

Section 13.6 Combined Transformations with Sine and Cosine Functions

Review...

General Equations and Transformation of Sine and Cosine Graphs

$$y = A \sin(B(x \pm C)) + D$$

$$y = A \cos(B(x \pm C)) + D$$

Where:

Amplitude = A

Horizontal Translation (Phase Shift) = C

Frequency = B

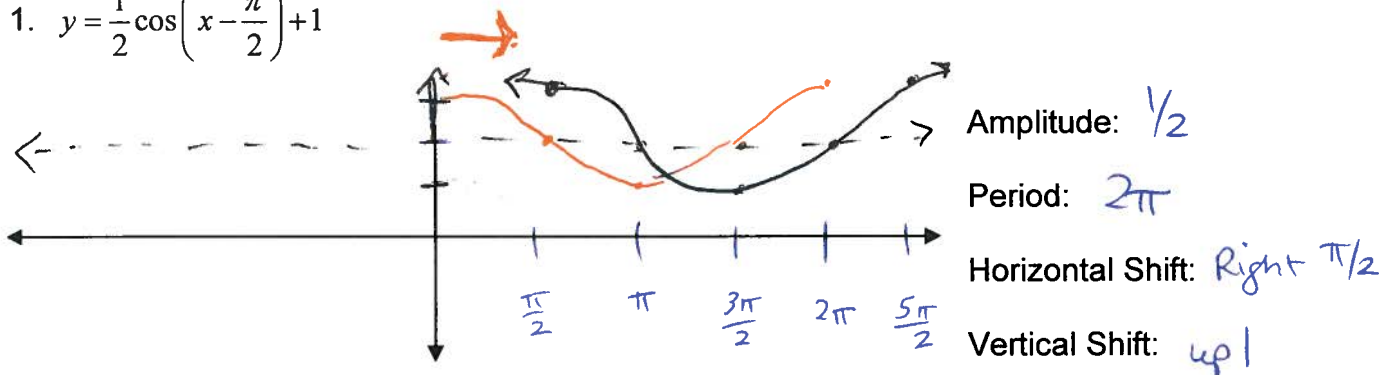
Vertical Translation = D

Period = $2\pi/B$ or π/B

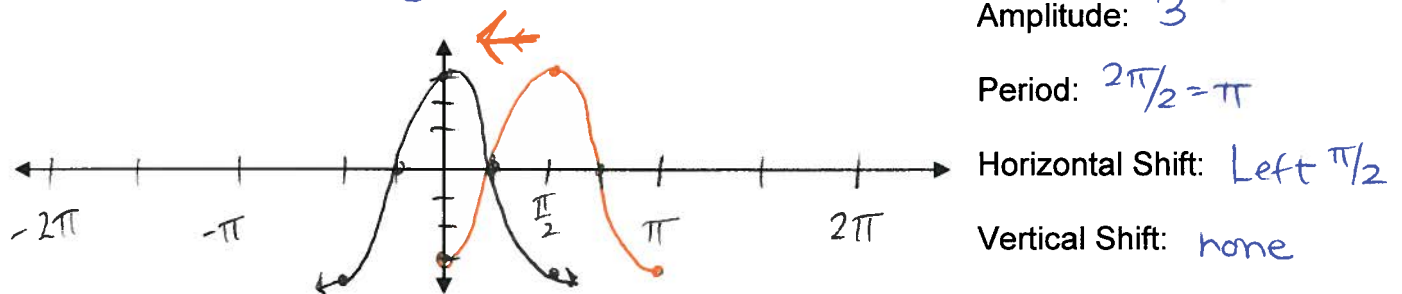
When you have multiple transformations it's best to do intermediate sketches...

Make a neat sketch of the functions over at least one full cycle.

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



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



When writing an equation from a given graph, the more transformations that have occurred the harder it is.

The following can help. Keep in mind, not all of the following will apply to every graph.

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

Period: Horizontal distance to complete a cycle (easy to find from max to max or min to min)

***Keep in mind that the B value is what I need for my equation: **Period = $2\pi/B$**

Horizontal Translation:

Cosine graphs normally start on the y-axis at a max. How far (if any) must you move FROM the y-axis to reach a max?

Sine graphs normally start at the origin at an inflection point. How far (if any) must you move FROM the y-axis to reach an inflection point

Vertical Translation: $\frac{1}{2}(\max + \min)$

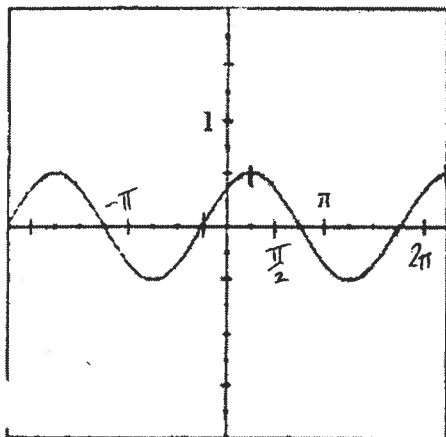
Normally the midline of a sine or cosine graph is the x-axis. How far must you move FROM the x-axis to reach the midline?

Reflection:

If a cosine graph starts at a minimum or if a sine graph starts at an inflection point and goes down, then the graph has been reflected. Add a negative in front of your amplitude.

When asked to write a sine AND cosine function from a single graph, start with whichever one is easiest for you. All aspects (Amplitude, Period, Vertical Translation) will be the same for the other function except the Horizontal Translation.

Write one sine and one cosine equation for the given functions.



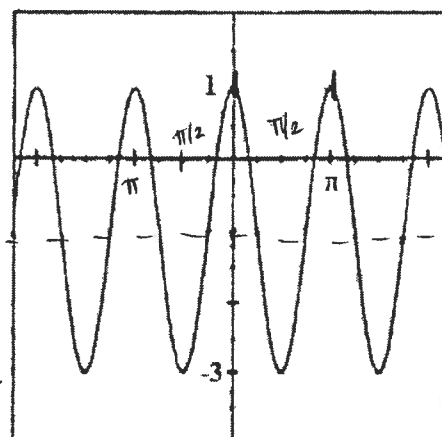
VT: none
 Amp: $1/2$
 Period: 2π
 Sine Translation:
 left $\pi/4$
 Cosine Translation:
 right $\pi/4$

Sine:

$$y = \frac{1}{2} \sin(x + \pi/4)$$

cosine

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



VT: down 1
 Amp: 2
 Period: π
 $\pi = 2\pi/B$ ($B=2$)
 Sine translation:
 left $\pi/4$
 cosine translation:
 none

Sine:

$$y = 2 \sin 2(x + \pi/4) - 1$$

cosine:

$$y = 2 \cos 2x - 1$$