Section 4.5 | Trigonometric Functions: Translations

Objective: Using the parent functions $\sin\theta$ and $\cos\theta$ with their characteristics students will analyze the changes that can occur with additional values of k, a, and b.

Study Problems - Part 1

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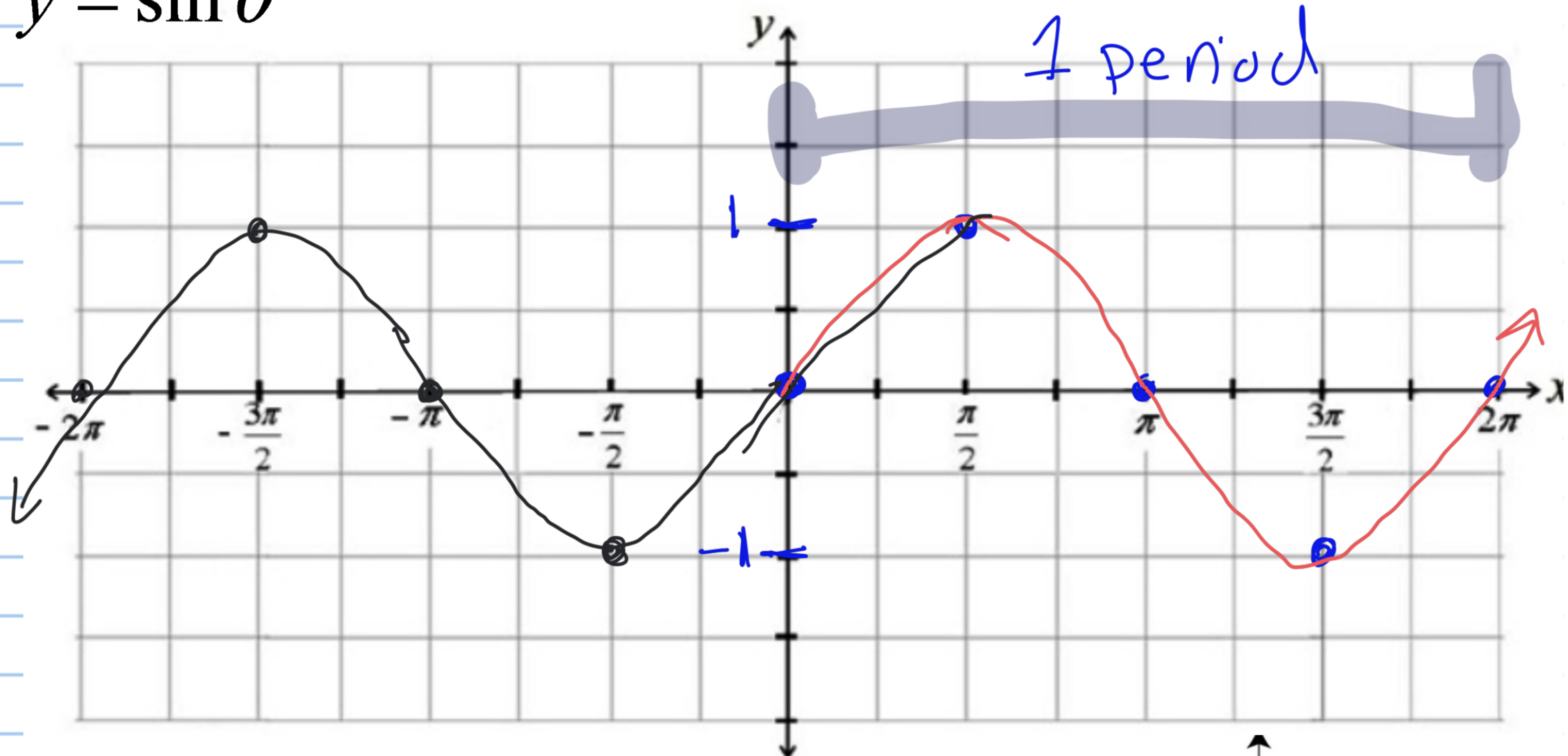
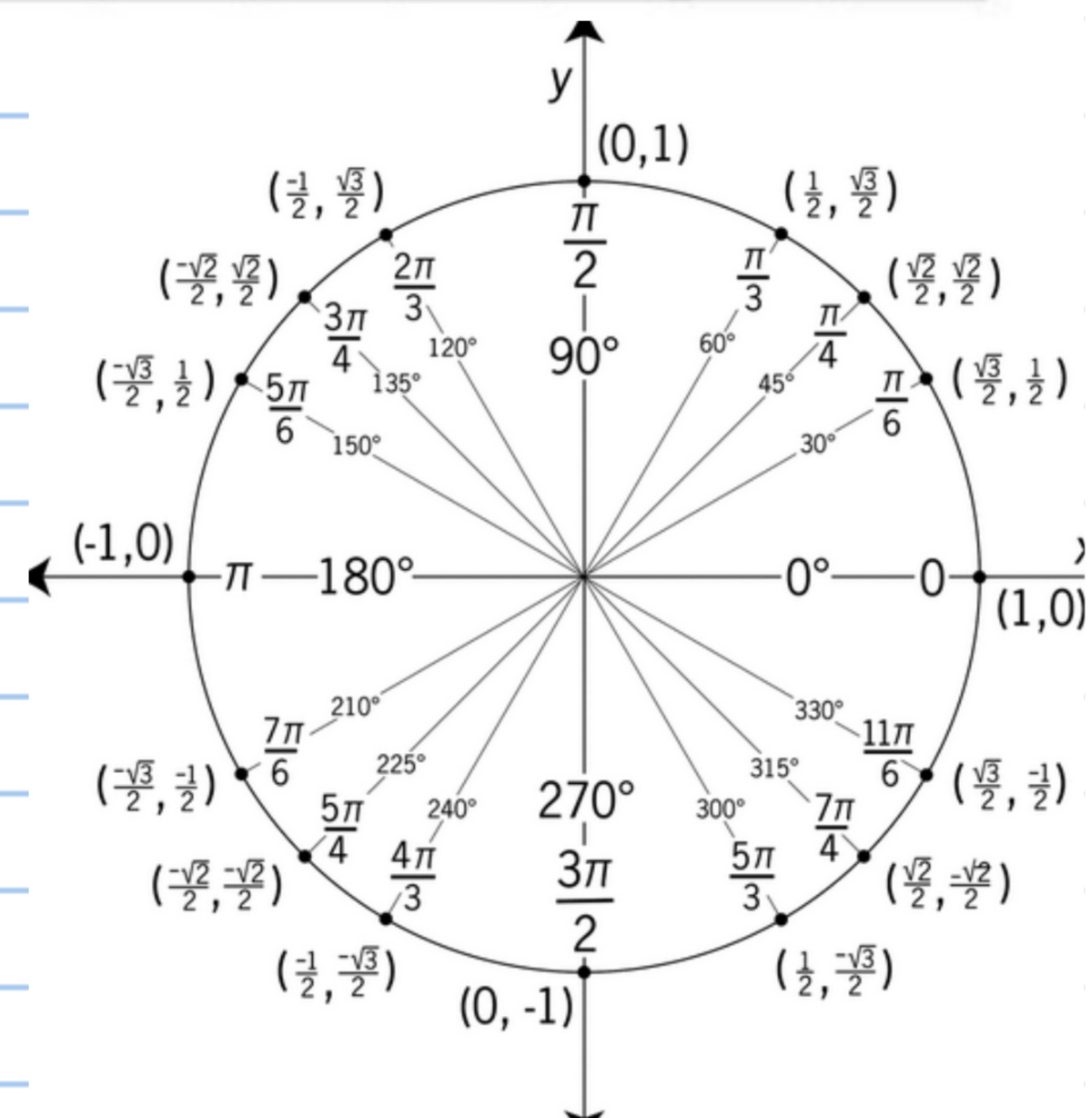
Example

Graph $y = \sin\theta$

x	y
0	0
$\pi/2$	1
π	0
$\frac{3\pi}{2}$	-1
2π	0

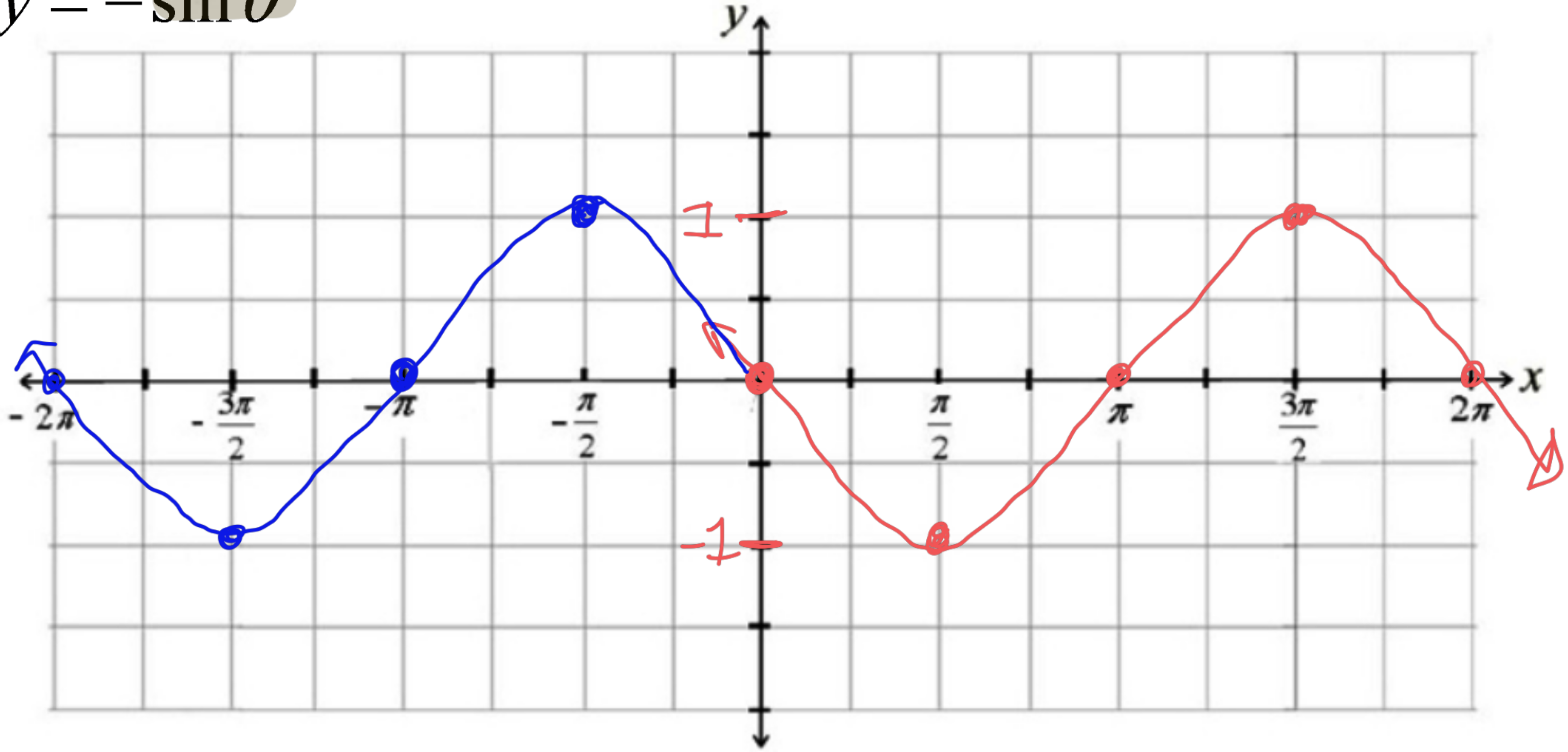




Example

Graph $y = -\sin\theta$

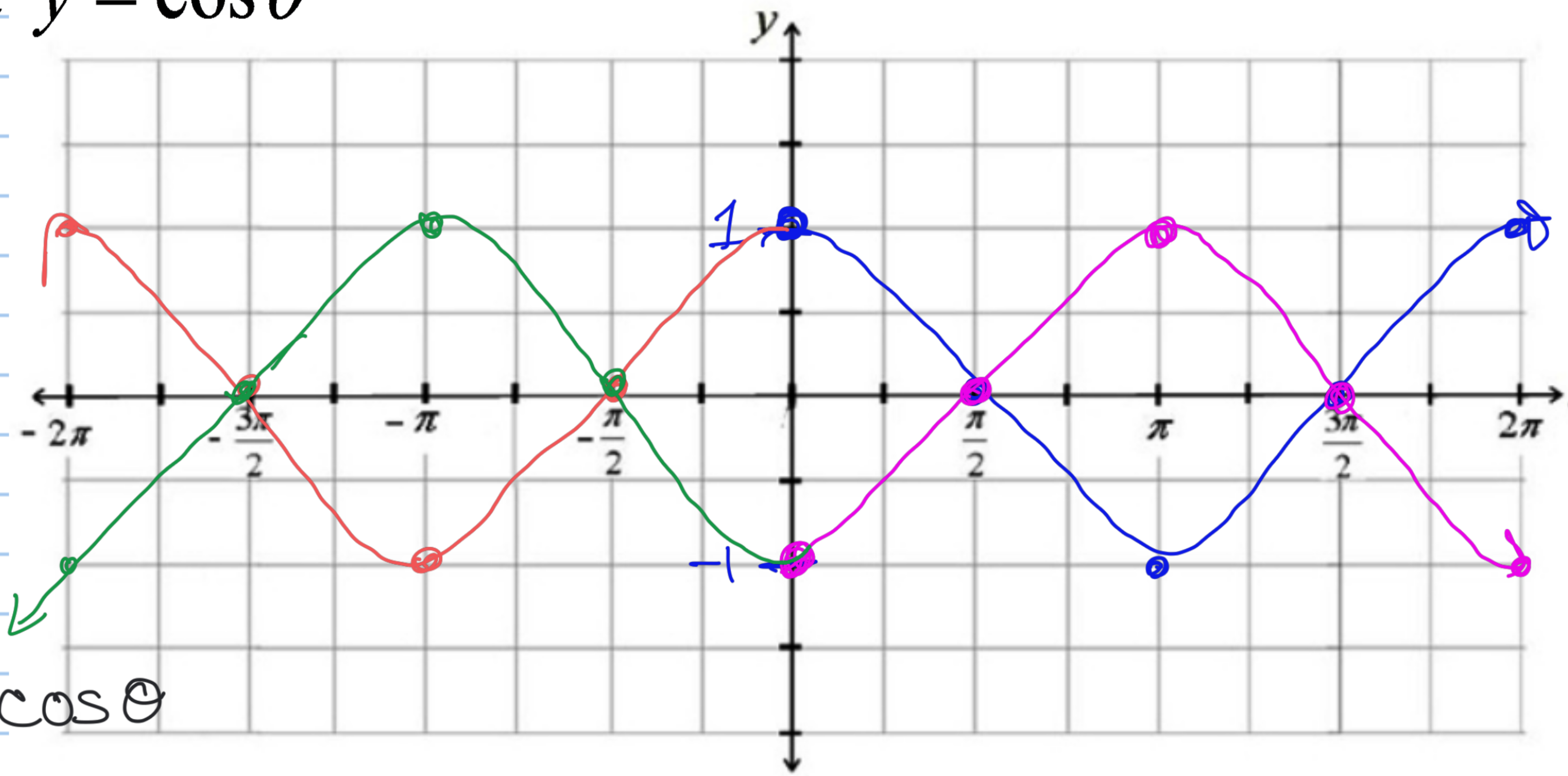
x	y
0	0
$\pi/2$	-1
π	0
$\frac{3\pi}{2}$	1
2π	0



Example

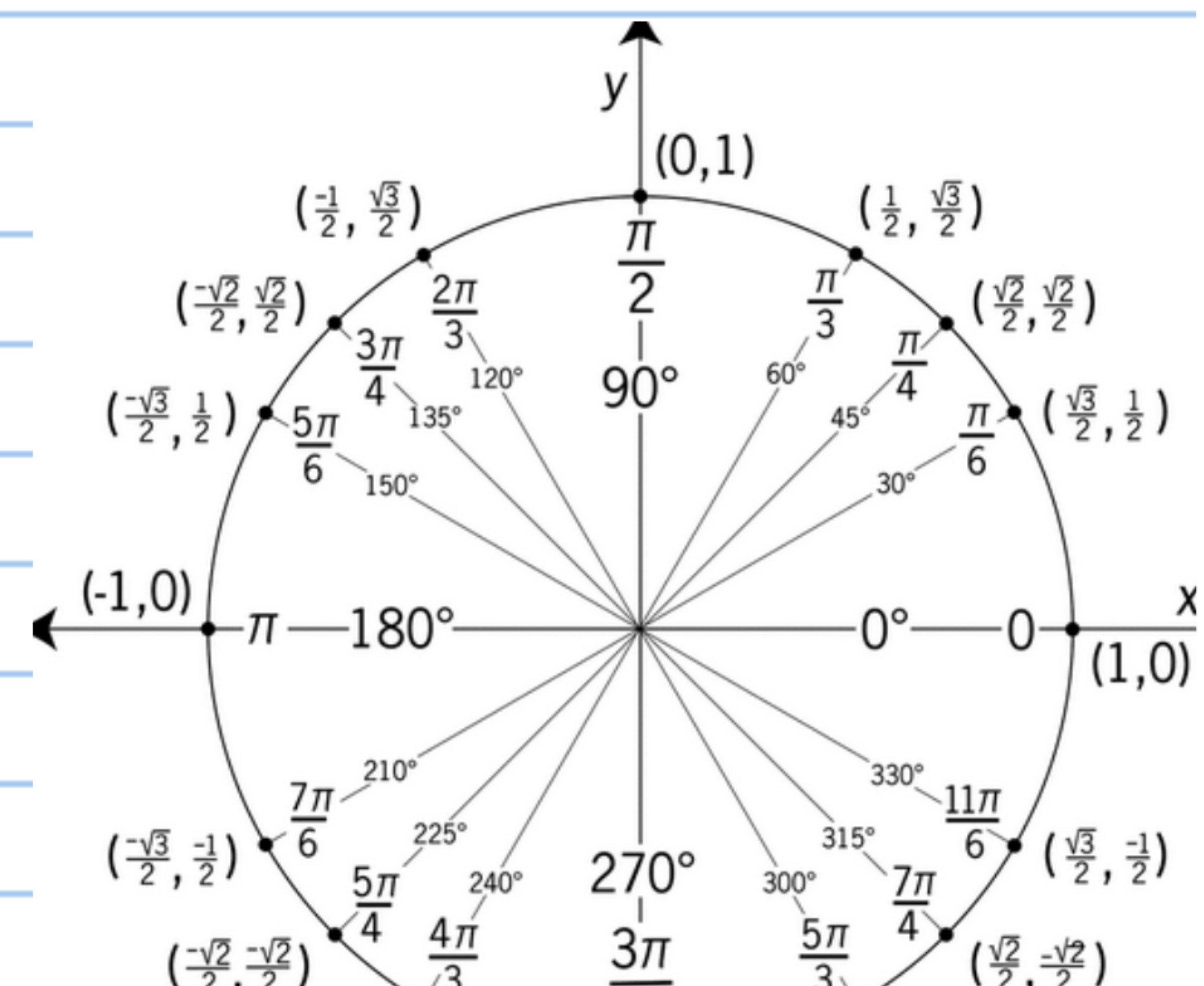
Graph $y = \cos\theta$

x	y
0	1
$\frac{\pi}{2}$	0
π	-1
$\frac{3\pi}{2}$	0
2π	1



$y = -\cos\theta$

x	y
0	-1
$\pi/2$	0
π	1
$3\pi/2$	0
2π	-1



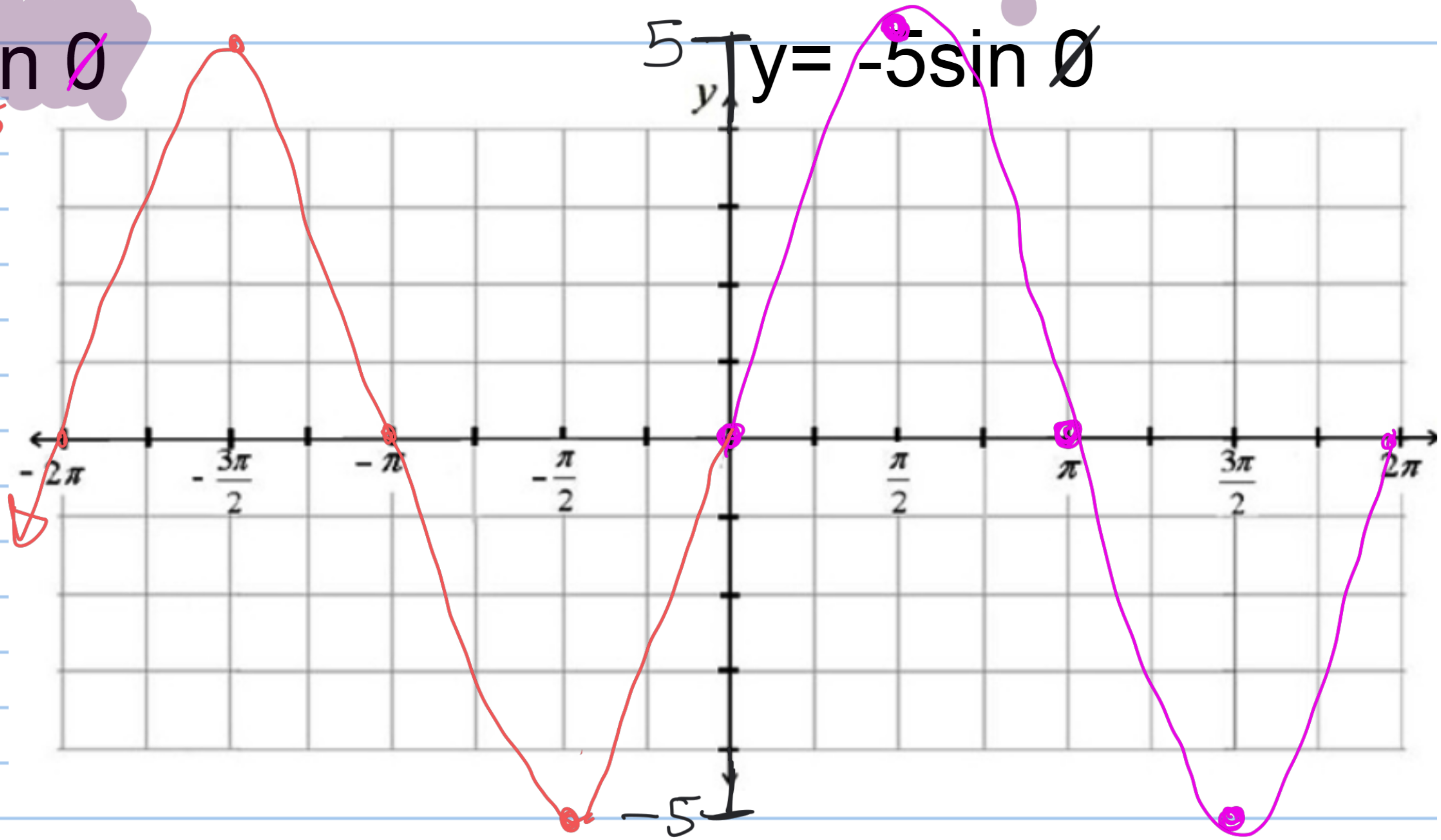
Example

Sketch the function

$y = 5\sin\theta$

x	$y \cdot 5$
0	0
$\frac{\pi}{2}$	5
π	0
$\frac{3\pi}{2}$	-5
2π	0

$y = -5\sin\theta$



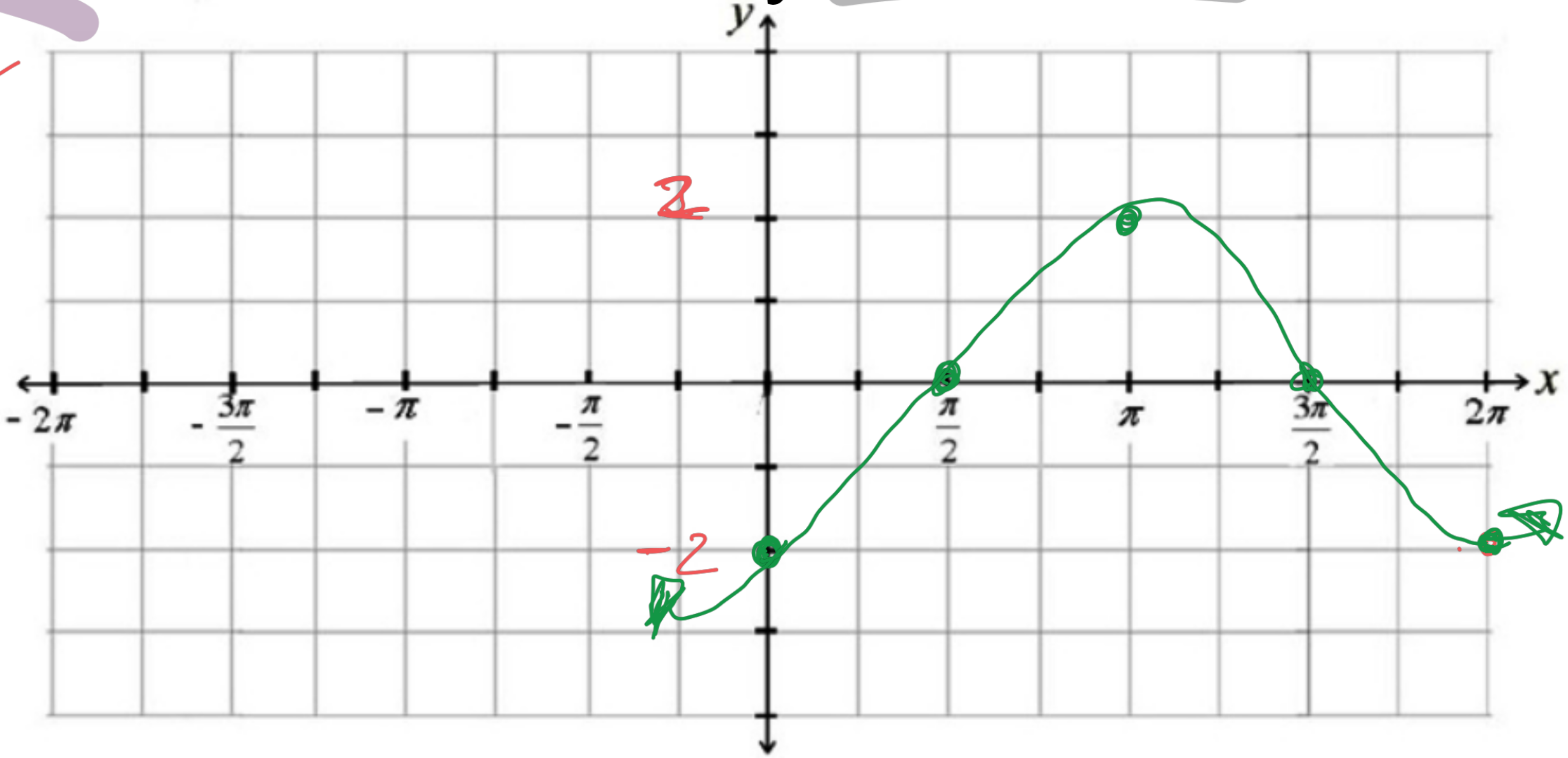
mple

etch the function

~~2cos Ø~~

$y = -2\cos Ø$

x	y
0	-2
$\frac{\pi}{2}$	0
π	2
$\frac{3\pi}{2}$	0
2π	-2

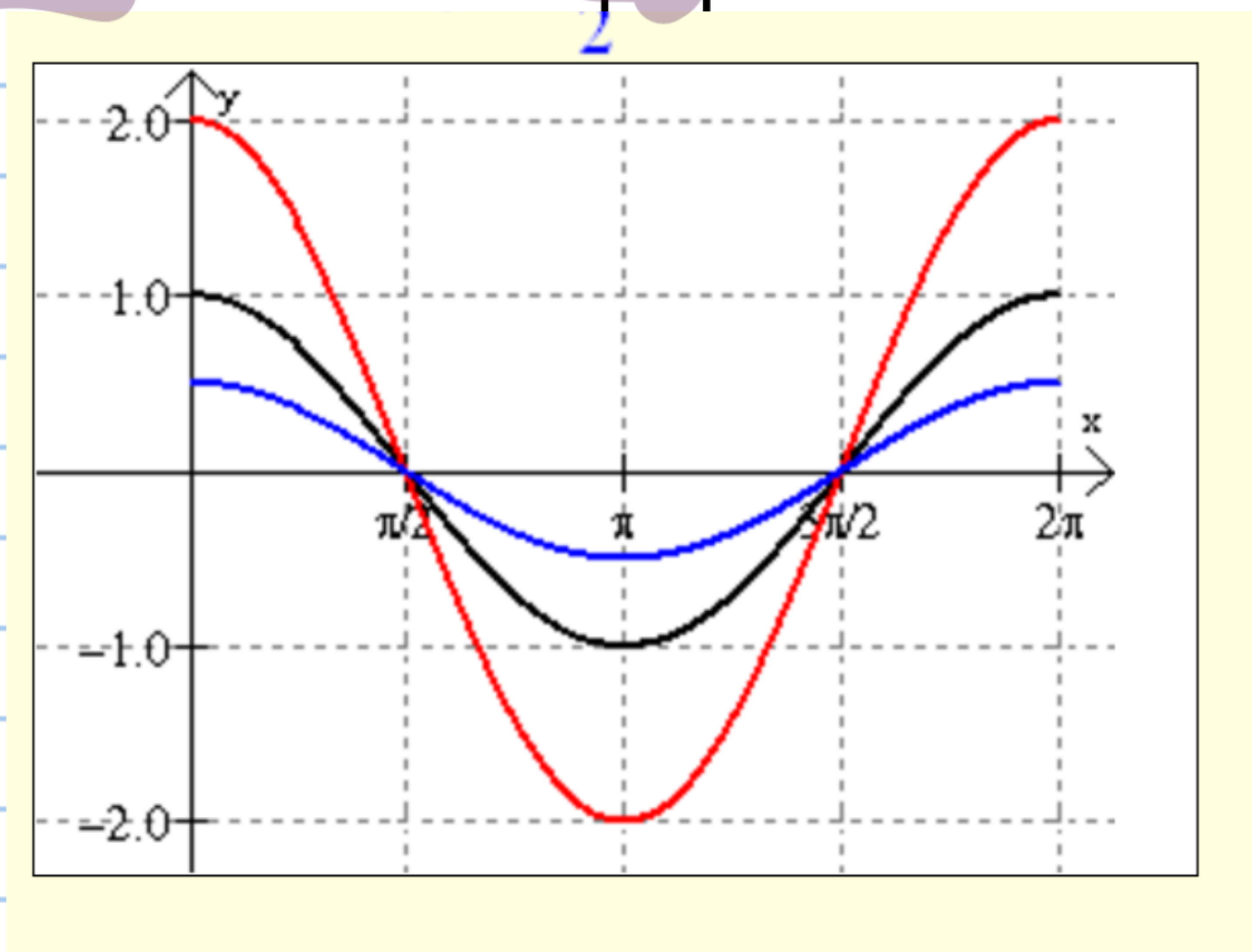


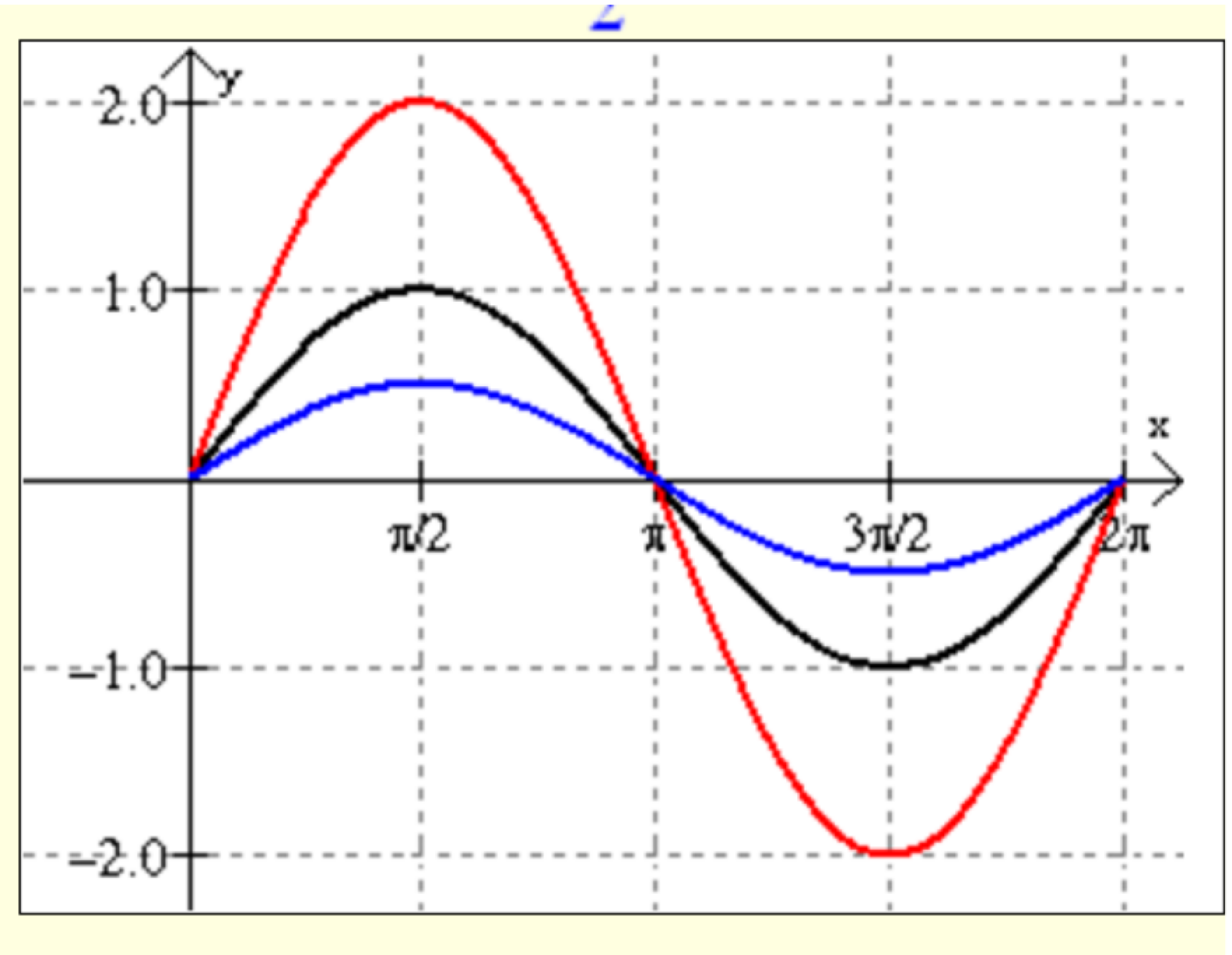
Definition of Amplitude of Sine and Cosine Curves

The amplitude of $y = a\sin x$ and $y = a\cos x$

represent half the distance between the max and min values of the functions and is given by:

amplitude $= |a|$





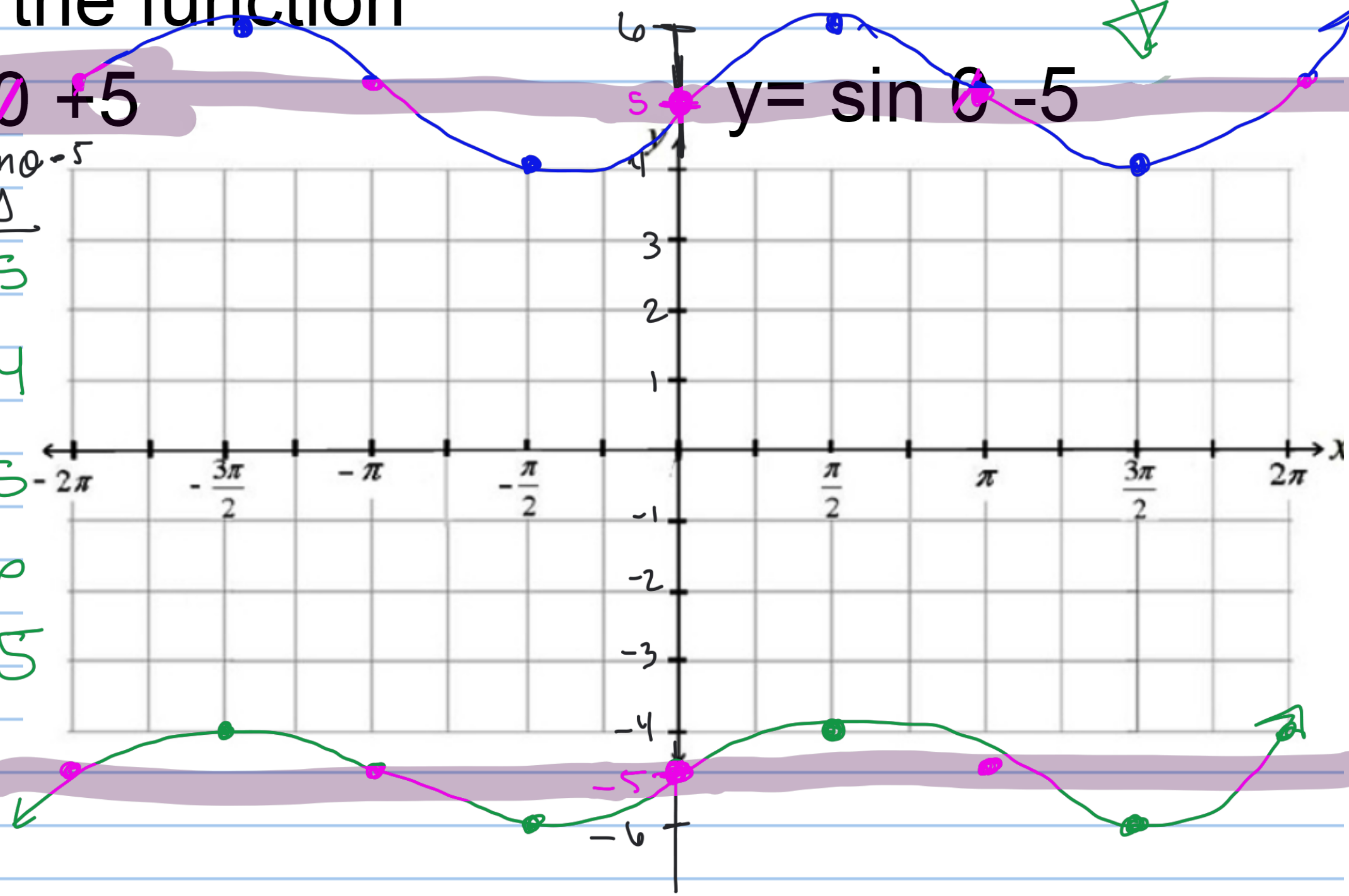
Example

Sketch the function

$y = \sin \theta + 5$ $y = \sin \theta - 5$

Midline

x	y ($\sin\theta+5$)	y ($\sin\theta-5$)
0	5	-5
$\frac{\pi}{2}$	6	-4
π	5	-5
$\frac{3\pi}{2}$	4	-6
2π	5	-5

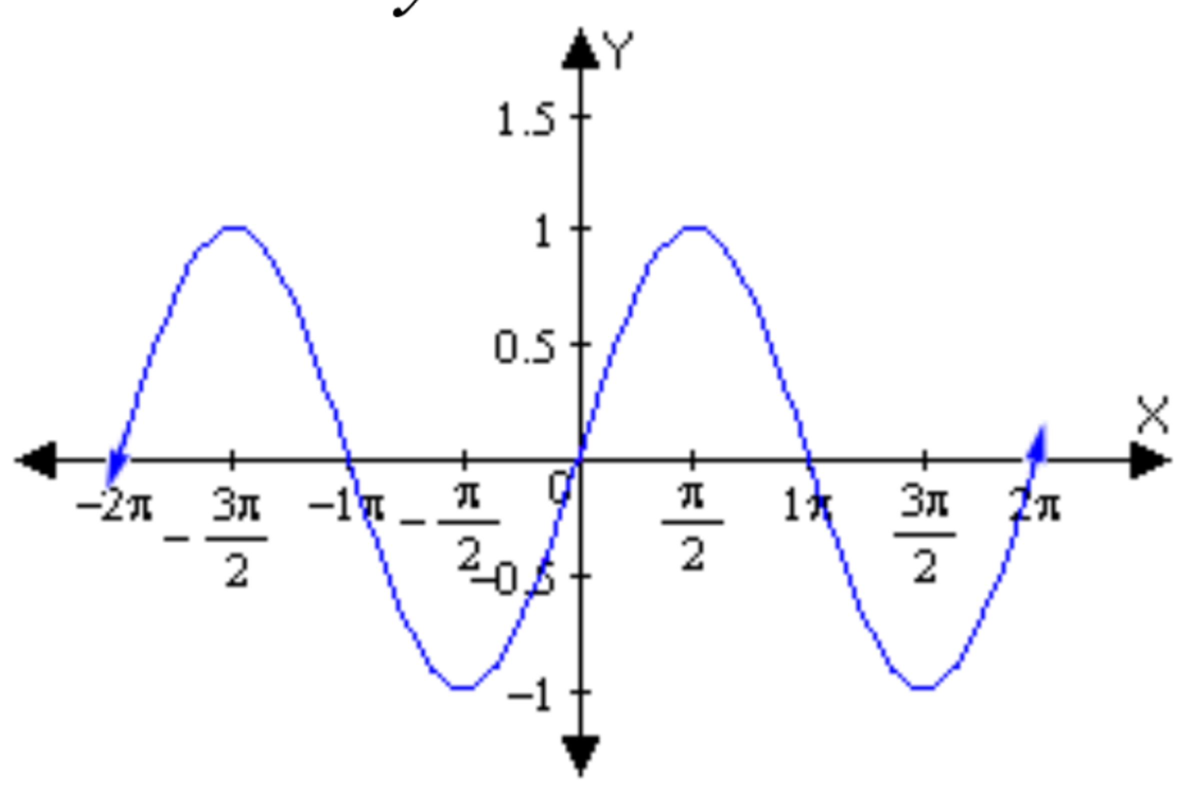


Definition of Midline of Sine and Cosine Curves

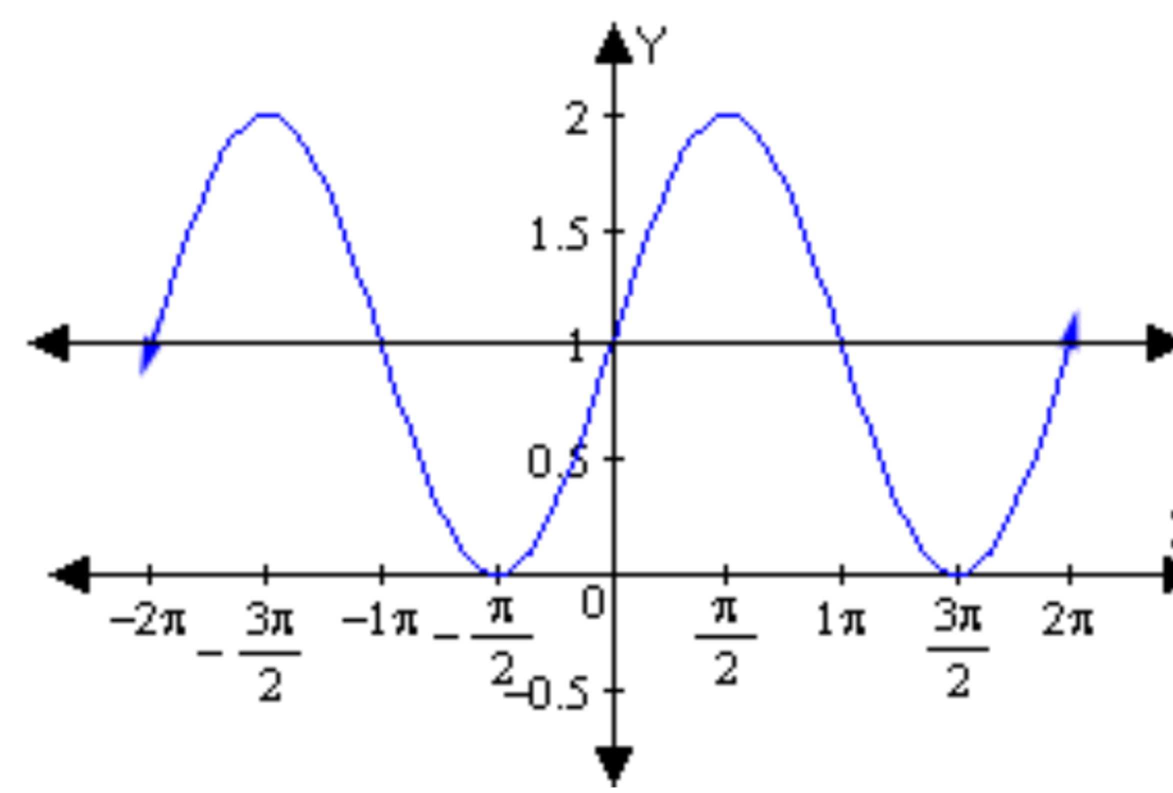
The midline of $y=a\sin x+k$ and $y=a\cos x+k$

represent the vertical translation, which is the average of the max and min values of the functions.

$y=\sin x$



$y=\sin x+1$



Period $= 2\pi$

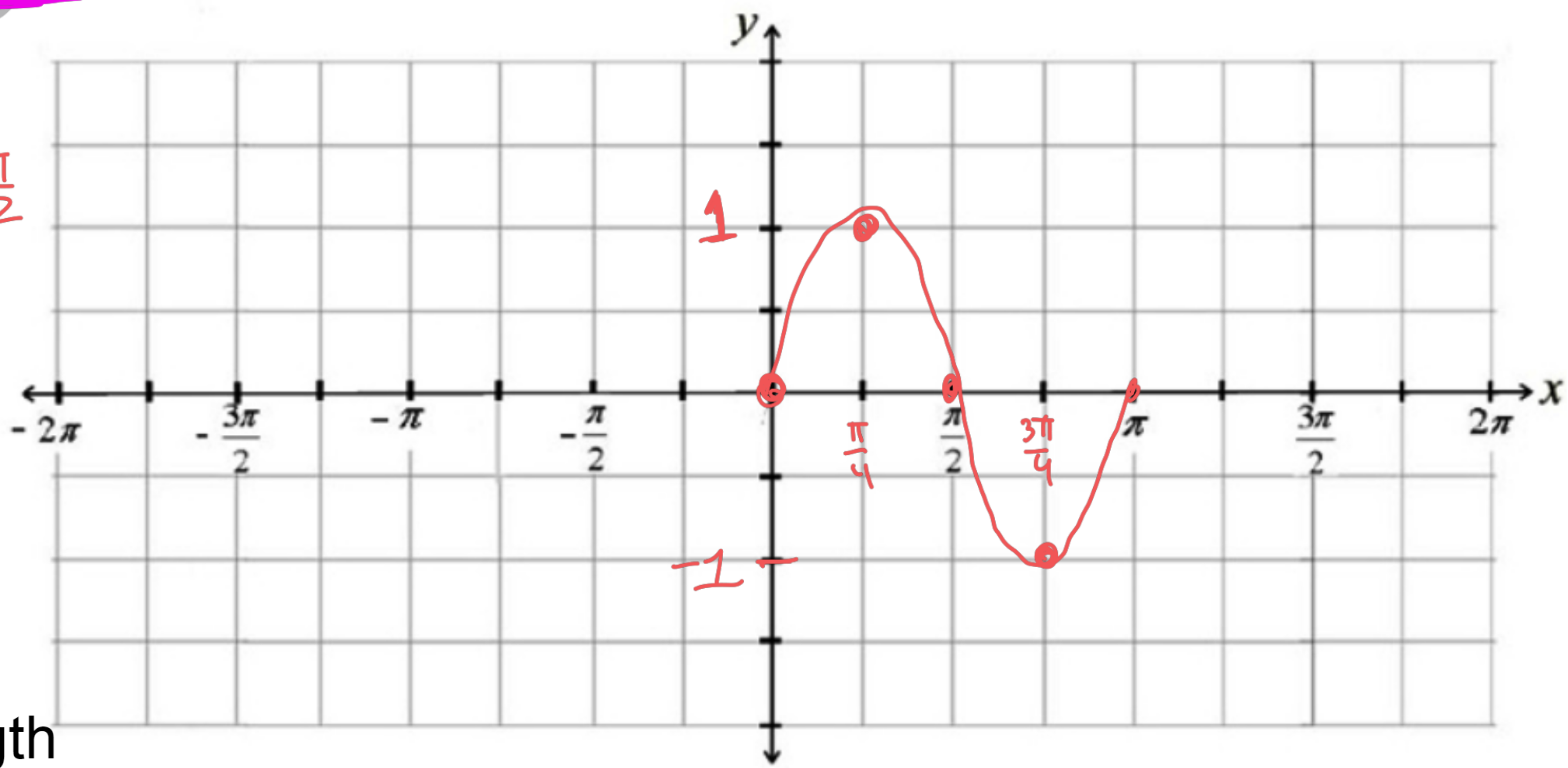
length of Cycle/Period $= \dfrac{2\pi}{b}$

Example

Sketch the function

$y = \sin \boxed{2}\theta$

x	y
0	0
$\pi/4$	$2(\frac{\pi}{4}) = \frac{\pi}{2}$ 1
$\frac{2\pi}{4} = \frac{\pi}{2}$	0
$\frac{3\pi}{4}$	-1
$\frac{4\pi}{4} = \pi$	0



Period Length

Number of cycles in 2pi

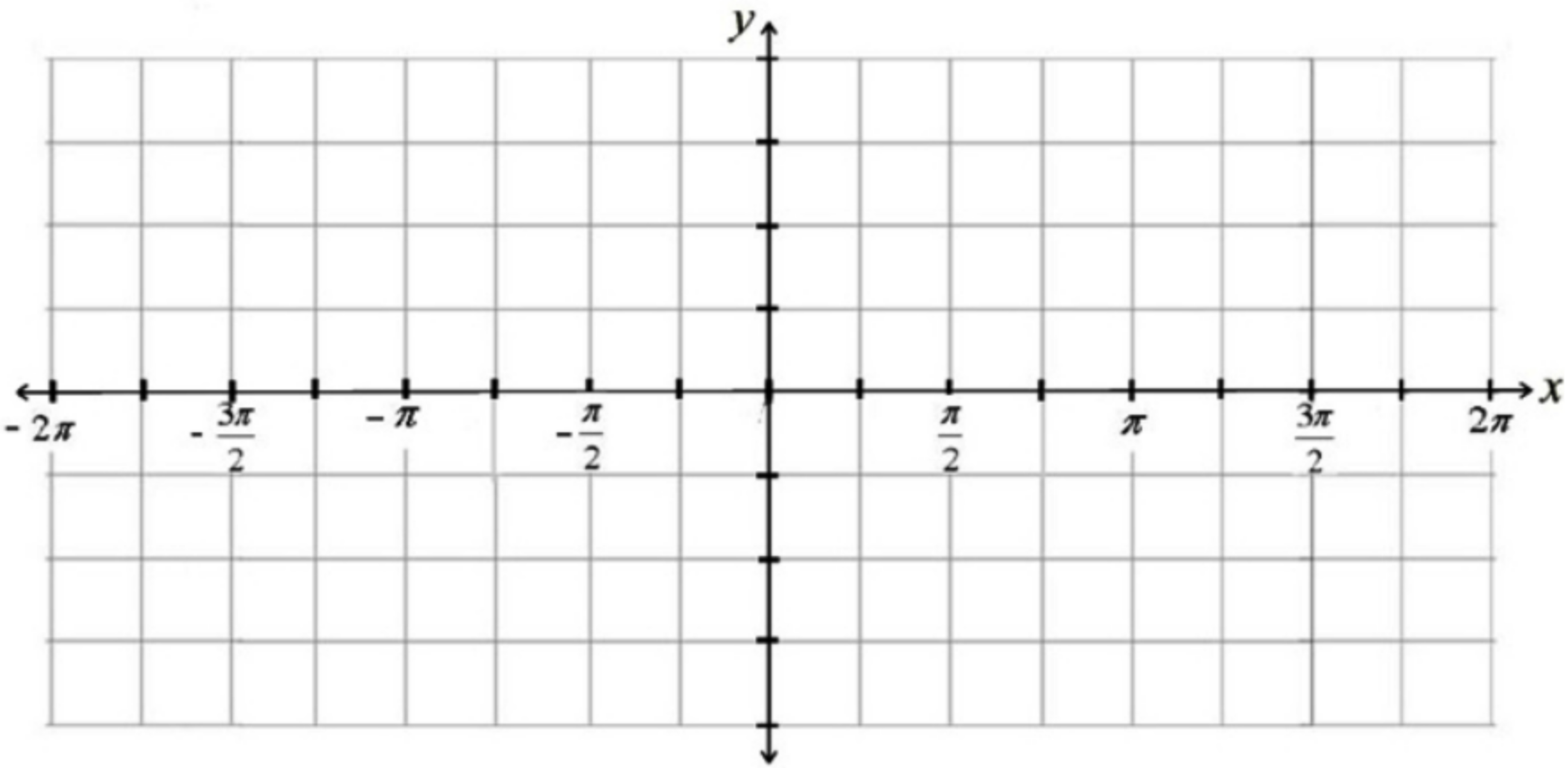
$$\text{Period} = \frac{2\pi}{b} = \frac{2\pi}{2} = \pi$$

$$\text{Int} = \frac{\text{Period}}{4} = \frac{\pi}{4}$$

Example

Sketch the function

$y = \cos 0.5\theta$



Period Length

Number of cycles in 2pi

Period of Sine and Cosine Functions

Let b be a positive real number. The period of $y = a\sin bx$ and $y = a\cos bx$ is given by

$$b \text{ is the number of cycles in } 2\pi$$

$$\text{Length of Period} = \frac{2\pi}{b}$$