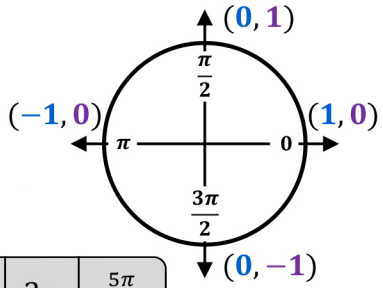
## TOPIC: GRAPHS OF SINE & COSINE

### Graphing Sine & Cosine (with Vertical Shifts)

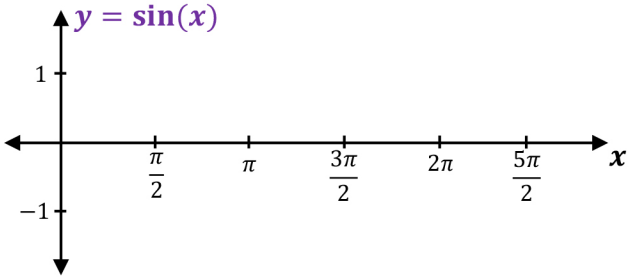


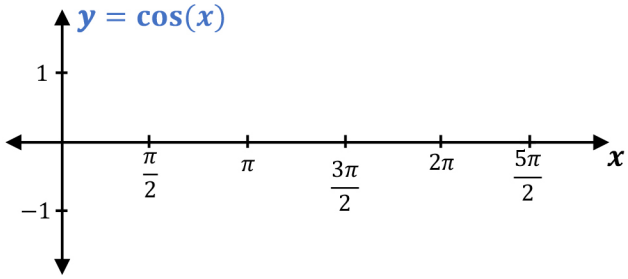

◆ Sine & Cosine values _____ around the unit circle, so their graphs are _____.

- The high points are "crests" or _____; the low points are "troughs" or _____.

| $x$ | 0 | $\frac{\pi}{2}$ | $\pi$ | $\frac{3\pi}{2}$ | $2\pi$ | $\frac{5\pi}{2}$ |
|---|---|---|---|---|---|---|
| $\sin x$ | | | | | | |

| $x$ | 0 | $\frac{\pi}{2}$ | $\pi$ | $\frac{3\pi}{2}$ | $2\pi$ | $\frac{5\pi}{2}$ |
|---|---|---|---|---|---|---|
| $\cos x$ | | | | | | |




◆ Just as we've vertically shifted functions, we can also vertically shift $\sin$ & $\cos$ by adding a constant ___.

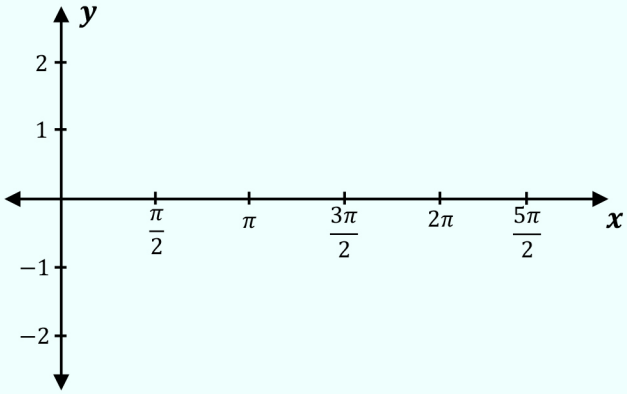
- For positive $k$, graph shifts **[UP | DOWN]**; for negative $k$, graph shifts **[UP | DOWN]**.

$y = \sin(x) + \_\_$ $y = \cos(x) + \_\_$

**Recall** **Transformations**

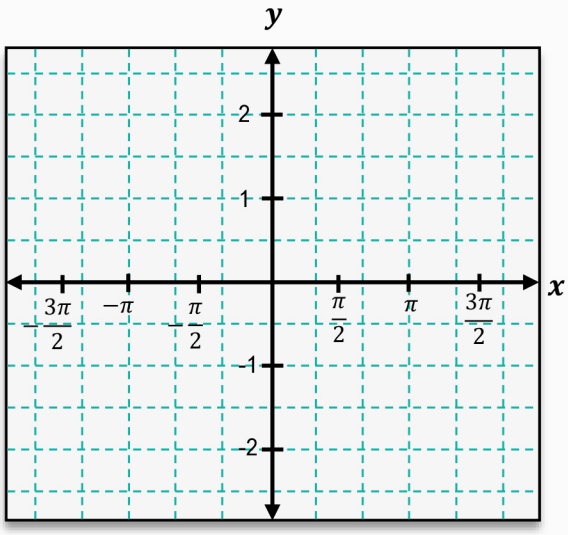
$g(x) = f(x) + k$

**EXAMPLE** Graph the function $y = \sin(x) + 1$.

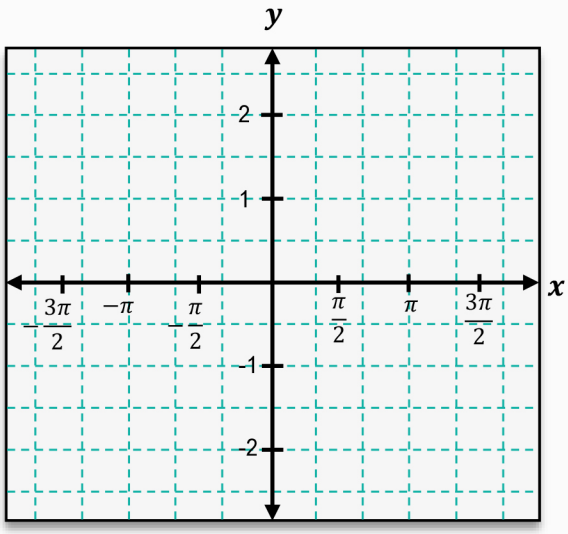


## TOPIC: GRAPHS OF SINE & COSINE

**PRACTICE** Sketch the function $y = \cos(x) - 1$ on the graph below.

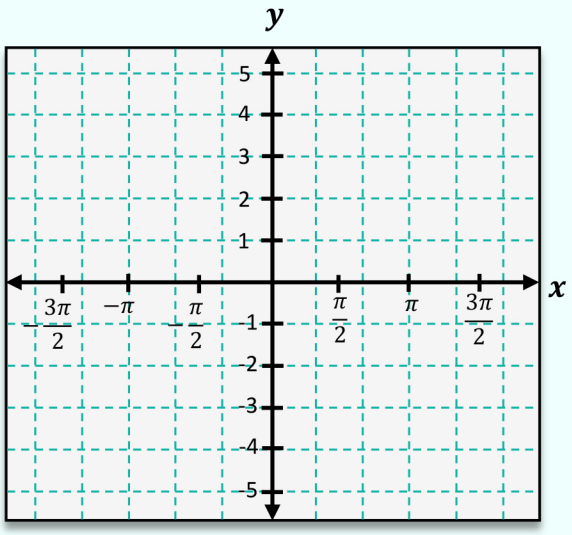



**PRACTICE** Determine the value of $y = \sin\left(-\frac{\pi}{2}\right) + 50$ without using a calculator or the unit circle.



## TOPIC: GRAPHS OF SINE & COSINE

**EXAMPLE** Graph the function $y = \sin(x) + 3$.



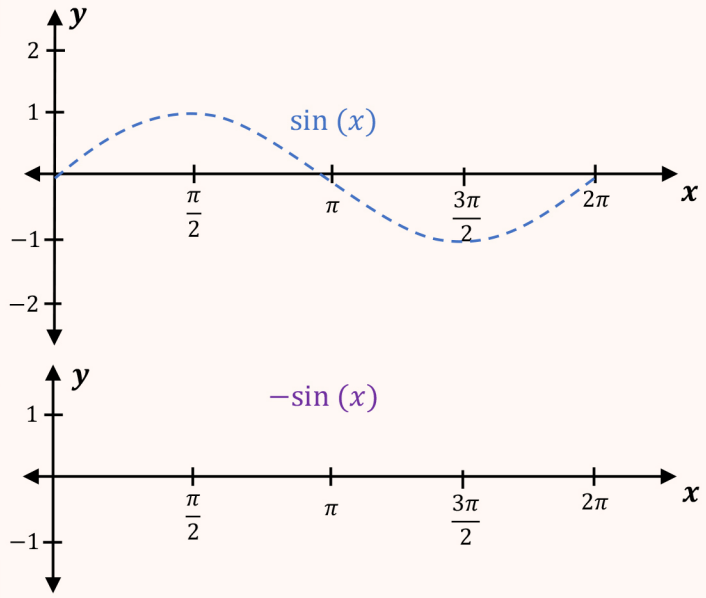
## TOPIC: GRAPHS OF SINE & COSINE

## Amplitude & Reflection of Sine & Cosine

◆ Recall: Sine & Cosine graphs are repeating waves.

- **Amplitude:** # affecting how _____ the peaks are, i.e. the distance from the midline to the peaks or valleys.
- If the amplitude is negative, the graph is _____ over the x-axis.

**New** **Amplitude**

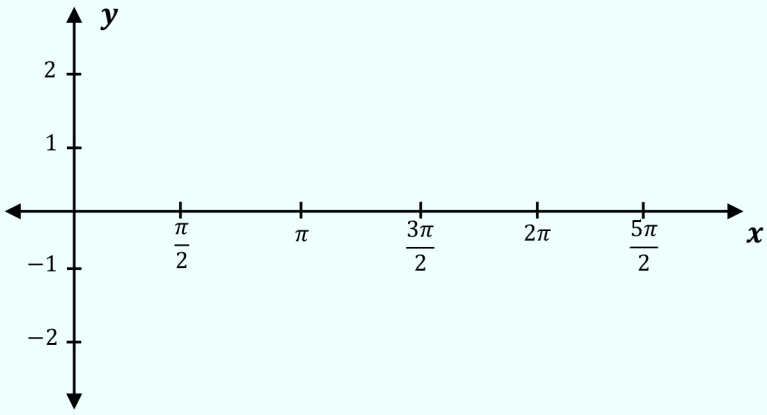



| $x$ | $0$ | $\frac{\pi}{2}$ | $\pi$ | $\frac{3\pi}{2}$ | $2\pi$ |
|---|---|---|---|---|---|
| $\sin x$ | $0$ | $1$ | $0$ | $-1$ | $0$ |
| $2 \cdot \sin x$ | | | | | |
| $-\sin x$ | | | | | |

$y = \_\_\sin(x) + k$

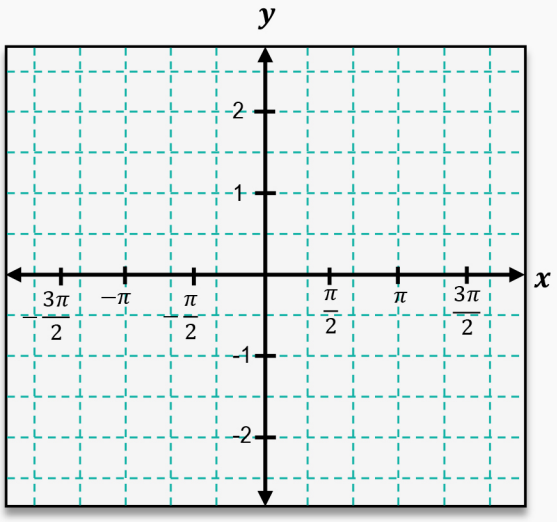
$y = \_\_\cos(x) + k$

**EXAMPLE** Graph the function $y = -\frac{3}{2} \cdot \cos x$

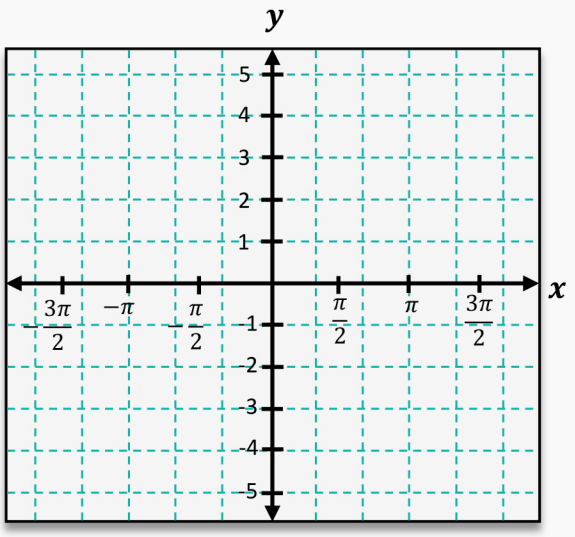


## TOPIC: GRAPHS OF SINE & COSINE

**PRACTICE** Determine the value of $y = -2 \cdot \sin\left(-\frac{3\pi}{2}\right) + 10$ without using a calculator or the unit circle.

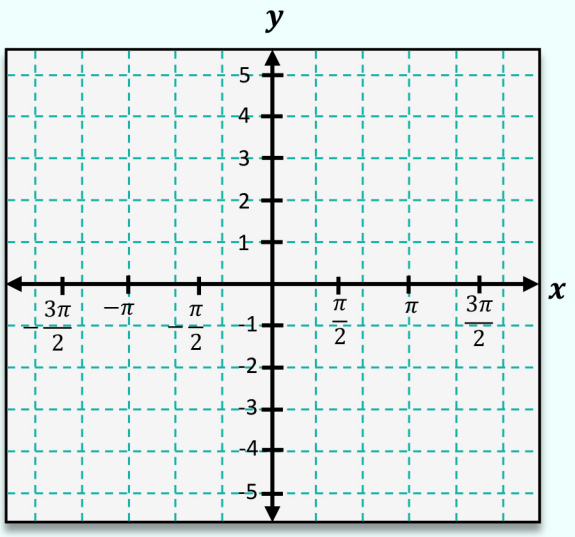



**PRACTICE** Graph the function $y = -3 \cdot \cos(x)$.



## TOPIC: GRAPHS OF SINE & COSINE

**EXAMPLE** Graph the function $y = 2 \cdot \sin(x) - 1$.



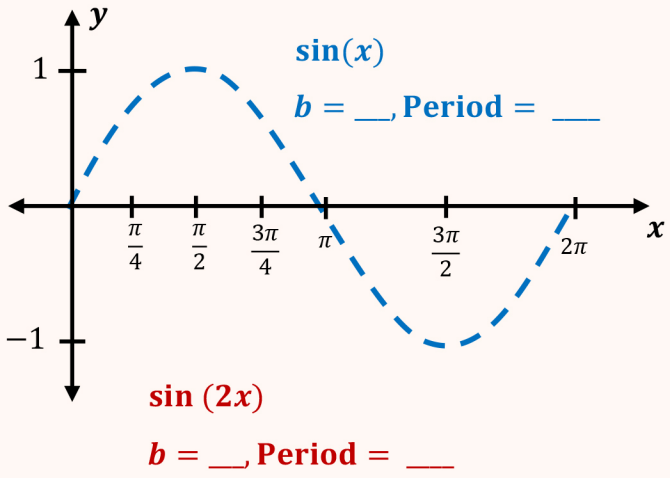
## TOPIC: GRAPHS OF SINE & COSINE

### Period of Sine & Cosine

◆ **Period:** How "_____" the graph is, i.e. the distance (along $x$) of a full wave or cycle.

- Period is modified by a # (given by ___) in front of $x$ in $\sin(x)$ or $\cos(x)$.

**New** **Period of Sine & Cosine Graphs**




| $x$ | 0 | $\frac{\pi}{4}$ | $\frac{\pi}{2}$ | $\frac{3\pi}{4}$ | $\pi$ | $\frac{5\pi}{4}$ | $\frac{3\pi}{2}$ | $\frac{7\pi}{4}$ |
|---|---|---|---|---|---|---|---|---|
| $\sin(x)$ | 0 | $\frac{\sqrt{2}}{2}$ | 1 | $\frac{\sqrt{2}}{2}$ | 0 | $\frac{-\sqrt{2}}{2}$ | $-1$ | $\frac{-\sqrt{2}}{2}$ |
| $\sin(2x)$ | | | | | | 1 | 0 | -1 |

$y = \mathrm{A}\sin(\_\_\_x) + k$

$y = \mathrm{A}\cos(\_\_\_x) + k$

Period $(T)$ = ——

For $b > 1$, graph horizontally **[SHRINKS | STRETCHES]**

For $0 < b < 1$, graph horizontally **[SHRINKS | STRETCHES]**

**EXAMPLE** Without graphing, calculate the period of the following functions.

$(A)$

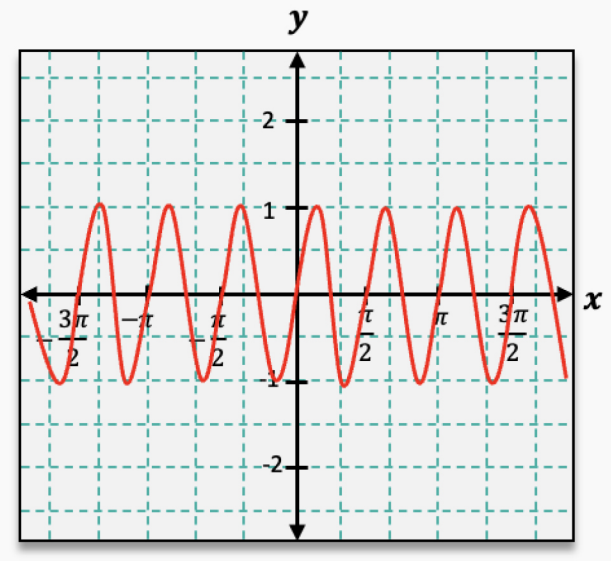
$$y = \sin\left(\frac{1}{2}x\right)$$

$(B)$

$$y = \cos(4\pi x)$$

## TOPIC: GRAPHS OF SINE & COSINE

**PRACTICE** Given below is the graph of the function $y = \sin(bx)$. Determine the correct value for $b$.




**PRACTICE** The period for the function $y = \cos(bx)$ is $T = 20\pi$. Determine the correct value for $b$.