8.4 – Writing Equations for Sine and Cosine Functions

Sine Function → $y = a\sin(bx \pm c) \pm d$ **Cosine Function** → $y = a\cos(bx \pm c) \pm d$

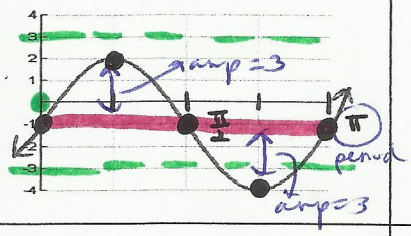
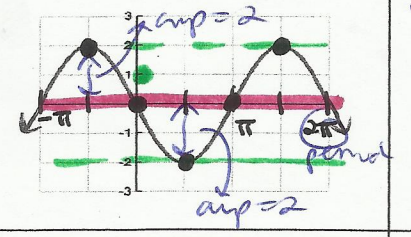
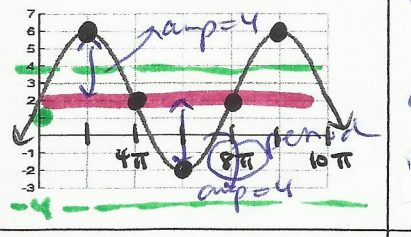
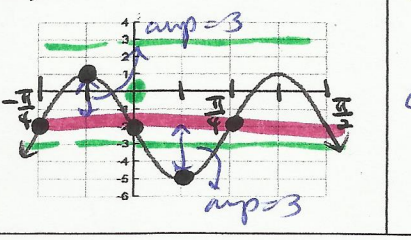
where use the following "formulas" to find each parameter (the value of each letter):

a = amplitude b = $\frac{2\pi}{\text{period}}$ c = $-b \cdot$ ph. shift d = $\nearrow$ up = +d, $\searrow$ down = −d

Example 1: Given specific set of details about a function, write its equation.

Given Info	Function	Work to Find a , b , c , and d	Equation for Function
a.) amplitude = 4 , period = $\frac{\pi}{3}$, left by $\frac{\pi}{2}$, up by 5	sine	$a=4$ $b=\frac{2\pi}{\frac{\pi}{3}}$ $b=6$ $c=-6\cdot-\frac{\pi}{2}$ $c=\frac{6\pi}{2}$ $c=3\pi$ $d=5$	$y=5\sin(6x+3\pi)+5$
b.) amplitude = 1 , period = 4π , right by 2π , down by 3	cosine	$a=1$ $b=\frac{2\pi}{4\pi}$ $b=\frac{1}{2}$ $c=-\frac{1}{2}\cdot 2\pi$ $c=\frac{2\pi}{2}$ $c=-\pi$ $d=-3$	$y=\cos\left(\frac{1}{2}x-\pi\right)-3$

Example 2: Given a specific graph of a function, write its equation. → midline

Given Graph	Info About Graph	Work to Find a , b , c , and d	Equation for Function
a.) 	3 dots line up → $y=\sin x$ amplitude = 3 period = π p.shift = none v.shift = down 1	$a=3$ $b=\frac{2\pi}{\pi}$ $b=2$ $c=-2\cdot 0$ $c=0$ $d=-1$	$y=3\sin(2x)-1$
b.) 	2 dots line up → $y=\cos x$ amplitude = 2 period = 2π pShift = left $\frac{\pi}{2}$ vShift = none	$a=2$ $b=\frac{2\pi}{2\pi}$ $b=1$ $c=-1\cdot-\frac{\pi}{2}$ $c=\frac{\pi}{2}$ $d=0$	$y=2\cos\left(x+\frac{\pi}{2}\right)$
c.) 	2 dots line up → $y=\cos x$ amplitude = 4 period = 8π pShift = right 2π v.shift = up 2	$a=4$ $b=\frac{2\pi}{8\pi}$ $b=\frac{1}{4}$ $c=-\frac{1}{4}\cdot 2\pi$ $c=\frac{-2\pi}{4}$ $c=-\frac{\pi}{2}$ $d=2$	$y=4\cos\left(\frac{1}{4}x-\frac{\pi}{2}\right)+2$
d.) 	3 dots line up → $y=\sin x$ amplitude = 3 period = $\frac{\pi}{2}$ pShift = left $\frac{\pi}{4}$ v.shift = down 2	$a=3$ $b=\frac{2\pi}{\frac{\pi}{2}}$ $b=4$ $c=-4\cdot-\frac{\pi}{4}$ $c=\frac{4\pi}{4}$ $c=\pi$ $d=-2$	$y=3\sin(4x+\pi)-2$