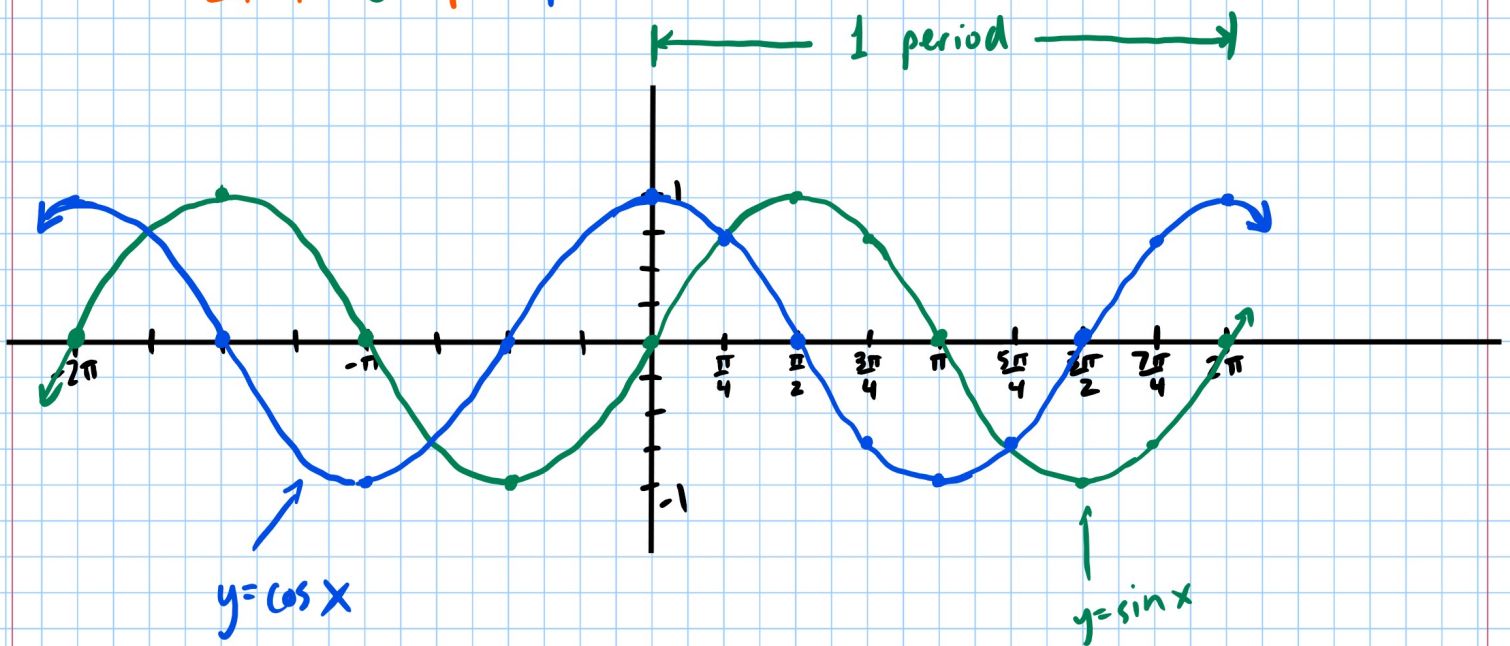


WARMUP

Put your calculator in radian mode and fill in the chart with decimals to the nearest 100th.

| Angle, θ | $\sin \theta$ | $\cos \theta$ |
|------------------|---------------|---------------|
| 0 | 0 | 1 |
| $\frac{\pi}{4}$ | .71 | .71 |
| $\frac{\pi}{2}$ | 1 | 0 |
| $\frac{3\pi}{4}$ | .71 | -.71 |
| π | 0 | -1 |
| $\frac{5\pi}{4}$ | -.71 | -.71 |
| $\frac{3\pi}{2}$ | -1 | 0 |
| $\frac{7\pi}{4}$ | -.71 | .71 |
| 2π | 0 | 1 |



KEY POINTS of $y = \sin x$: $(0, 0)$, $(\frac{\pi}{2}, 1)$, $(\pi, 0)$, $(\frac{3\pi}{2}, -1)$, $(2\pi, 0)$

KEY POINTS of $y = \cos x$: $(0, 1)$, $(\frac{\pi}{2}, 0)$, $(\pi, -1)$, $(\frac{3\pi}{2}, 0)$, $(2\pi, 1)$

Characteristics: for $\sin x$ and $\cos x$
 $D = (-\infty, \infty)$, $R = [-1, 1]$
Period = 2π

Review:

$f(x-h) \Rightarrow$ Right h units

$f(x+h) \Rightarrow$ Left h units

$f(x)+k \Rightarrow$ Up k units

$f(x)-k \Rightarrow$ Down k units

$af(x) \Rightarrow$ Multiply y by a

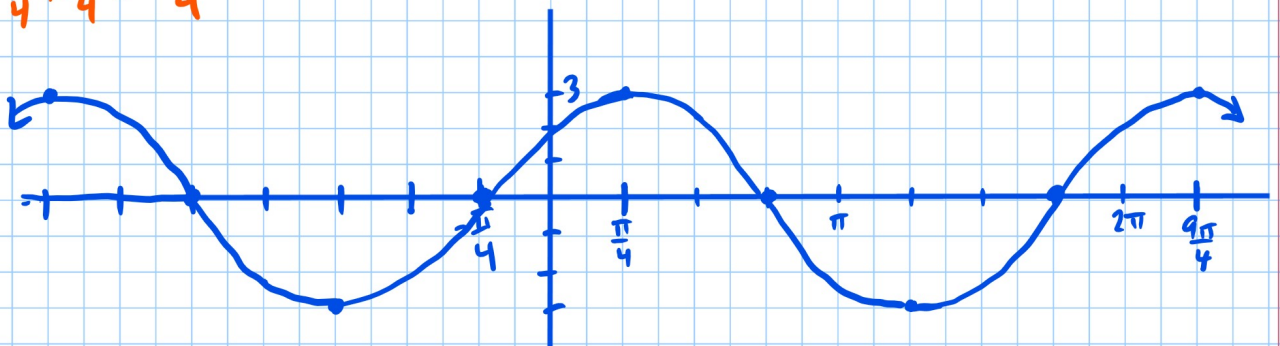
ex: Graph $y = 3 \cos\left(x - \frac{\pi}{4}\right)$
Right $\frac{\pi}{4}$ units
 $+\frac{\pi}{4}$ to x
multiply y by 3

$$\frac{\pi}{2} + \frac{\pi}{4} = \frac{2\pi}{4} + \frac{\pi}{4} = \frac{3\pi}{4}$$

$$\pi + \frac{\pi}{4} = \frac{4\pi}{4} + \frac{\pi}{4} = \frac{5\pi}{4}$$

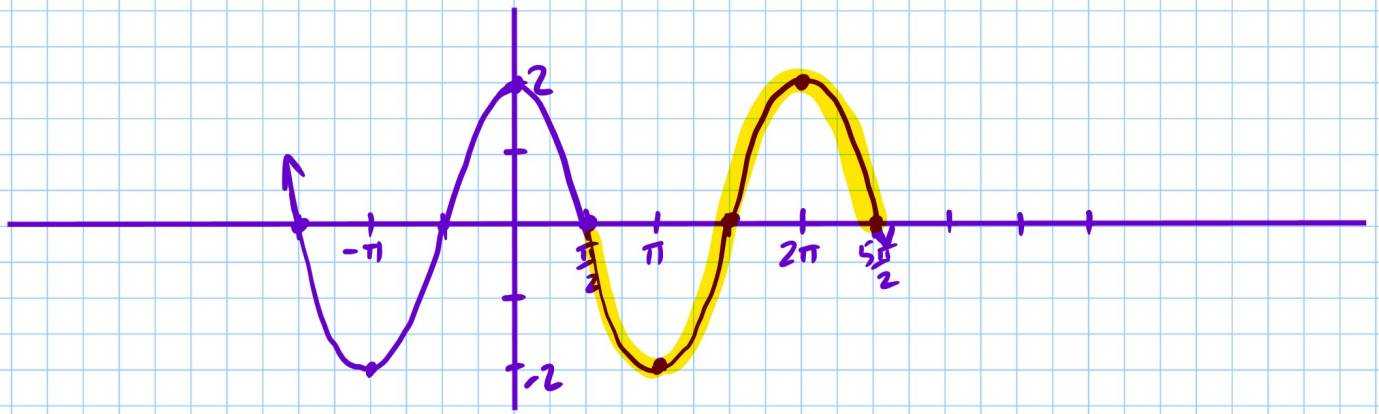
Keys for cos: $+\frac{\pi}{4}$ to x , $\times y$ by 3

| | | |
|----------------------------------|-------------------|-----------------------------------|
| $(0, 1)$ | \longrightarrow | $\left(\frac{\pi}{4}, 3\right)$ |
| $\left(\frac{\pi}{2}, 0\right)$ | \longrightarrow | $\left(\frac{3\pi}{4}, 0\right)$ |
| $(\pi, -1)$ | \longrightarrow | $\left(\frac{5\pi}{4}, -3\right)$ |
| $\left(\frac{3\pi}{2}, 0\right)$ | \longrightarrow | $\left(\frac{7\pi}{4}, 0\right)$ |
| $(2\pi, 1)$ | \longrightarrow | $\left(\frac{9\pi}{4}, 3\right)$ |



ex: $y = -2 \sin\left(x - \frac{\pi}{2}\right)$
 $+\frac{\pi}{2}$ to x
mult. y by -2

| Original Keys | | New Keys |
|-----------------------------------|-------------------|----------------------------------|
| $(0, 0)$ | \longrightarrow | $\left(\frac{\pi}{2}, 0\right)$ |
| $\left(\frac{\pi}{2}, 1\right)$ | \longrightarrow | $(\pi, -2)$ |
| $(\pi, 0)$ | \longrightarrow | $\left(\frac{3\pi}{2}, 0\right)$ |
| $\left(\frac{3\pi}{2}, -1\right)$ | \longrightarrow | $(2\pi, 2)$ |
| $(2\pi, 0)$ | \longrightarrow | $\left(\frac{5\pi}{2}, 0\right)$ |



Try: Graph $y = \sin\left(x + \frac{\pi}{2}\right) - 3$

subtract $\frac{\pi}{2}$ from x subtract 3 from y