

4A, 4B

1. $y = \sin(x)$

$|A| = 1$
Period = 2π
Phase shift: 0
Vertical shift: 0

2. $y = \sin(x - \frac{\pi}{2})$

$|A| = 1$
Period = 2π
Phase shift = $\frac{\pi}{2}$
Vertical shift = 0

3. $y = \sin(x + \frac{\pi}{4})$

$|A| = 1$
Period = 2π
Phase shift = $-\frac{\pi}{4}$
Vertical shift = 0

4. $y = 2 \cos(x - \frac{\pi}{3})$

$|A| = 2$
Period = 2π
Phase shift = $\frac{\pi}{3}$
Vertical shift = 0

5. $y = -3 \cos(x + \frac{\pi}{3}) + 1$

$|A| = 3$
Period = 2π
Phase shift = $-\frac{\pi}{3}$
Vertical shift = 1

10. $y = 2 \sin(x - \frac{\pi}{4})$

$|A| = 2$
Period = 2π
Phase shift = $\frac{\pi}{4}$
Vertical shift = 0

$y = -\cos(x + \frac{\pi}{2}) + 2$

$|A| = 1$
Period = 2π
Phase shift = $-\frac{\pi}{2}$
Vertical shift = 2

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

$|A| = 1$
Period = 2π
Phase shift = $\frac{2\pi}{3}$
Vertical shift = 1

$y = 3 \sin(x + \frac{\pi}{3}) - 2$

$|A| = 3$
Period = 2π
Phase shift = $-\frac{\pi}{3}$
Vertical shift = -2

5A, 5B

1. $y = \sin(x)$

$|A| = 1$
period = 2π
phase shift = 0
vertical shift = 0

2. $y = \sin(2x)$

$|A| = 1$
period = π
phase shift = 0
vertical shift = 0

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

$|A| = 1$
period = 4π
phase shift = 0
vertical shift = 0

4. $y = \sin\left(2\left(x - \frac{\pi}{2}\right)\right)$

$|A| = 1$
period = π
phase shift = $\frac{\pi}{2}$
vertical shift = 0

5. $y = \cos\left(\frac{1}{2}(x - \pi)\right)$

$|A| = 1$
period = 4π
phase shift = π
vertical shift = 0

10. A) $y = -2\sin(4x)$

$|A| = 2$
period = $\frac{\pi}{2}$
phase shift = 0
vertical shift = 0

B) $y = \cos\left(\frac{1}{2}x\right) - 2.5$

$|A| = 1$
period = 4π
phase shift = 0
vertical shift = -2.5

C) $y = 3\cos\left(3\left(x - \frac{\pi}{3}\right)\right)$

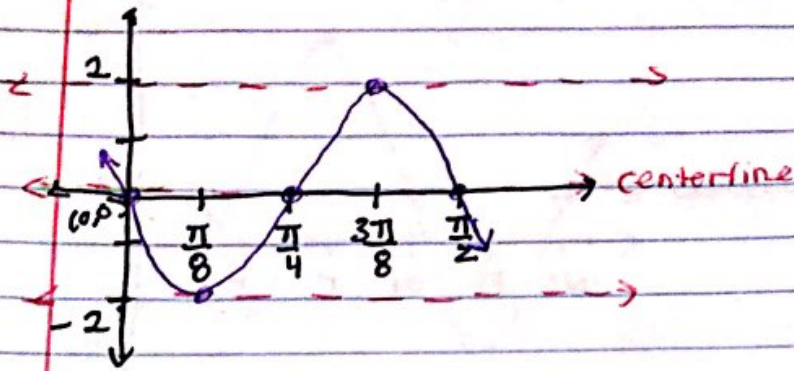
$|A| = 3$
period = $\frac{2\pi}{3}$
phase shift = $\frac{\pi}{3}$
vertical shift = 0

D) $y = 15\sin\left(\frac{\pi}{6}(x - 4)\right) + 5$

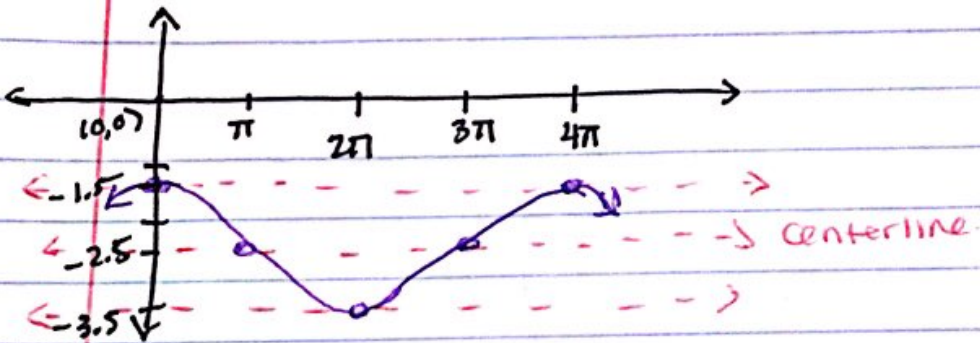
$|A| = 15$
period = 12
phase shift = 4
vertical shift = 5

Graphs 5B

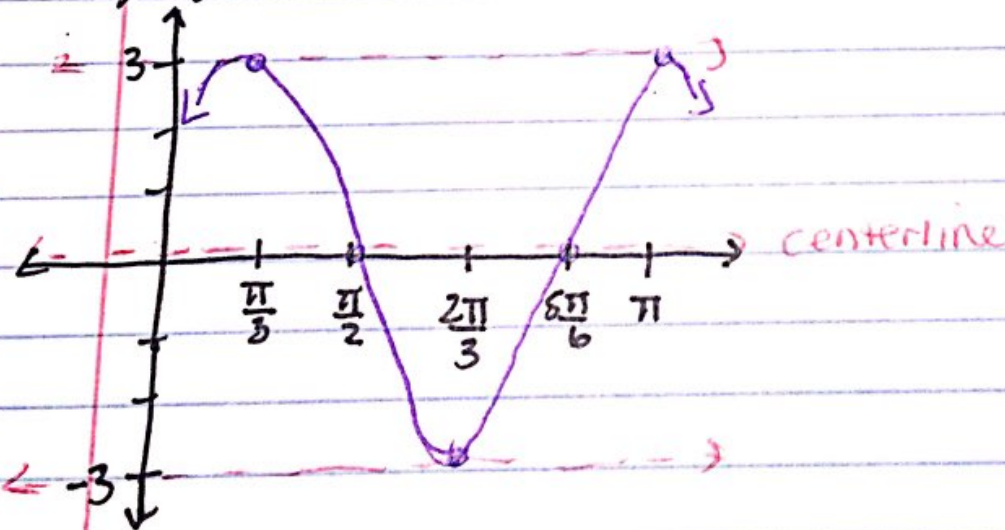
10a.) $y = -2 \sin(4x)$



10b.) $y = \cos(\frac{1}{2}x) - 2.5$

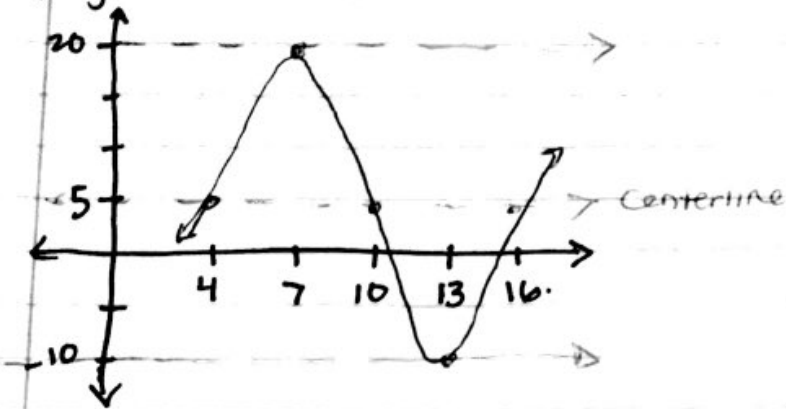


10c.) $y = 3 \cos(3(x - \frac{\pi}{3}))$



Graphs SB continued...

10d.) $y = 15 \sin\left(\frac{\pi}{6}(x-4)\right) + 5$



1. Based on your investigation, what overall effect does each have on the graphs of $y = A \sin(B(x-C)) + D$ and $y = A \cos(B(x-C)) + D$

- A: Amplitude: vertical stretch/compression
 B: period = $2\pi/B$
 C: phase shift: shifts left/right
 D: vertical shift: shifts up/down (centerline is $y=D$)

2. Graph each of the following equations without a calculator. Then check your answers.

Equation	Center-line	Amp-litude	Period	Phase Shift	Graph
$y = 2 \sin\left(x + \frac{\pi}{3}\right)$	$y = 0$	2	2π	$-\frac{\pi}{3}$	
$y = \cos(3x) - 2$	$y = -2$	1	$\frac{2\pi}{3}$	0	
$y = -3 \sin\left(x + \frac{\pi}{2}\right) - 1$	$y = -1$	3	2π	$-\frac{\pi}{2}$	
$y = -\cos(x) - 3$	$y = -3$	1	2π	0	

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6A, 6B

• $y = 2 \sin(x + \frac{\pi}{3})$

$|A| = 2$

period = 2π

phase shift = $-\frac{\pi}{3}$

vertical shift = 0

• $y = 3 \cos(2(x - \pi))$

$|A| = 3$

period = π

phase shift = π

vertical shift = 0

• $y = \cos(3x) - 2$

$|A| = 1$

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

phase shift = 0

vertical shift = -2

★ • $y = 3 \sin(2x - \pi) + 1$

$|A| = 3$

period = π

phase shift = $\frac{\pi}{2}$

vertical shift = 1

• $y = -3 \sin(x + \frac{\pi}{2}) - 1$

$|A| = 3$

period = 2π

phase shift = $-\frac{\pi}{2}$

vertical shift = -1

• $y = -2 \cos(x + \frac{2\pi}{3}) + 3$

$|A| = 2$

period = 2π

phase shift = $-\frac{2\pi}{3}$

vertical shift = 3

• $y = -\cos(x) - 3$

$|A| = 1$

period = 2π

phase shift = 0

vertical shift = -3

• $y = 2 \cos(x - 90^\circ) + 1$

$|A| = 2$

period = 2π

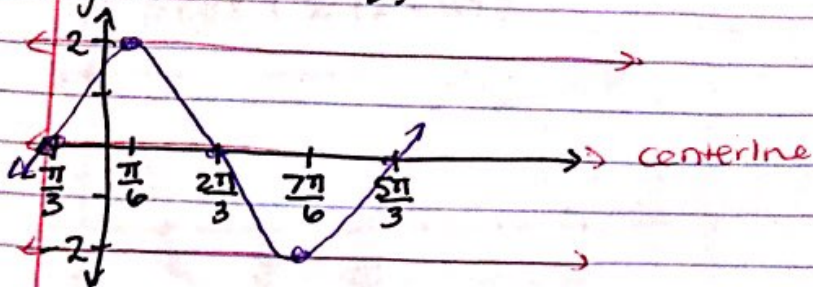
phase shift = $90^\circ / \frac{\pi}{2}$

vertical shift = 1

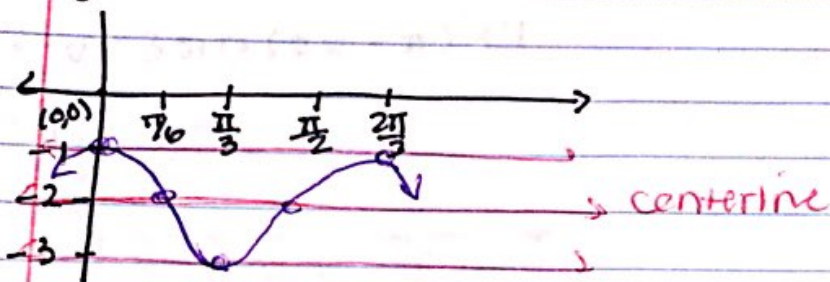


Graphs 6A

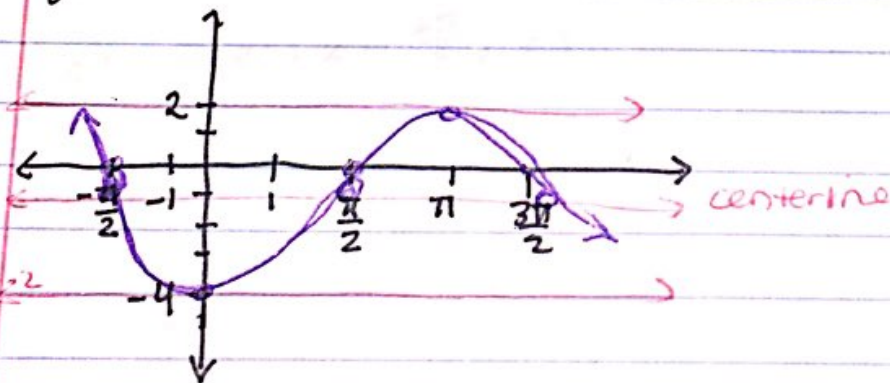
• $y = 2 \sin(x + \frac{\pi}{3})$



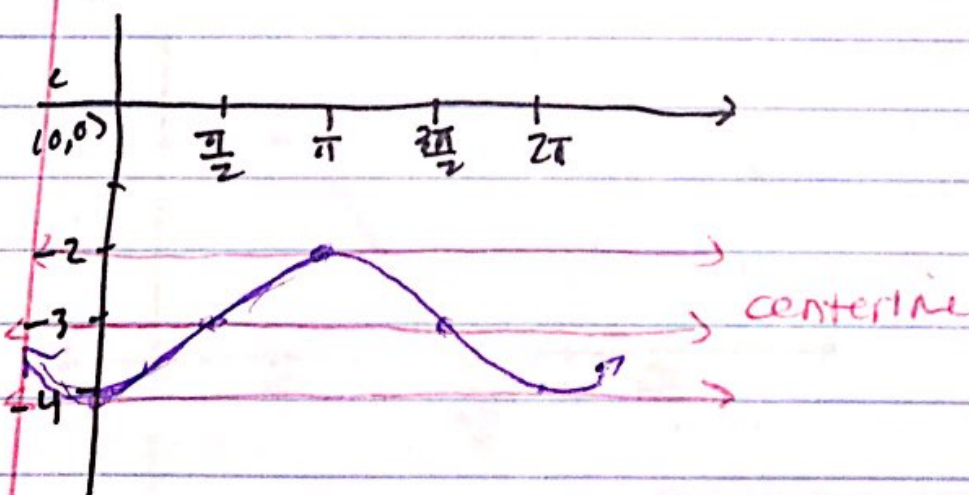
• $y = \cos(3x) - 2$



• $y = -3 \sin(x + \frac{\pi}{2}) - 1$



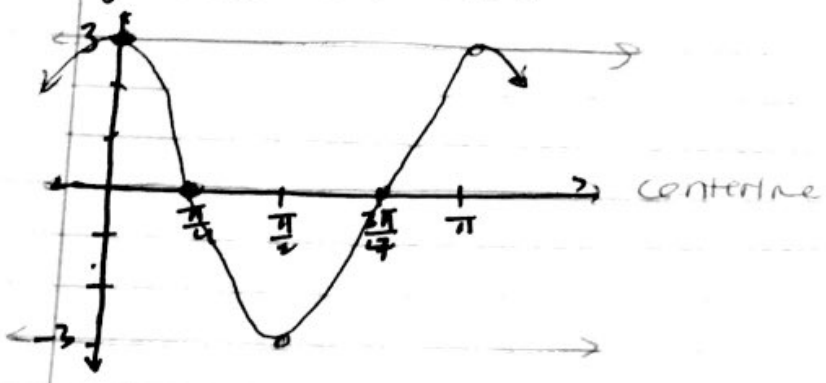
• $y = -\cos(x) - 3$



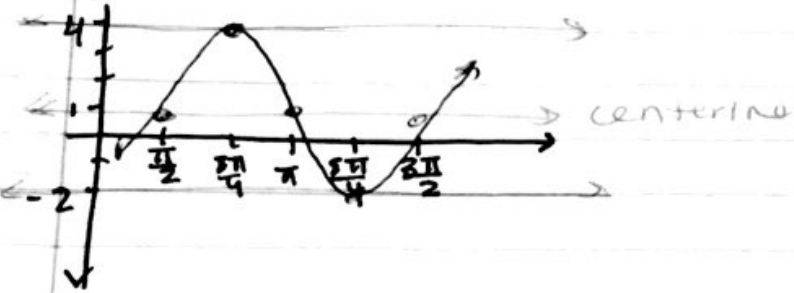
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Graphs 6B

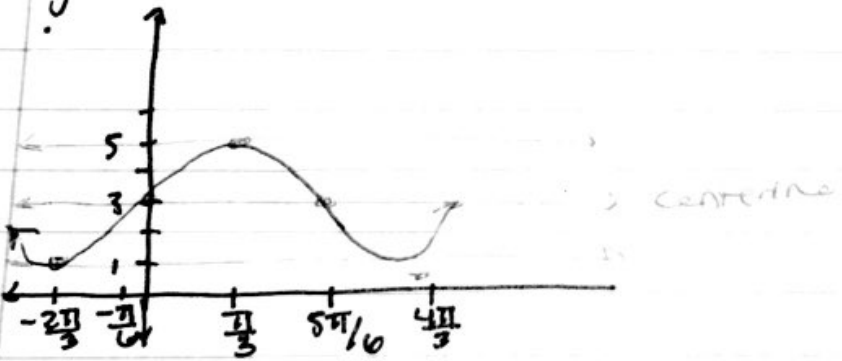
• $y = 3 \cos(2(x - \pi))$



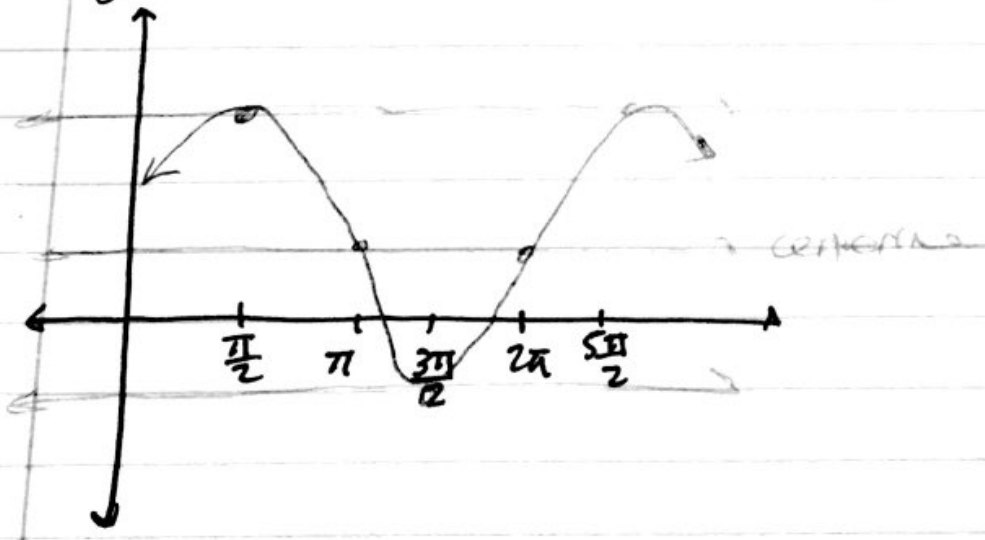
• $y = 3 \sin(2x - \pi) + 1$



• $y = -2 \cos(x + \frac{2\pi}{3}) + 3$



• $y = 2 \cos(x - 90^\circ) + 1$ or $y = 2 \cos(x - \frac{\pi}{2}) + 1$



Based on your investigation of A, B, C, and D, answer the following questions.

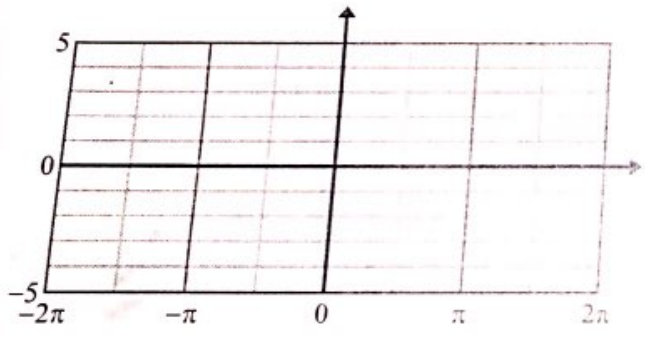
- What is meant by Period with respect to sine and cosine graphs? the length of one cycle
 - What is the default value of B in the parent functions, $y = \sin(x)$ and $y = \cos(x)$? 1
 When $B = 1$, what is the period of the parent functions? 2π
 How many cycles of the graph will you see between 0 and 2π ? 1
 - When $B > 1$, what happens to the period of the graph? it is shorter
 What happens to the number of cycles between 0 and 2π ? there are more cycles
 - When $0 < B < 1$, what happens to the Period of the graph? it is longer
 What happens to the number of cycles between 0 and 2π ? there are fewer cycles
 - Write a formula that shows the relationship between B and the period of the graph (measured in radian).
 Remember that your formula must work for all the problems you have done. Per = $\frac{2\pi}{B}$
 - Rewrite the formula using degrees instead of radian. Per = $\frac{360}{B}$
 - Write an equation in the form $y = \sin(Bx)$ or $y = \cos(Bx)$ for each period.

$B = \frac{2\pi}{\text{period}}$

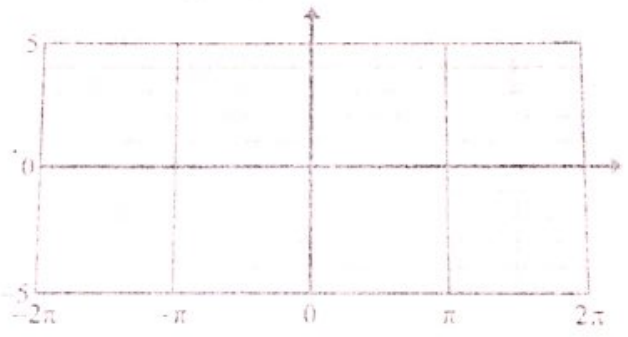
 - π $y = \sin(2x)$
 - $\frac{2}{3}\pi$ $y = \sin(3x)$
 - 12 $y = \sin(\frac{\pi}{6}x)$
- Write a cosine equation whose graph has amplitude 2 and period $\frac{\pi}{2}$ $A=2$ $B=4$ $y = 2\cos(4x)$
- Write a sine equation whose graph has a vertical shift of -2, amplitude of 1.5, and period of 4π . $B = \frac{1}{2}$
- $y = 1.5\sin(\frac{1}{2}x) - 2$

Graph each of the equations below without using a calculator. Then, check your answer on the calculator.

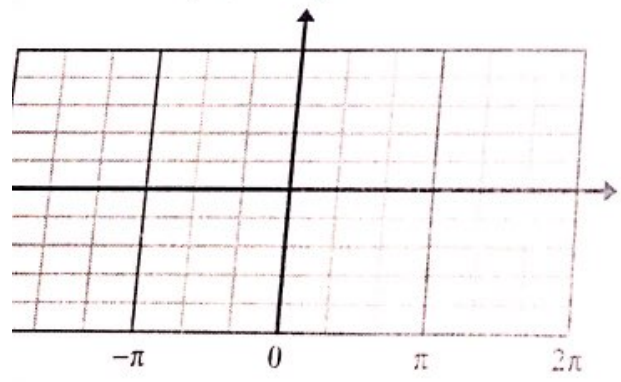
a. $y = -2\sin(4x)$



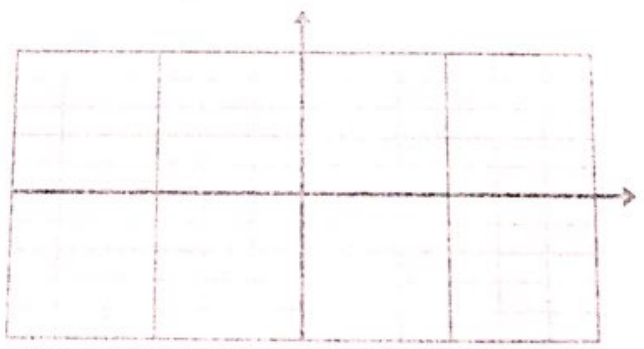
b. $y = \cos(\frac{1}{2}x) - 2.5$



c. $y = 3\cos(3(x - \frac{\pi}{3}))$



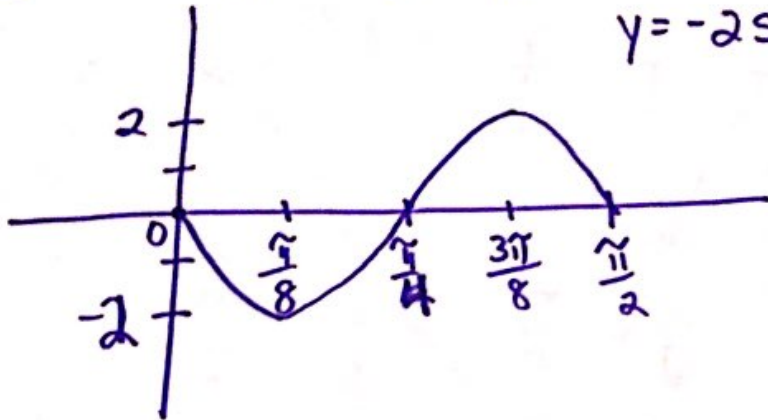
d. $y = 15\sin(\frac{\pi}{6}(x-4)) + 5$



WS 5B Graphs

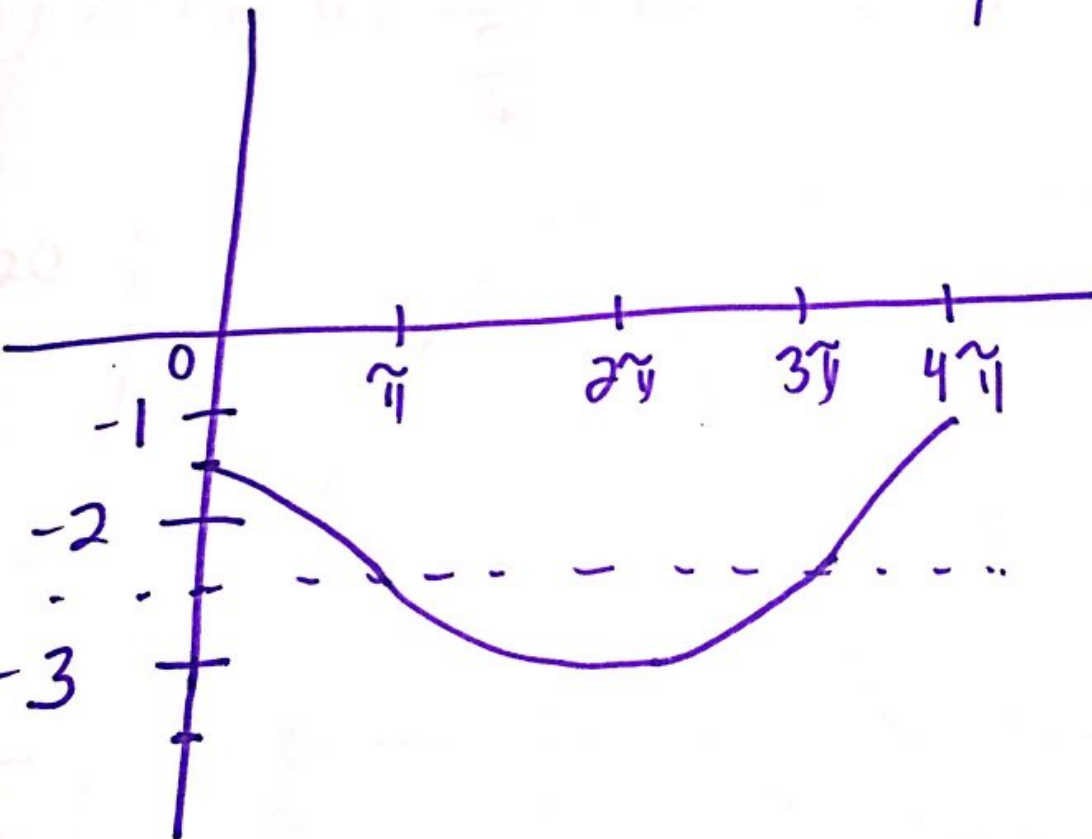
10) a) $A=2$, $Per = \frac{2\pi}{4} = \frac{\pi}{2}$

$$y = -2\sin(4x)$$



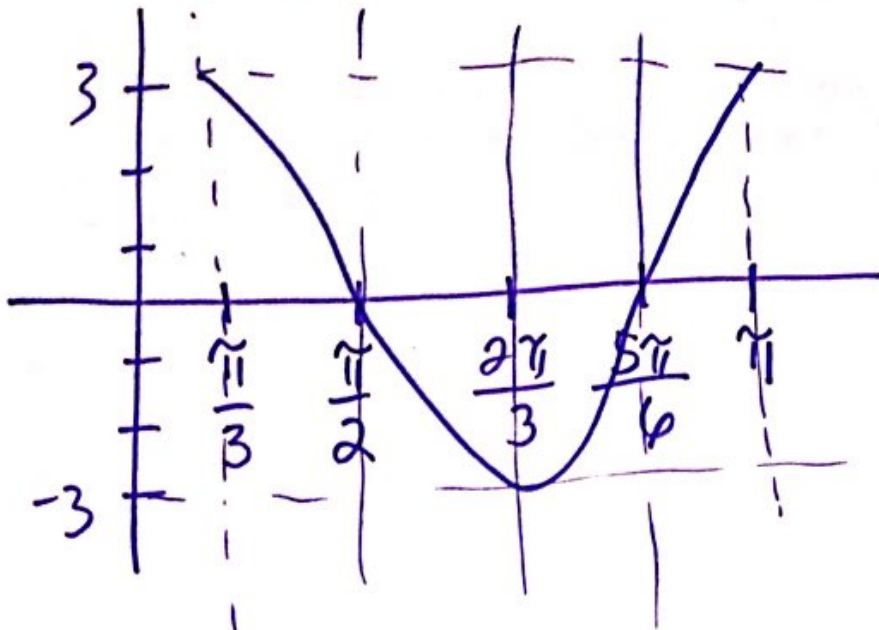
b) $Per = \frac{2\pi}{\frac{1}{2}} = 4\pi$ V.S. = -2.5

$$y = \cos\left(\frac{1}{2}x\right) - 2.5$$

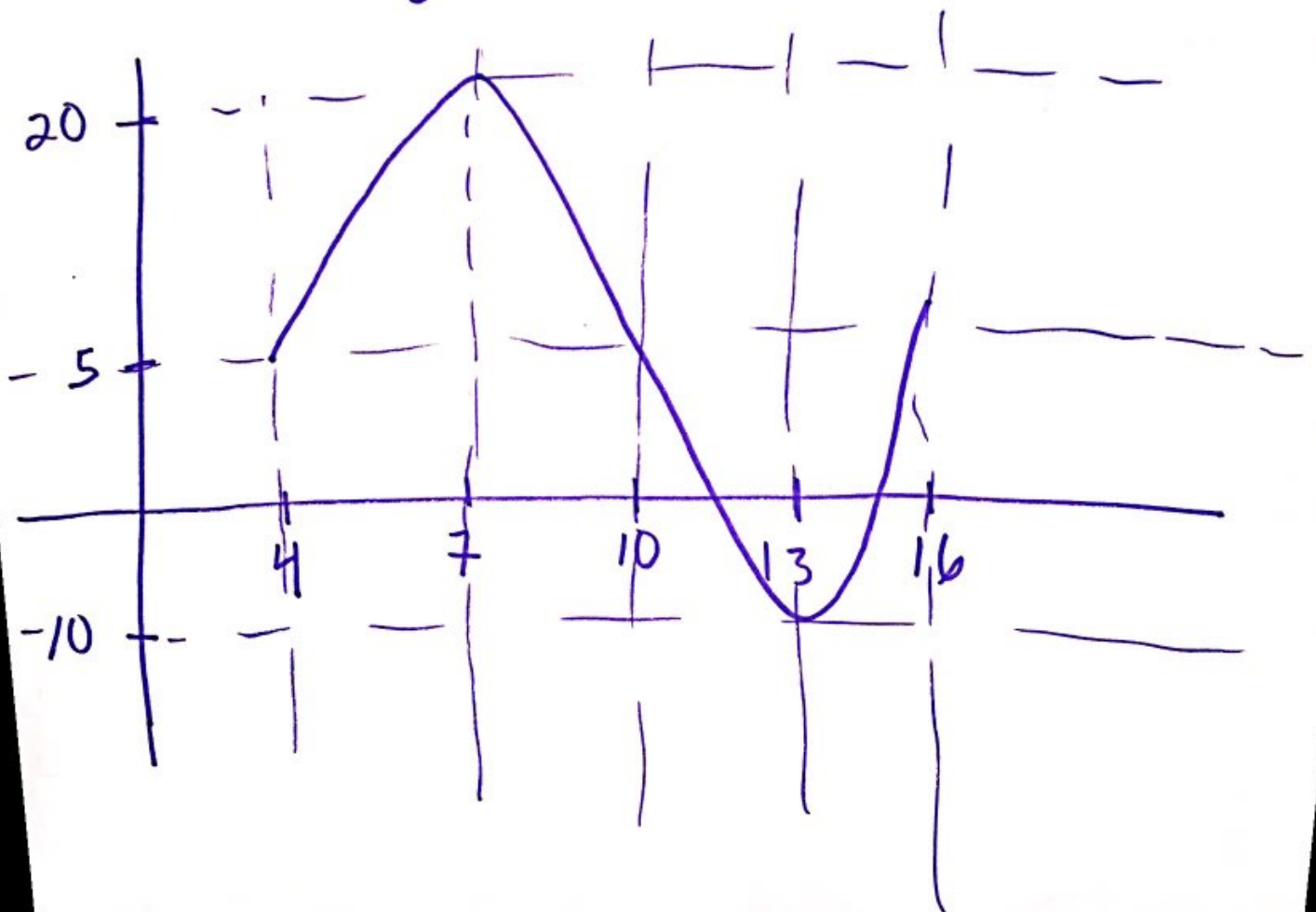


b) $A=3$ Per = $\frac{2\pi}{3}$ P.S. = $\frac{\pi}{3}$

$$y = 3\cos\left(3\left(x - \frac{\pi}{3}\right)\right)$$



d) $A=15$ Per = $\frac{2\pi}{\frac{\pi}{6}} = 12$ P.S. = 4 V.S. = 5
 $y = 15\sin\left(\frac{\pi}{6}(x-4)\right) + 5$



1. Based on your investigation, what does a function in the form $y = A \cos(B(x-C)) + D$ or $y = A \sin(B(x-C)) + D$ represent?

$y = A \cos(B(x-C)) + D$ * In Factored Form

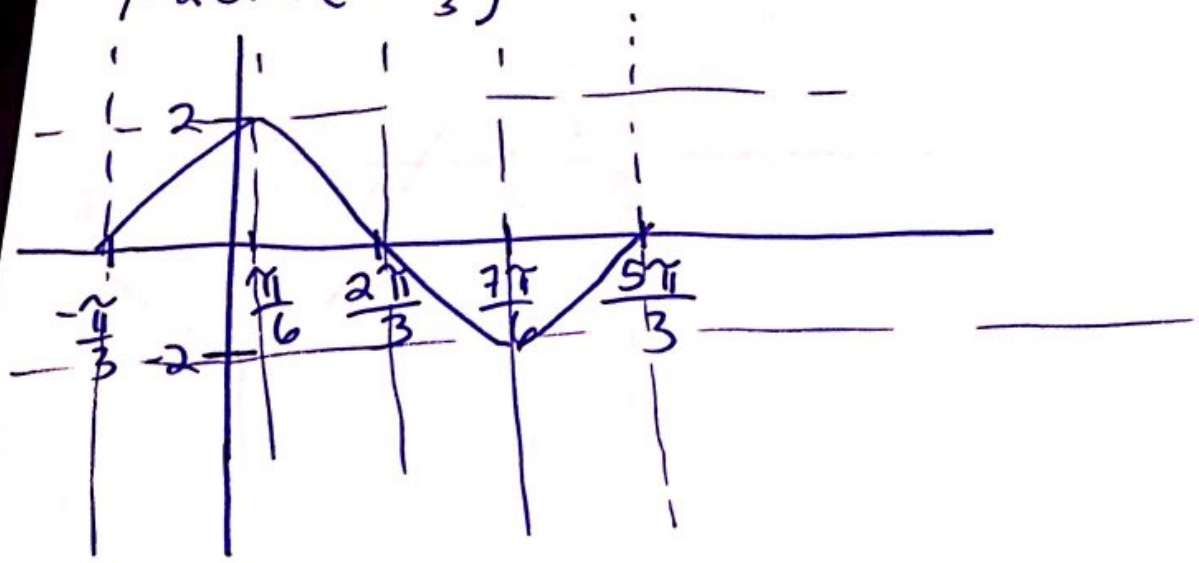
- A. Amplitude - Vertical Stretch/compression
- B. changes the period length $P = \frac{2\pi}{B}$
- C. Phase Shift
- D. Vertical Shift

2. Graph each of the following equations without a calculator. The x-axis is in radians.

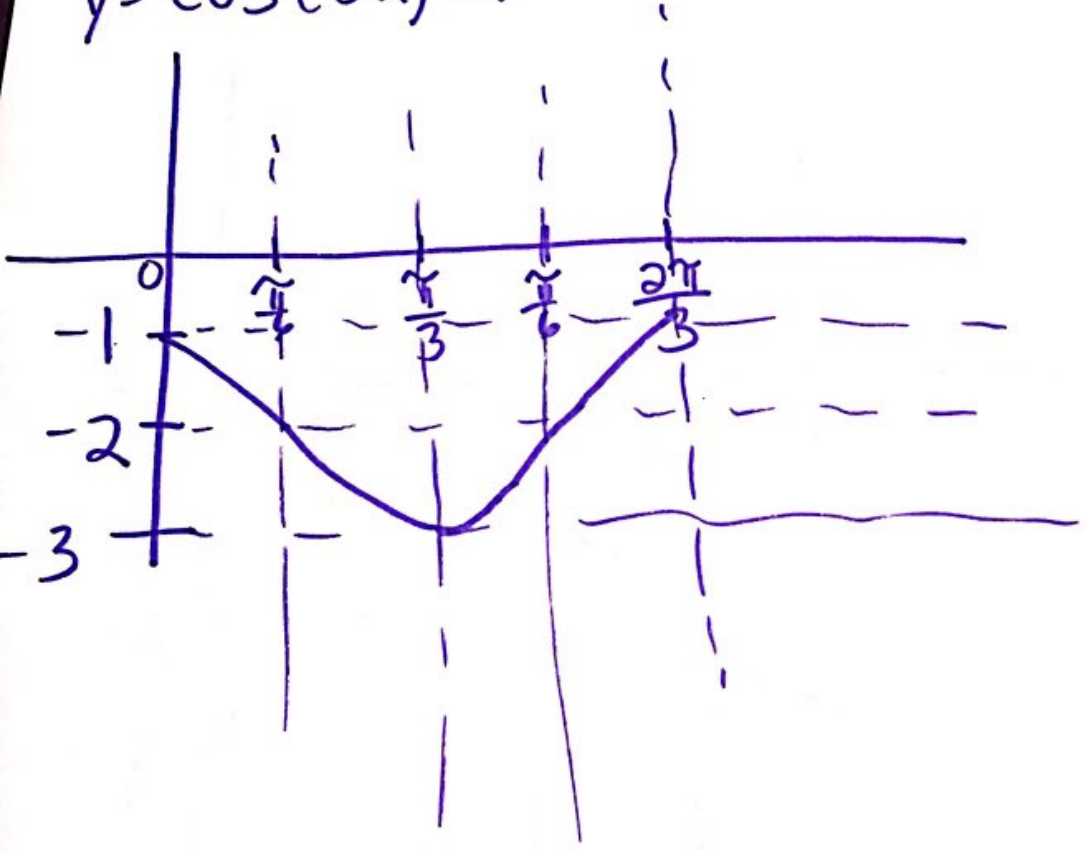
Equation	Center line	Amplitude	Period	Phase Shift	Graph
$y = 2 \sin\left(x + \frac{\pi}{3}\right)$					
$y = \cos(3x) - 2$					
$y = -3 \sin\left(x + \frac{\pi}{2}\right) - 1$					
$y = -\cos(x) - 3$					

6A Graphs

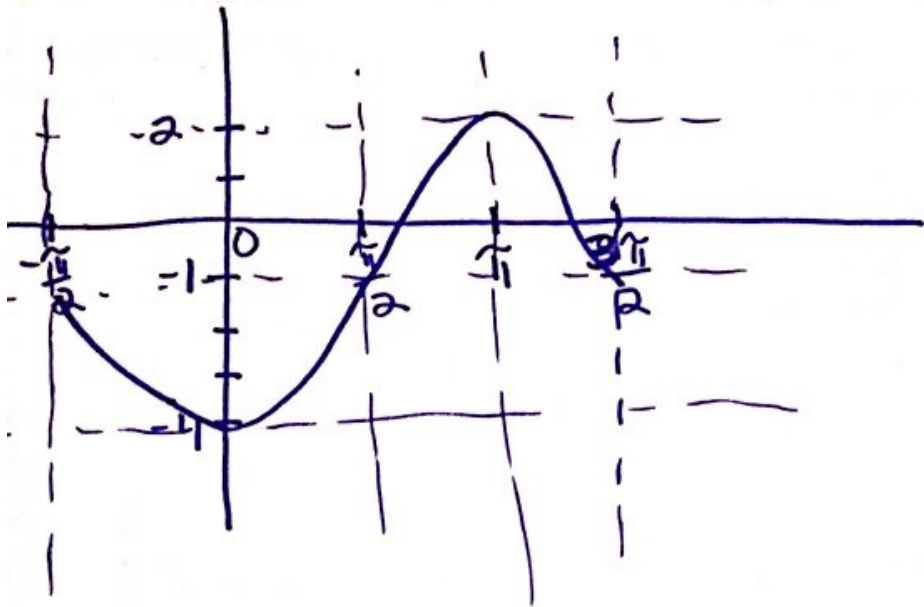
$$y = 2 \sin \left(x + \frac{\pi}{3} \right)$$



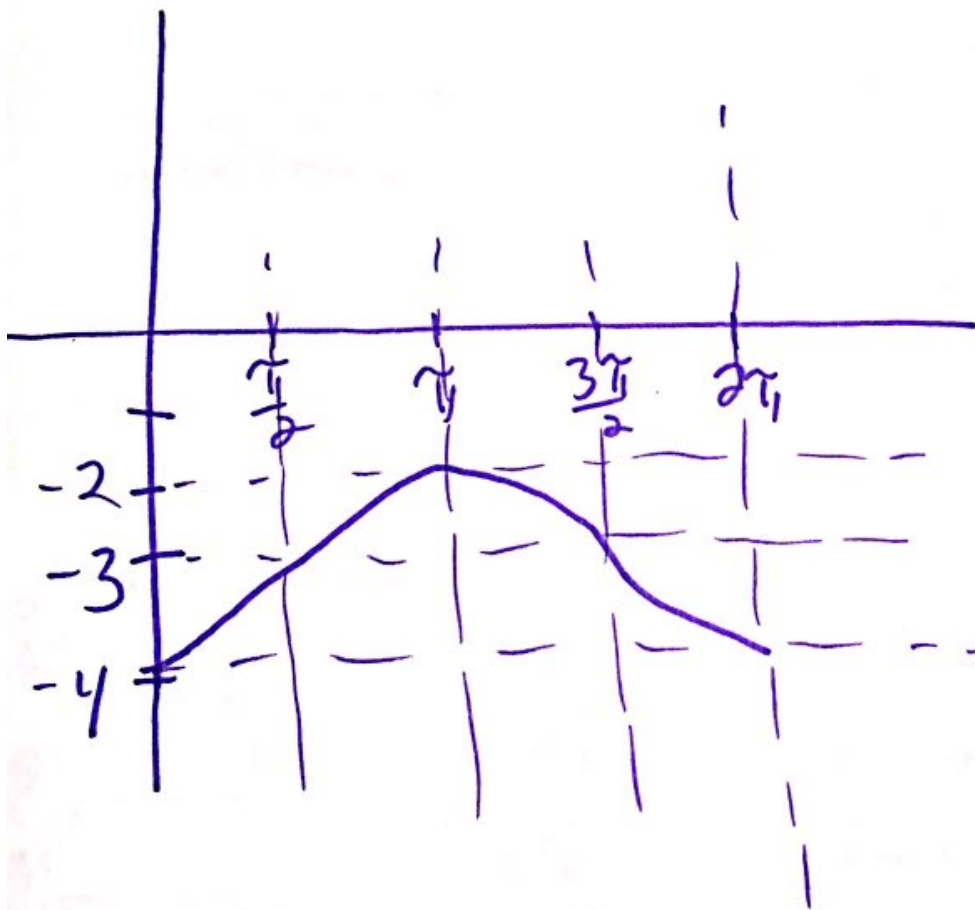
$$y = \cos(3x) - 2$$



$$y = -3\sin\left(x + \frac{\pi}{2}\right) - 1$$



$$y = -\cos(x) - 3$$

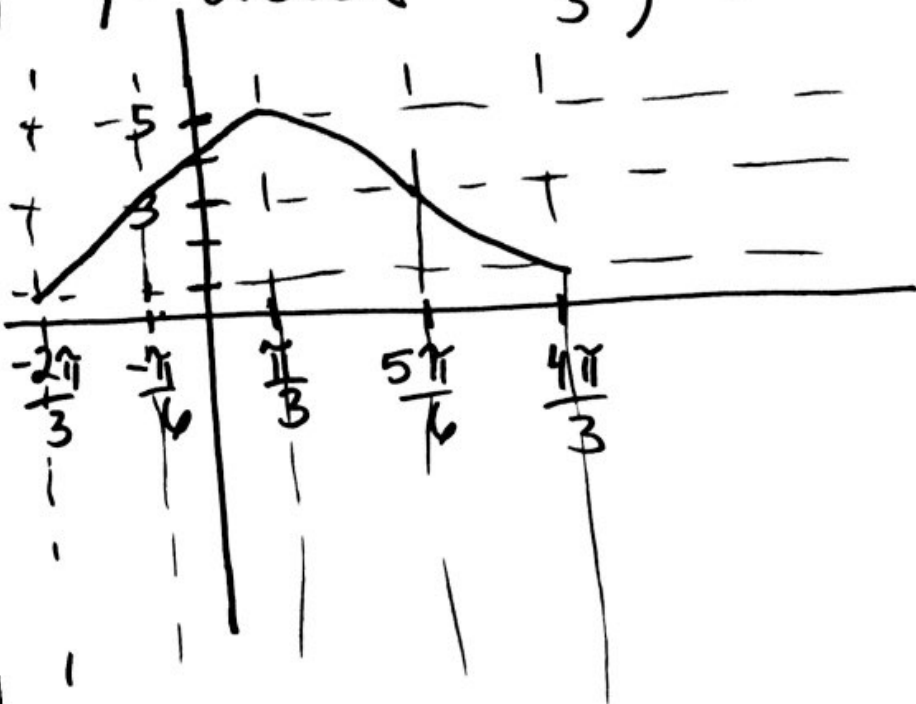


Equation	Center line	Amp litude	Period	Phase Shift	Graph using $-2\pi \leq x \leq 2\pi$	6B
$y = 3\cos(2(x-\pi))$						
$y = 3\sin(2x-\pi)+1$						
$y = -2\cos\left(x + \frac{2\pi}{3}\right) + 3$						
$y = 2\cos(x-90^\circ)+1$ Note that x is in degrees						

3. Write an equation of the form $y = A\sin(B(x-C))+D$ for the information below.

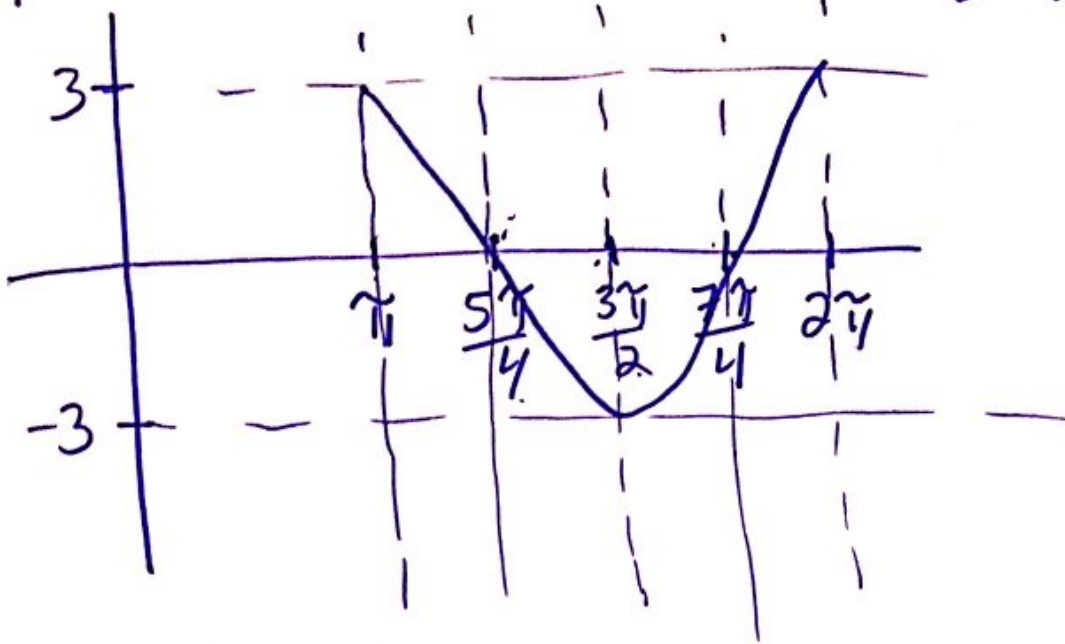
Maximum	Minimum	Period	Phase Shift	Equation
3	-2	2π $B=1$	0	$y = 2.5\sin(x-0) + 0.5 \rightarrow y = 2.5\sin x + 0.5$
1	-1	$\frac{\pi}{2}$ $B=4$	$-\frac{\pi}{4}$	$y = 1\sin 4\left(x + \frac{\pi}{4}\right) + 0 \rightarrow y = \sin 4\left(x + \frac{\pi}{4}\right)$
2	0	π $B=2$	0	$y = 1\sin 2(x-0) + 1 \rightarrow y = \sin 2x + 1$
1	-3	$\frac{\pi}{2}$ $B=4$	0	$y = 2\sin 4(x-0) - 1 \rightarrow y = 2\sin 4x - 1$

$$y = -2\cos\left(x + \frac{2\pi}{3}\right) + 3$$



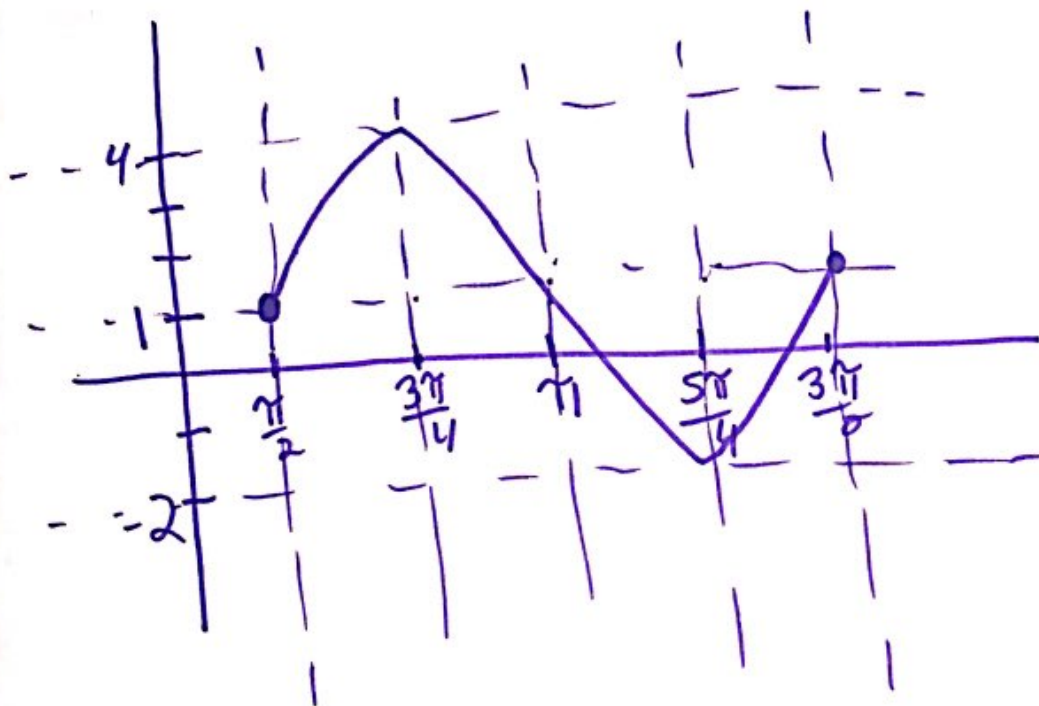
$$y = 3 \cos(2(x - \pi)) \quad A = 3, \text{ Per} = \frac{2\pi}{2} = \pi \quad \text{P.S.} = \pi$$

$$V.S. = 0$$



$$y = 3 \sin(2x - \pi) + 1$$

$$A = 3 \quad \text{P.S.} = \frac{\pi}{2} \quad \text{Per} = \pi \quad V.S. = 1$$



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

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

$$\left(\frac{1}{2}\right) + \left(\frac{1}{4}\right) = \frac{3}{4}$$