

TOPIC: PHASE SHIFTS OF SINE & COSINE

Phase Shifts

- ◆ Phase shift (h): a _____ shift (left/right), indicated by numbers [INSIDE | OUTSIDE] parentheses.
 - ▶ A phase shift can make a cosine graph look like a _____ graph.

New

Phase Shifts of Sine & Cosine Graphs

A graph of the cosine function $y = \cos(x)$ is shown on a Cartesian coordinate system. The x-axis is labeled with $-\frac{\pi}{2}$, $\frac{\pi}{2}$, π , $\frac{3\pi}{2}$, and 2π . The y-axis is labeled with 1 and -1 . The graph is a dashed blue line starting at $(0, 1)$, reaching a minimum at $(\pi, -1)$, and returning to $(2\pi, 1)$. A red arrow points from the y-axis to the peak of the graph, labeled $\frac{h}{b} = -$.

x	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π
$\cos x$	1	0	-1	0	1
$\cos\left(x - \frac{\pi}{2}\right)$					

$y = A \sin (bx - \text{---}^*) + k$

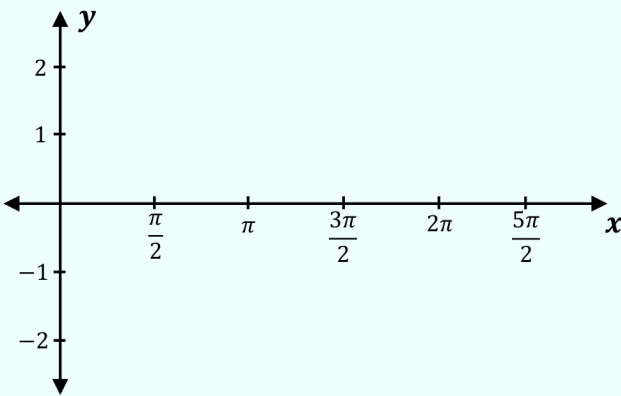
$y = A \cos (bx - \text{---}^*) + k$

*you may see other letters for this (ϕ, C, d)

If given $(bx - \#)$ h is positive and graph shifts $\left[\leftarrow \mid \rightarrow\right]$ by $\frac{h}{b}$
If given $(bx + \#)$ h is negative and graph shifts $\left[\leftarrow \mid \rightarrow\right]$ by $\frac{h}{b}$

EXAMPLE

Graph $y = \sin (2x + \pi)$ over one full period.



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PRACTICE

Describe the phase shift for the following function: $y = \cos \left(5x - \frac{\pi}{2} \right)$

PRACTICE

Describe the phase shift for the following function: $y = \cos \left(2x + \frac{\pi}{6} \right)$

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EXAMPLE

Graph the function $y = 3 \cdot \sin(x + \pi)$.

