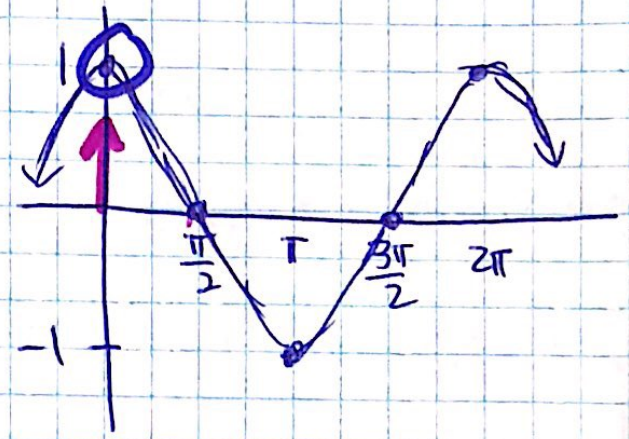
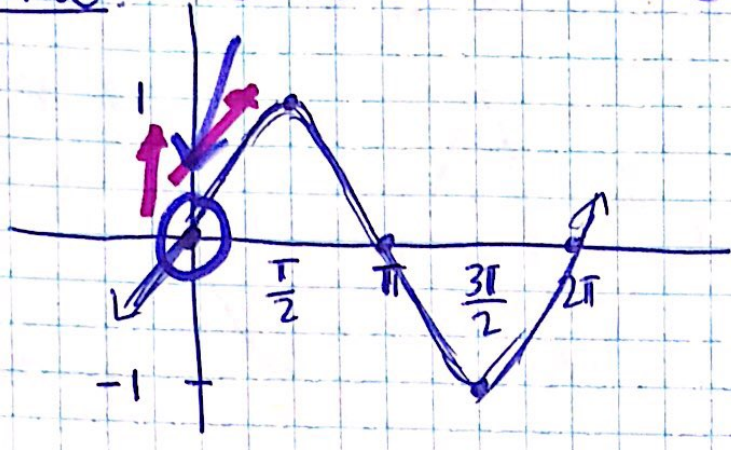


Graphs of Sine and Cosine

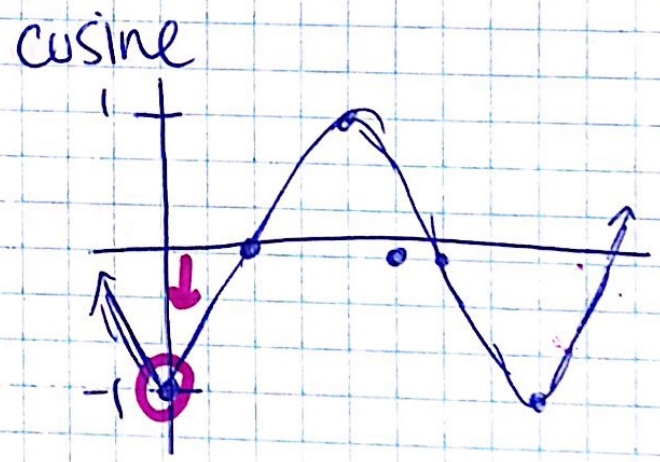
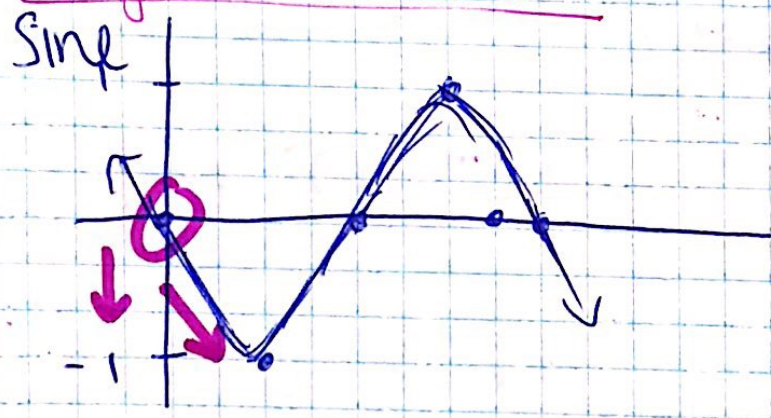
Sine: sine starts at $(0,0)$

starts at cosine: $(0,1)$



(values come right off our unit circle!)

Negative Functions:



Negatives make us go down first!

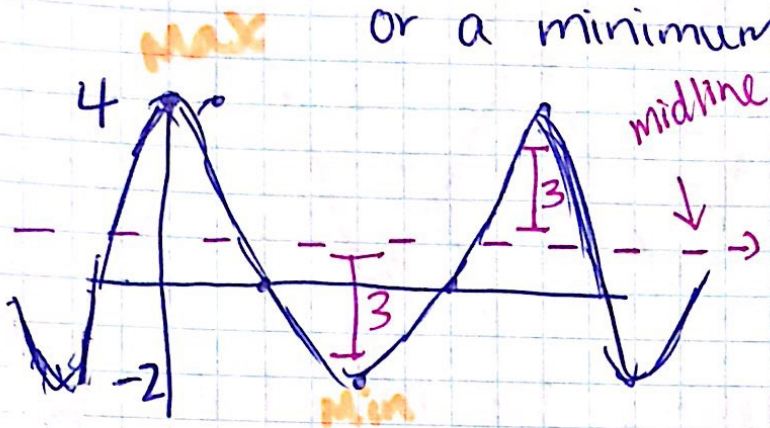
Generic Form of our Functions:

$$y = a \sin(b\theta) + k$$

$$y = a \cos(b\theta) + k$$

Key Features:

Amplitude: distance from the midline to a maximum ^{or} or a minimum (A)



Look at Graph:

$$A = \frac{1}{2} (\text{maximum} - \text{minimum})$$

$$A = \frac{1}{2} (4 - (-2)) = \frac{1}{2} (6) = 3$$

Amplitude is 3

From an equation

Amplitude is $|a|$, the absolute value of a !

ex) $y = \underline{5} \cos 2\theta + 3$

$$a = 5$$

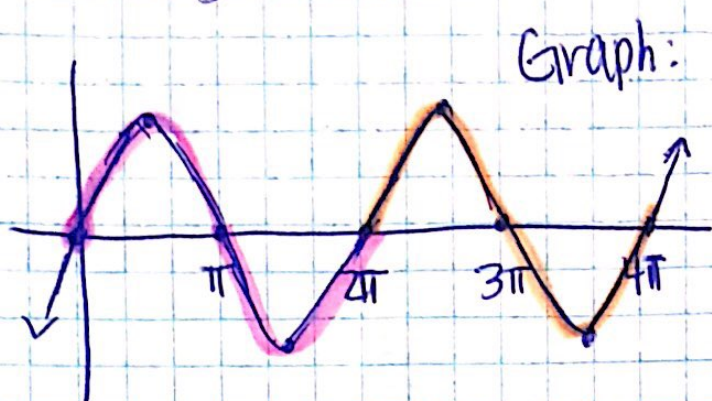
$$\text{Amplitude: } |5| = \underline{5}$$

ex) $y = \underline{-6} \cos \theta - 2$

$$a = -6$$

$$\text{Amplitude} = |-6| = 6$$

Period: how long (how many radians) until the graph repeats its pattern



* start at my origin/
y-axis

Each color is one full pattern

period = 2π , we completed our pattern in 2π .

Equation Formula: $\text{period} = \frac{2\pi}{b}$

Ex) $y = b \sin 5\theta + 2$ $b=5$

period: $\frac{2\pi}{5}$

If we cannot reduce, or simplify leave it as it is in terms of π

Frequency: how much of a wave occurs in one radian.

Graph: How many patterns are in 2π ?

(Equation)
Other way.

Formula: $\frac{b}{2\pi} = \text{frequency}$

ex) $y = -2 \sin 3\theta + 1$

* Reciprocal of our period.

$b=3$ frequency = $\frac{3}{2\pi}$

Period? $\frac{2\pi}{3}$

Looking at Equations:

$$\textcircled{1} y = -5 \cos \frac{2}{3} \theta + 8$$

Amplitude: $| -5 | = 5$

Period: 3π

Frequency: $\frac{1}{3\pi}$

Vertical Shift UP 8

$$a = -5 \quad b = \frac{2}{3} \quad k = 8$$

$$\text{period} = \frac{2\pi}{\frac{2}{3}} = \frac{2\pi}{1} \cdot \frac{3}{2} = \frac{6\pi}{2}$$

Vertical Shift: how far above or below the x-axis the graph has moved.
(Where is the midline)

Equation: look at k value.

$+k \rightarrow$ up k

$-k \rightarrow$ down k



Vertical Shift: Up 1

$$\textcircled{2} y = 3 \sin 2\theta - 15$$

Amplitude: $|3| = 3$

Period: π

Frequency $\frac{1}{\pi}$

Vertical Shift Down 15

$$a = 3 \quad b = 2 \quad k = -15$$

$$\text{period} = \frac{2\pi}{b} = \frac{2\pi}{2} = \frac{\pi}{1}$$

$$(3) y = -\frac{2}{3} \cos 3\theta + \frac{1}{2}$$

$$a = -\frac{2}{3} \quad b = 3 \quad k = \frac{1}{2}$$

$$\text{Amplitude: } \frac{|-\frac{2}{3}|}{1} = \frac{2}{3}$$

$$\text{Period: } \frac{2\pi/3}{1}$$

$$\text{Frequency } \frac{3/2\pi}{1}$$

$$\text{Vertical Shift } \underline{\text{Up } \frac{1}{2}}$$

$$\text{period} = \frac{2\pi}{b} = \frac{2\pi}{3}$$

GUIDED NOTES: Graphs of Sine and Cosine

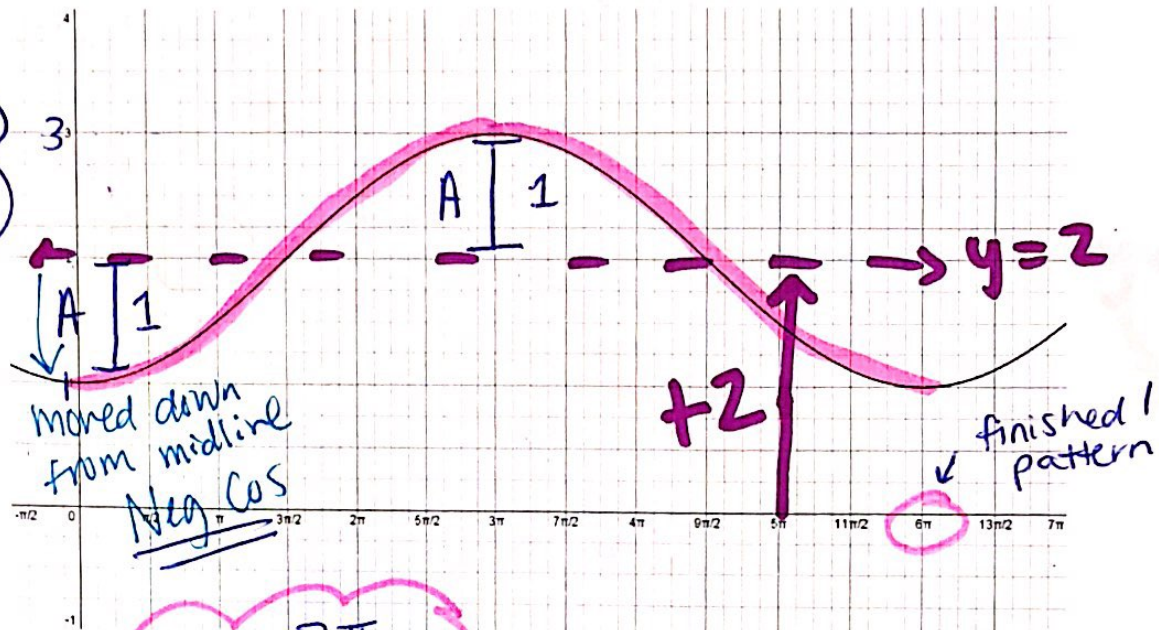
EX1:

Amplitude:
 $\frac{1}{2}(\text{max} - \text{min})$
 $\frac{1}{2}(3 - 1) = 1$

Period:
 6π

Frequency:
 $\frac{1}{6\pi}$

Vertical Shift
 UP 2



$b = \frac{2\pi}{\text{period}}$
 $b = \frac{2\pi}{6\pi} = \frac{1}{3}$

Equation:
 $y = -1 \cos \frac{1}{3}\theta + 2$

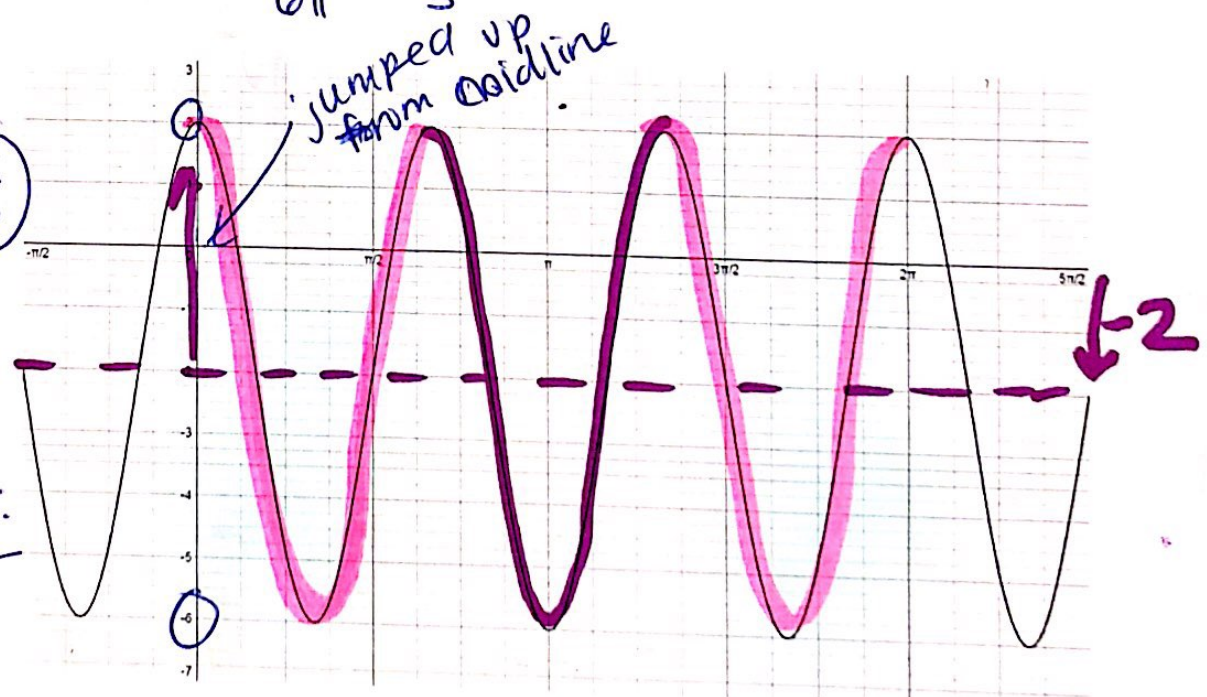
EX2:

Amplitude:
 $\frac{1}{2}(2 - (-6)) = 4$

Period:
 $\frac{2\pi}{3}$

Frequency:
 $\frac{3}{2\pi}$

b: 3
 Vertical Shift:
 Down 2



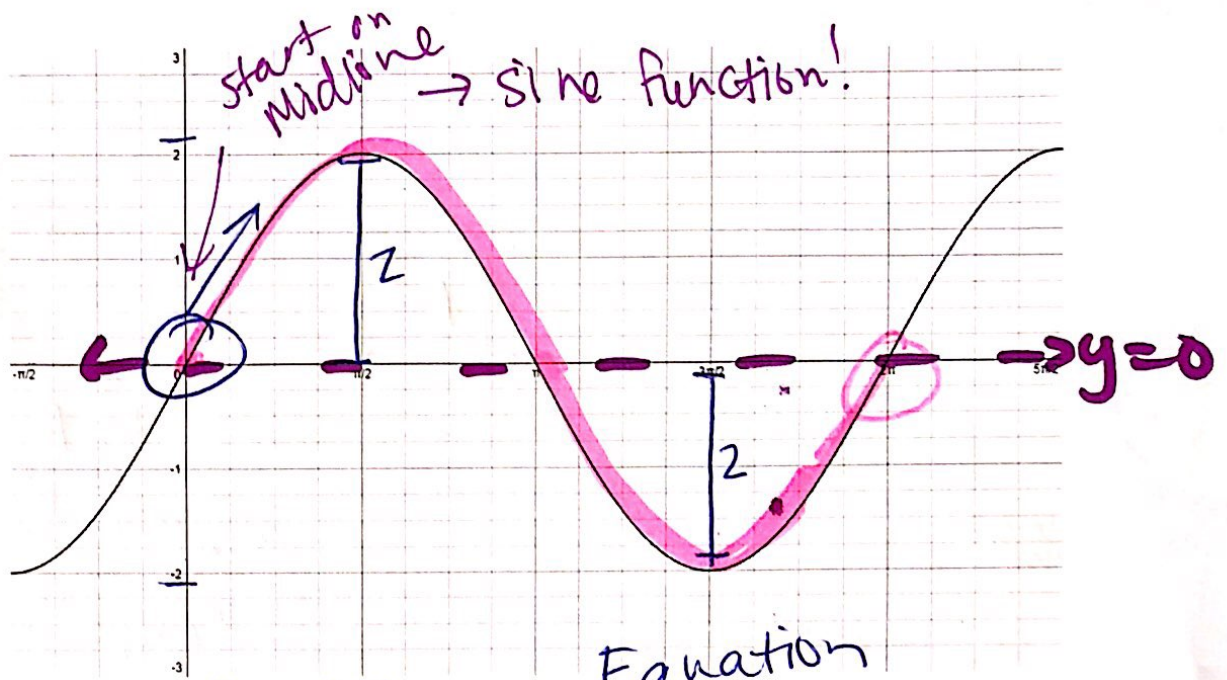
Equation
 $y = 4 \cos 3\theta - 2$

EX3:

Amplitude:
 $\frac{1}{2}(\max - \min)$
 $\frac{1}{2}(2 - (-2)) =$
 $\frac{1}{2}(4) = 2$

Period = 2π
 frequency:
 $\frac{1}{2\pi}$

$b = 1$



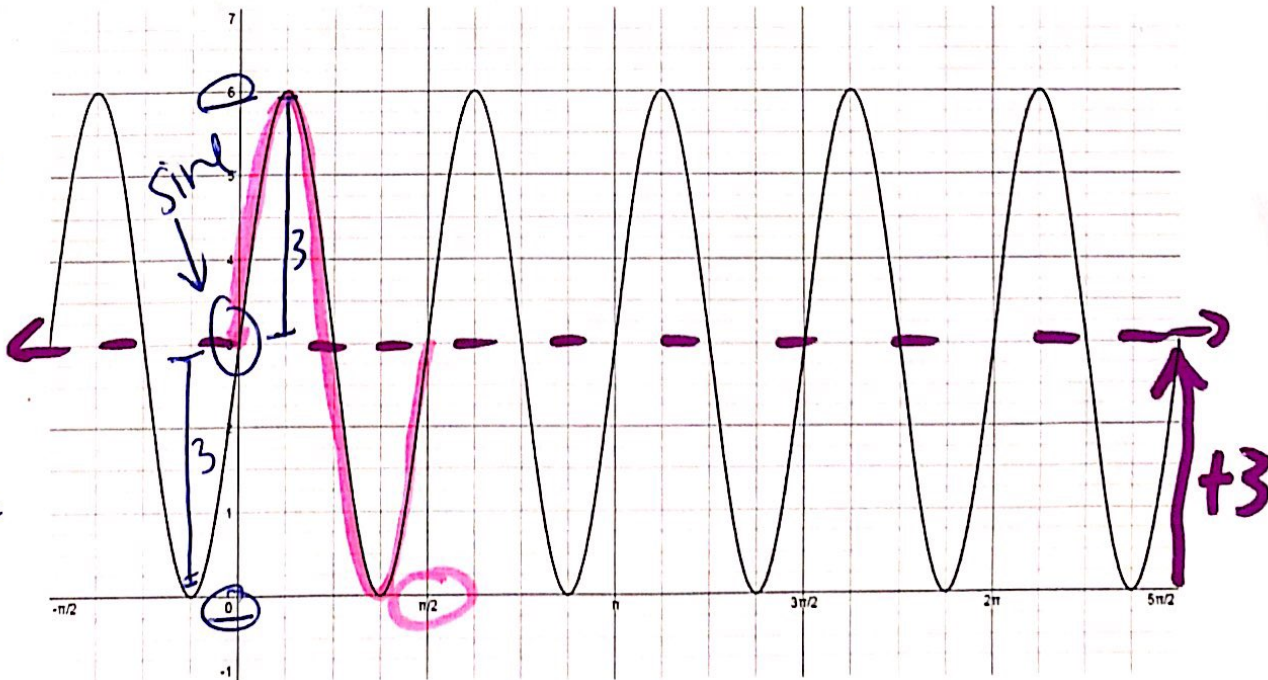
Vertical Shift
 none

Equation
 $y = 2 \sin \theta$

EX4:

Amplitude:
 $\frac{1}{2}(6 - 0) = 3$
 period:
 period = $\frac{\pi}{2}$

Frequency =
 $\frac{2}{\pi}$



~~vertical shift~~
 vertical shift
 VP 3
 $b = 4$

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

$\frac{2\pi}{1} \cdot \frac{2}{\pi} = \frac{4\pi}{\pi} = 4$

Equation: $y = 3 \sin 4\theta + 3$