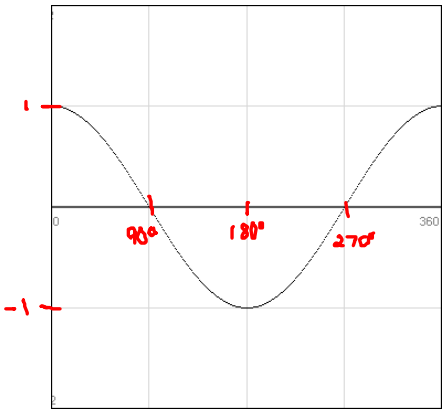
Graphs of Sine and Cosine Functions

$y = \sin x$



$y = \cos x$



$y = a \sin bx$

$y = a \cos bx$

$|a|$ = amplitude - half the distance between the maximum and minimum values

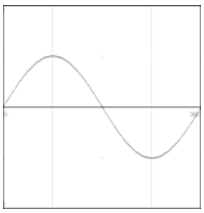
b = frequency - the number of cycles in 2π radians

$\frac{2\pi}{b}$ = period - how long it takes to complete one cycle

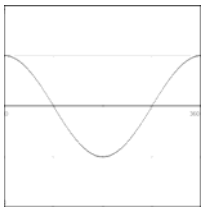
Transformations of the Sine and Cosines Functions

$a > 0$

$y = \sin x$



$y = \cos x$

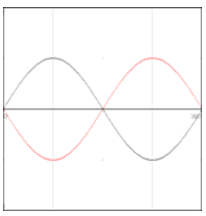


$a < 0$

$y = \sin x$

$y = -\sin x$

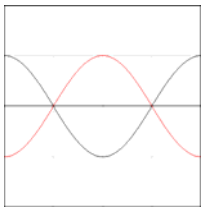
$a = -1$



$y = \cos x$

$y = -\cos x$

$a = -1$



$y = \sin x$

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

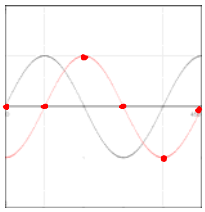
$y = \cos x$

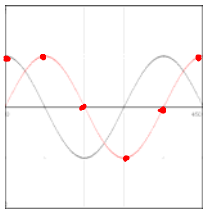
$y = \cos\left(x - \frac{\pi}{2}\right)$

$y = \sin(x - h)$

$y = \cos(x - h)$

Shift graph h units to the right





$y = \sin x$

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

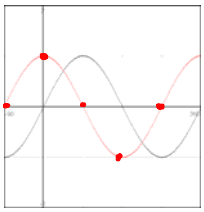
$y = \cos x$

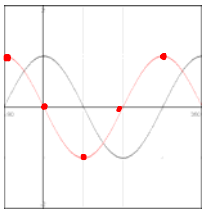
$y = \cos\left(x + \frac{\pi}{2}\right)$

$y = \sin(x + h)$

$y = \cos(x + h)$

Shift graph h units to the left





$y = \sin x$

$y = \sin x + 1$

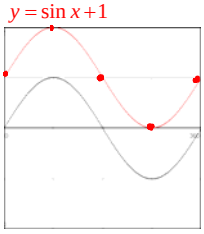
$y = \cos x$

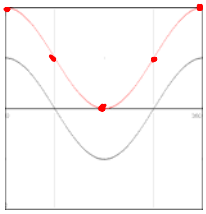
$y = \cos x + 1$

$y = \sin x + k$

$y = \cos x + k$

Shift graph k units up





$y = \sin x$

$y = \sin x - 1$

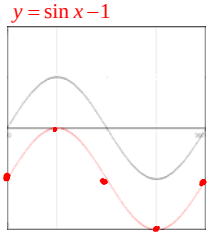
$y = \cos x$

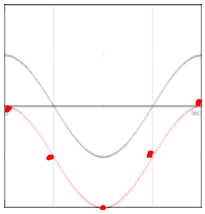
$y = \cos x - 1$

$y = \sin x - k$

$y = \cos x - k$

Shift graph k units down

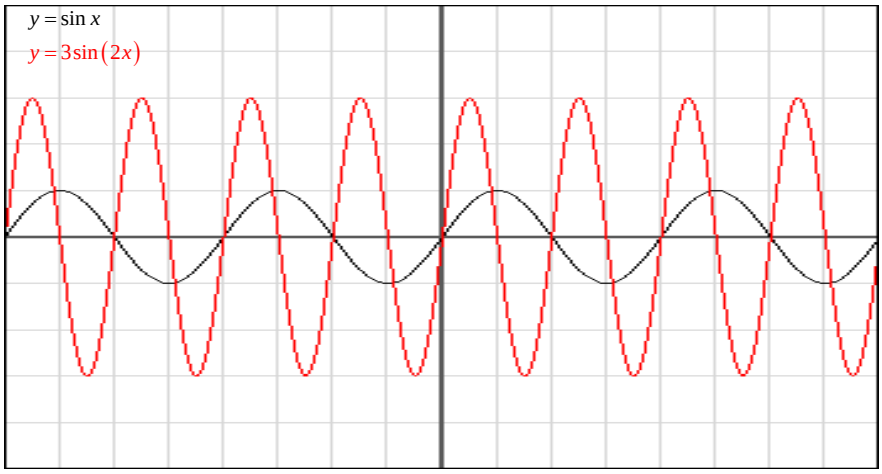




Directions: Sketch two full periods of the graph of each function.

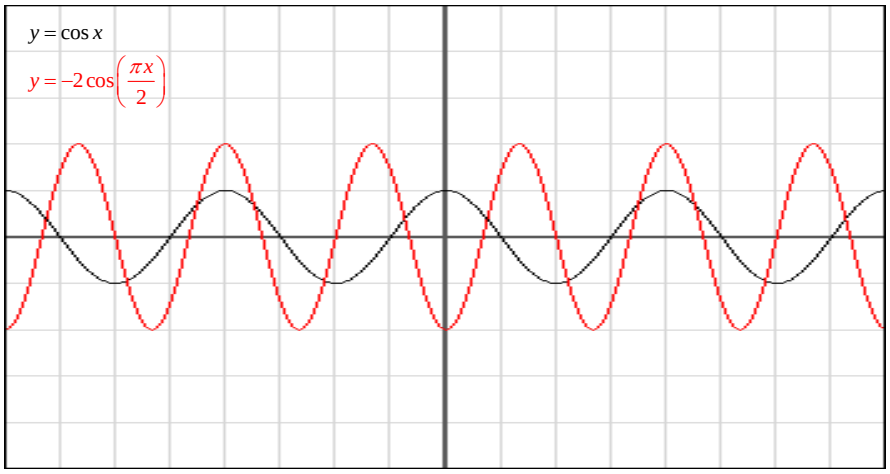
1. $y = 3\sin(2x)$

$a = 3$ $\sim$ $b = 2$ $\frac{2\pi}{b} = \frac{2\pi}{2} = \pi \mid 180°$

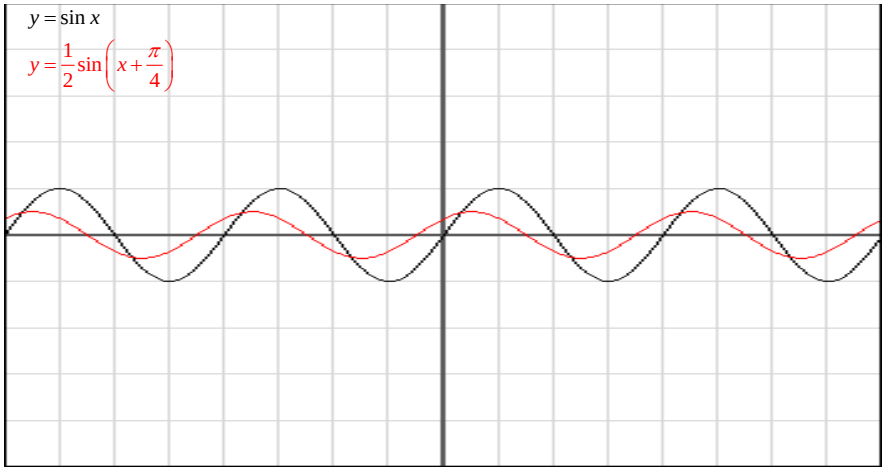


2. $y = -2\cos\left(\frac{\pi x}{2}\right)$

$|a| = |-2| = 2$ $b = \frac{\pi}{2} = \frac{3.14}{2} = 1.57$ $\frac{2\pi}{b} = \frac{2\pi}{\frac{\pi}{2}} = 2\pi \cdot \frac{2}{\pi} = 4$

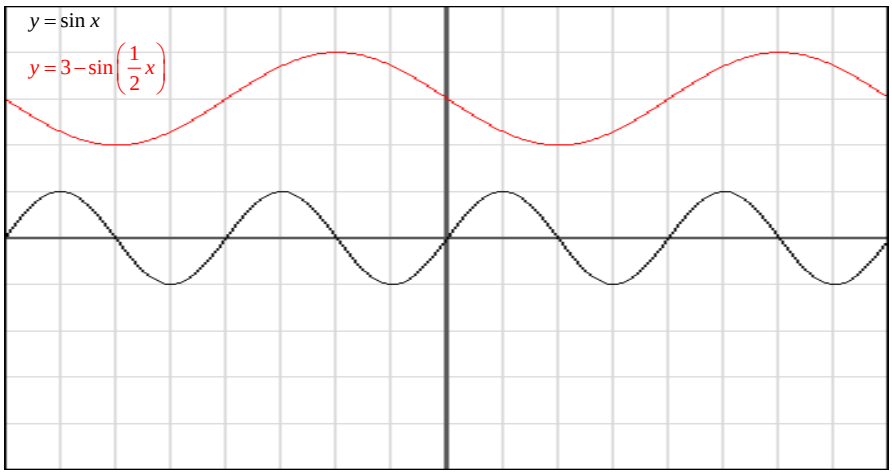


3. $y = \frac{1}{2}\sin\left(x + \frac{\pi}{4}\right)$ $a = \frac{1}{2}$ $b = 1$ $\frac{2\pi}{b} = \frac{2\pi}{1} = 2\pi$ shift left 45°



4. $y = 3 - \sin\left(\frac{1}{2}x\right)$

$y = -\sin\left(\frac{1}{2}x\right) + 3$ $|a| = |-1| = 1$ $b = \frac{1}{2}$ $\frac{2\pi}{b} = \frac{2\pi}{\frac{1}{2}} = 2\pi \cdot \frac{2}{1} = 4\pi$ shift up 3 units



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

$y = \cos(x - \pi/2) + 2$ $a = 1$ $b = 1$ $\frac{2\pi}{b} = \frac{2\pi}{1} = 2\pi$ shift right 90° shift up 2