

c\_13 Making sinusoidal equations

1) Write a step-by-step process for how to figure out

- vertical displacement
- amplitude
- period

2) Create an equation for each graph

3) Check each answer, by putting the equation into a graphing calculator and comparing the graph it makes to the one on the paper.

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**Graph 1:**  
 $y\text{-disp} = \frac{-1 + (-5)}{2} = -3$   
 $\text{amp} = \frac{-1 - (-5)}{2} = 2$   
 $\text{period} = 90^\circ - 0^\circ = 90^\circ$   
 $y = 2 \cos(bx) - 3$   
 $b = \frac{\text{regular period}}{\text{graph period}} = \frac{360}{90} = 4$   
 $y = 2 \cos(4x) - 3$

**Graph 2:**  
 $y\text{-disp} = \frac{\text{Max} + \text{min}}{2} = \frac{4 + (-20)}{2} = -8$   
 $\text{amp} = \frac{\text{Max} - \text{min}}{2} = \frac{4 - (-20)}{2} = 12$   
 $\text{period} = 2\pi - 0 = 2\pi$   
 $y = 12 \cos(bx) - 8$   
 $b = \frac{\text{reg. period}}{\text{graph period}} = \frac{2\pi}{2\pi} = 1$   
 $y = 12 \cos(x) - 8$

**Graph 3:**  
 $y\text{-disp} = \frac{\text{Max} + \text{min}}{2} = \frac{23 + 7}{2} = 15$   
 $\text{amp} = \frac{\text{Max} - \text{min}}{2} = \frac{23 - 7}{2} = 8$   
 $\text{period} = 70 - (-10) = 80$   
 $y = 8 \cos\left(b(x-30)\right) + 15$   
 $b = \frac{\text{reg. period}}{\text{graph period}} = \frac{2\pi}{80}$   
 $y = 8 \cos\left[\frac{2\pi}{80}(x-30)\right] + 15$   
 OR  
 $y = 8 \sin\left[\frac{2\pi}{80}(x-10)\right] + 15$

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To find vertical displacement

- 1) Find the maximum y-value
- 2) Find the minimum y-value
- 3) Average them:  $(\text{max} + \text{min})/2 = \text{vertical displacement}$

To find amplitude

- Subtract:  $(\text{max y-value}) - (\text{vertical displacement y-value}) = \text{amplitude}$

OR

- 1) Subtract:  $(\text{max y-value}) - (\text{min y-value})$
- 2) Divide that answer by 2, to get the amplitude

To find period

- 1) Find the x-value where the graph has a maximum
- 2) Find the next x-value where the graph has a maximum
- 3) Subtract them, to get the period

OR

- 1) Find the x-value where the graph has a minimum
- 2) Find the next x-value where the graph has a minimum
- 3) Subtract them, to get the period