

Ch. 5.1-5.2 Practice Examples:

Stretch Transformations  $y = a \sin bx$  and  $y = a \cos bx$

STEPS:

1. Determine the amplitude and period.
2. Adjust the scale on the x-axis according to the period (make the number of squares for one period divisible by 4 – for example: 8,12,16)
3. Adjust the scale on the y-axis according to the amplitude (with midline on the x-axis)
4. Graph **AT LEAST TWO CYCLES** of the function.

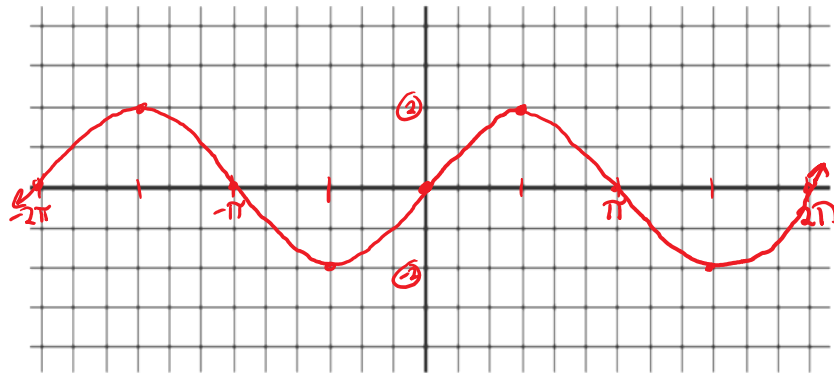
1)  $y = 2 \sin x$

amp = 2

period =  $2\pi$

12 squares

( $\div 4 = 3sq$ )



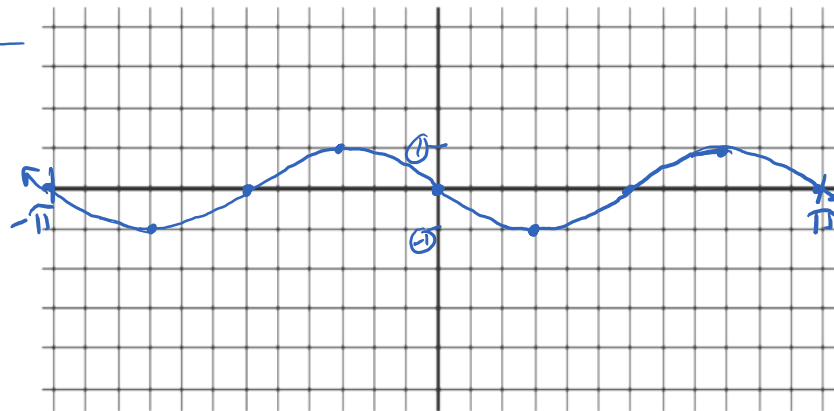
2)  $y = -\sin 2x$

amp = 1

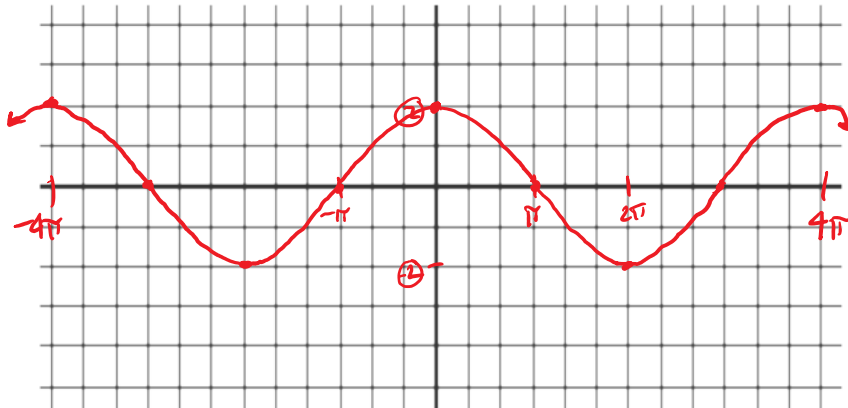
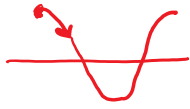
period =  $\frac{2\pi}{2} = \pi$

12 squares

( $\div 4 = 3sq$ )



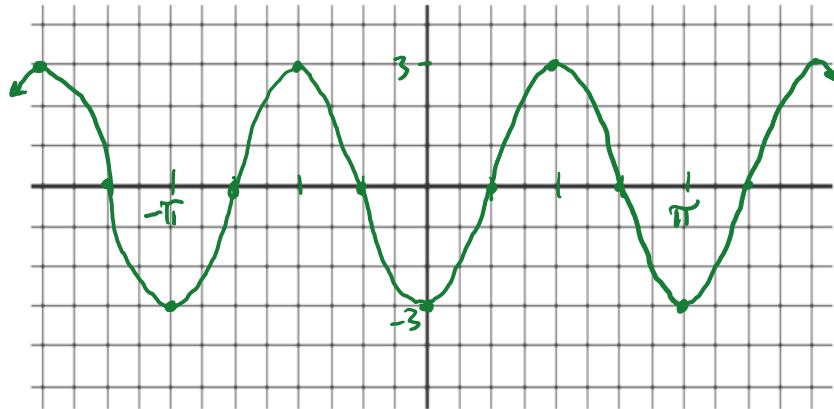
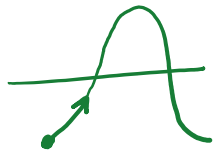
3)  $y = 2 \cos \frac{1}{2}x$



amp = 2      period =  $\frac{2\pi}{\frac{1}{2}} = 2\pi \times \frac{2}{1} = 4\pi$

↑  
12 squares  
(÷ 4 = 3 sq)

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

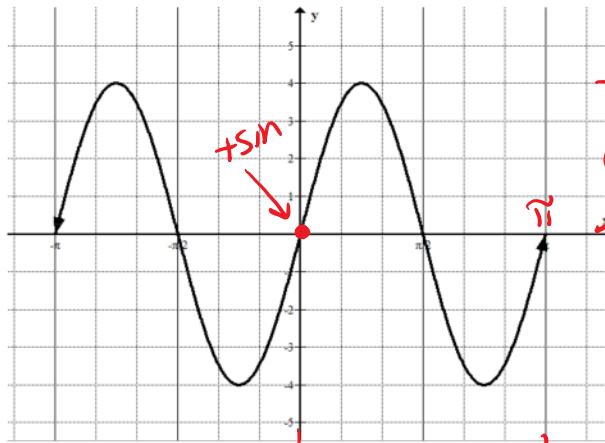


amp = 3      period =  $\frac{2\pi}{2} = \pi$

Try 8  
squares  
here  
(÷ 4 = 2 sq)

Determine the equation of the following functions:

1.

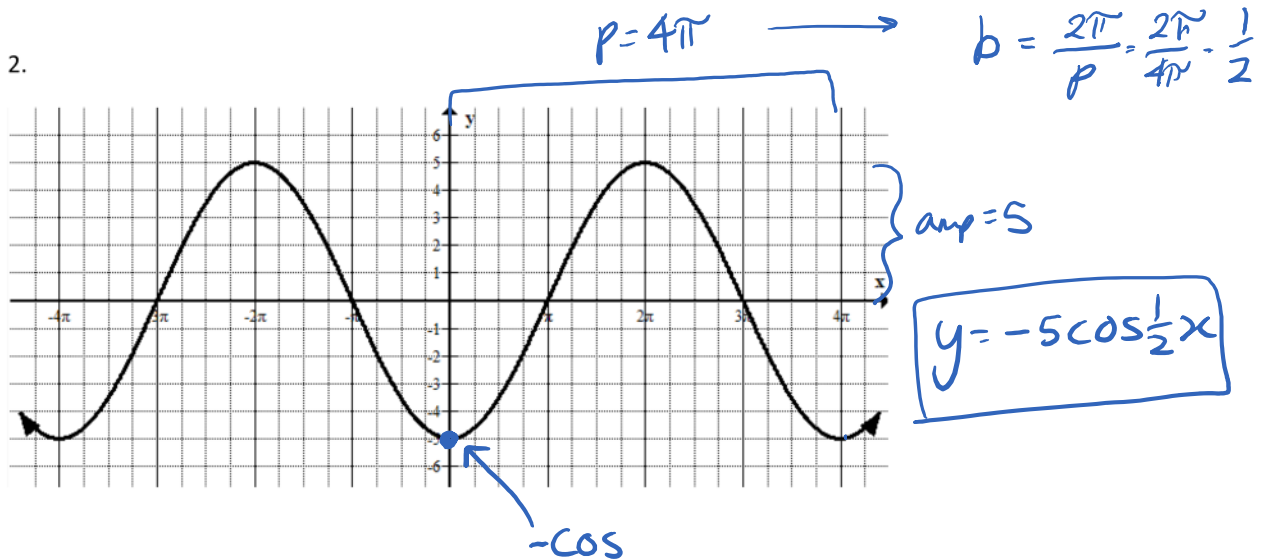


amp = 4

$y = 4 \sin 2x$

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

2.



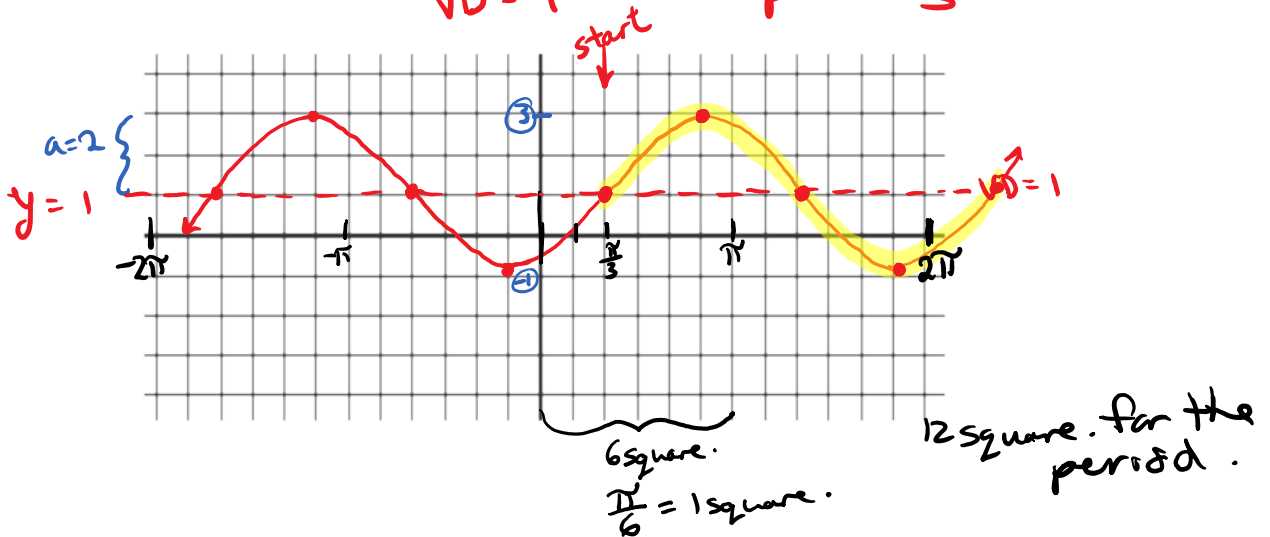
Combining ALL Transformations  $y = a \sin b(x - c) + d$  and  $y = a \cos b(x - c) + d$

STEPS:

1. Determine the amplitude, vertical displacement, period and phase shift.
  2. Adjust the scale on the x-axis according to the period (make the number of squares for one period divisible by 4 – for example: 8,12,16)
  3. Adjust the scale on the y-axis according to the centre line and amplitude
  4. Determine the starting point for sine or cosine at the phase shift.
  5. Graph AT LEAST TWO CYCLES of the function.
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1)  $y = 2 \sin\left(x - \frac{\pi}{3}\right) + 1$

$\text{amp} = 2$   
 $\text{VD} = 1$   
 $\text{period} = 2\pi$   
 $\text{p.s.} = \frac{\pi}{3}$



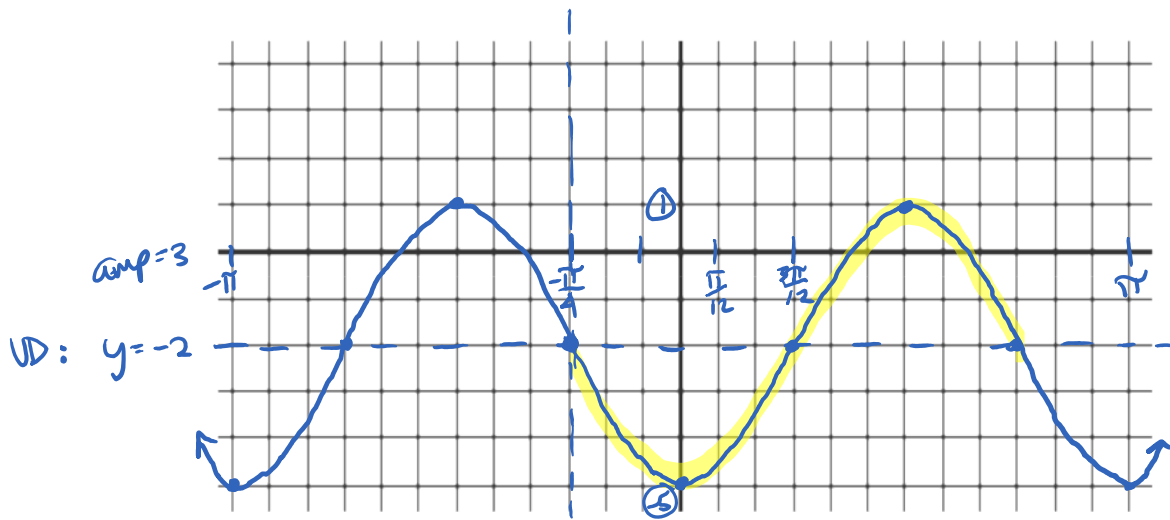
$$2) y = -3 \sin 2 \left( x + \frac{\pi}{4} \right) - 2$$

$$\text{amp} = 3$$

$$\text{VD} = -2$$

$$\text{period} = \frac{2\pi}{2} = \pi \text{ (2 sq)}$$

$$\text{P.S.} = -\frac{\pi}{4} \text{ (left)}$$



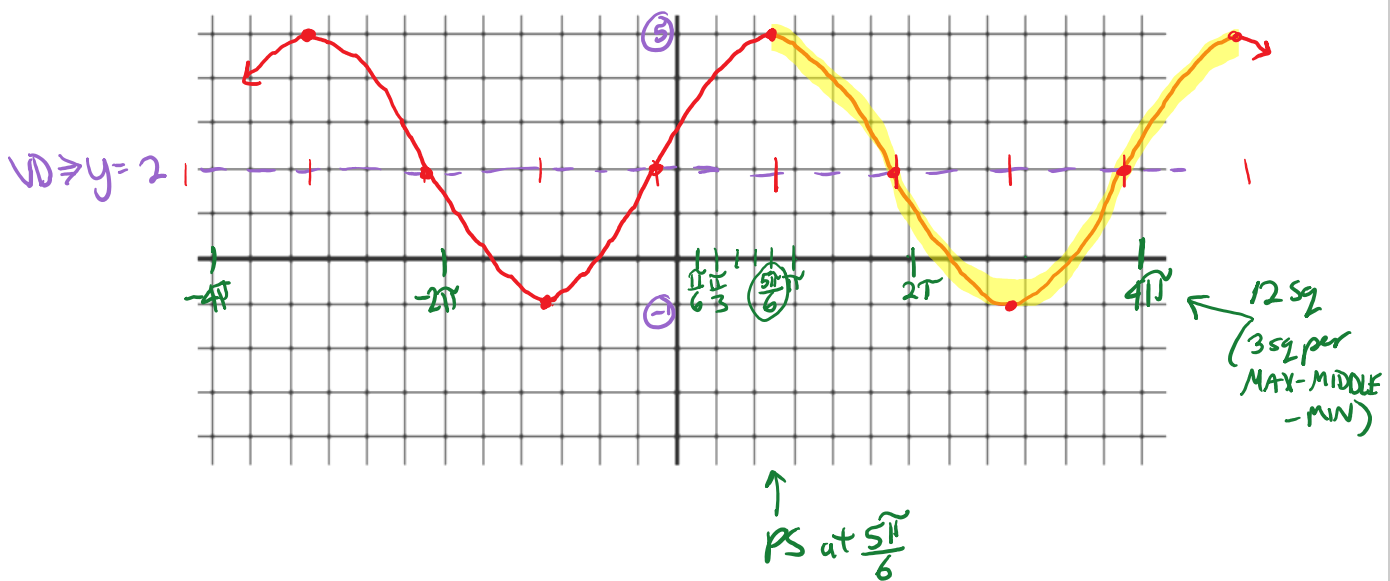
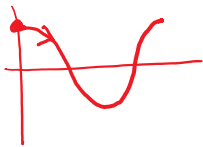
$$3) y = 3 \cos \frac{1}{2} \left( x - \frac{5\pi}{6} \right) + 2$$

$$\text{amp} = 3$$

$$\text{VD} = 2$$

$$\text{period} = \frac{2\pi}{\frac{1}{2}} = 2\pi \times 2 = 4\pi$$

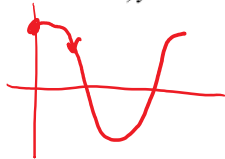
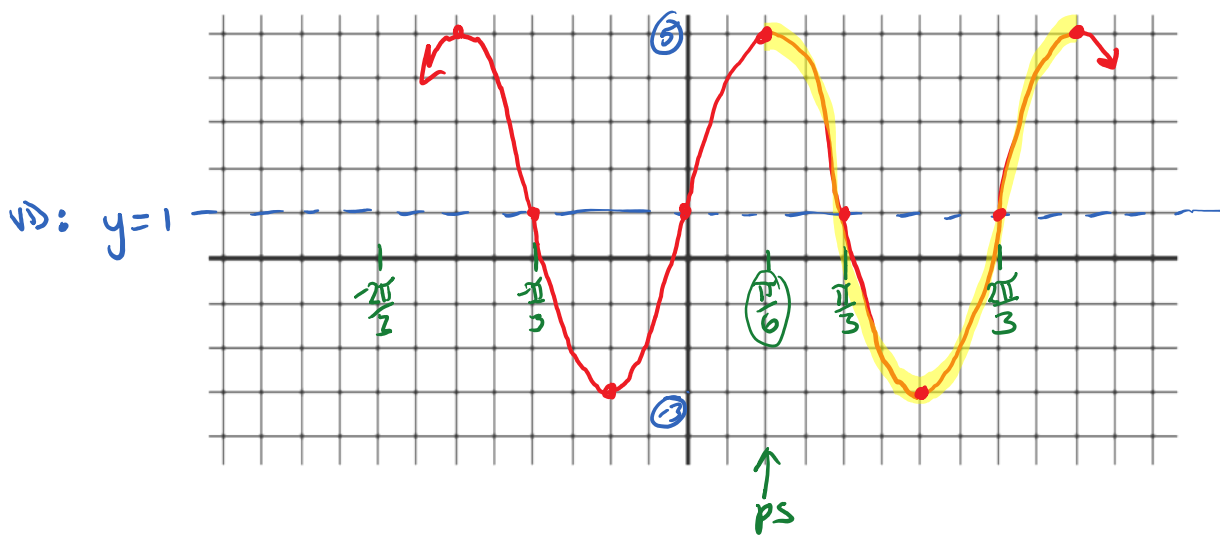
$$\text{P.S.} = \frac{5\pi}{6}$$



4)  $y = 4 \cos 3 \left( x - \frac{\pi}{6} \right) + 1$

amp = 4  
 VD = 1


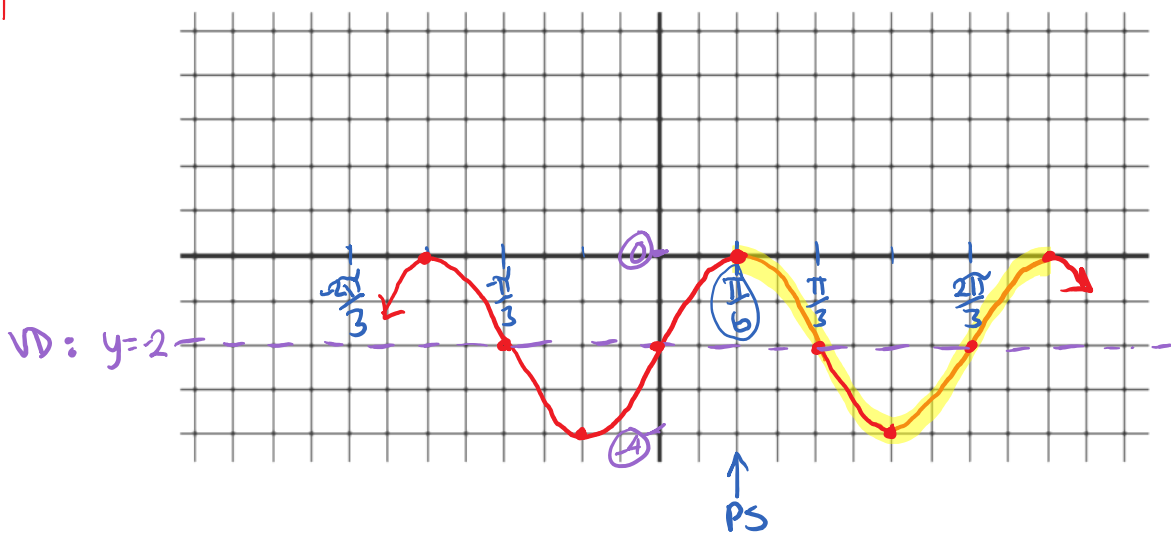
period =  $\frac{2\pi}{3}$  ← 8 sq  
 (2sq per MAX-MID-MIN)  
 PS =  $\frac{\pi}{6}$

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

amp = 2  
 VD = -2

period =  $\frac{2\pi}{3}$  ← 8 sq  
 (2sq per MAX-MID-MIN)  
 PS =  $\frac{\pi}{6}$

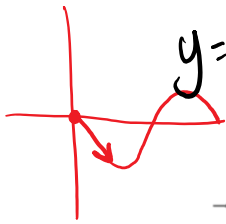
$$6) y = -\frac{1}{2} \sin\left(\frac{1}{2}\theta + \frac{\pi}{4}\right) + 1$$

$$\text{amp} = \frac{1}{2} \quad \text{VD} = 1$$

$$\text{period} = \frac{2\pi}{\frac{1}{2}} = 2\pi \times 2 = 4\pi$$

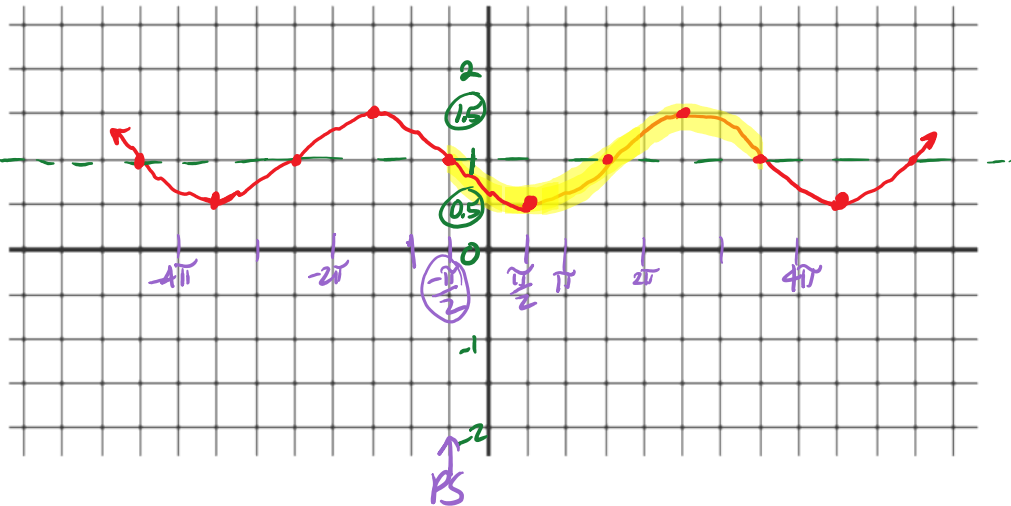
$$\text{PS} = -\frac{\pi}{2}$$

↑  
8 sq  
(2 sq per  
MAX-MID-MIN)



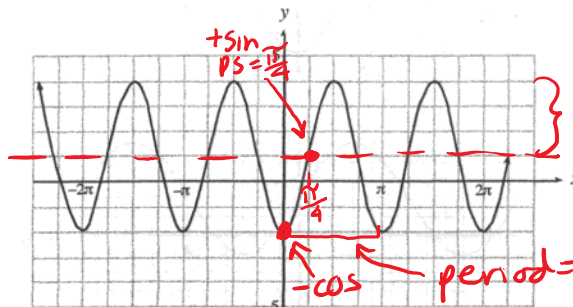
$$y = -\frac{1}{2} \sin\left(\frac{1}{2}\left(\theta + \frac{\pi}{2}\right)\right) + 1$$

$$\text{VD: } y = 1$$



7. Given the graphs below, determine a possible equation for each function.

a)



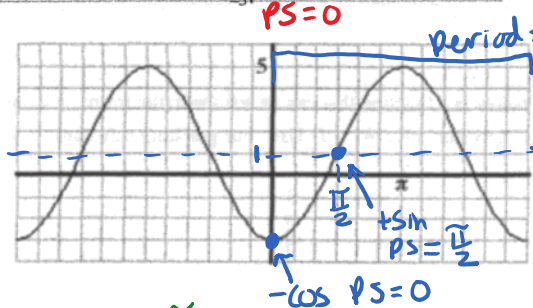
$$\text{amp} = 3 \quad \text{VD} = 1$$

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

or  $y = -3\cos\left(2\left(x + \frac{\pi}{4}\right)\right) + 1$

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

b)



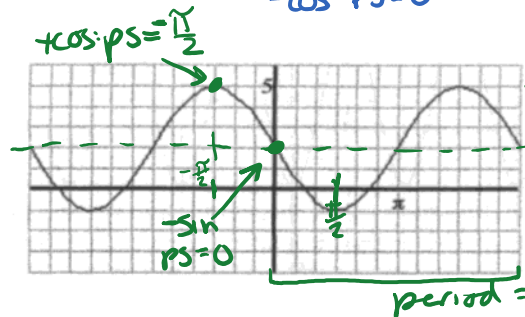
$$\text{period} = 2\pi \rightarrow b = \frac{2\pi}{2\pi} = 1$$

$$\text{amp} = 4 \quad \text{VD} = 1$$

$$y = -4\cos x + 1$$

or  $y = -4\sin\left(x - \frac{\pi}{2}\right) + 1$

c)



$$\text{amp} = 3 \quad \text{VD} = 2$$

$$y = -3\sin x + 2$$

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

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