

## 8.4 – Writing Equations for Sine and Cosine Functions

**Sine Function** →  $f(x) = a \sin(bx \pm c) \pm d$

**Cosine Function** →  $f(x) = a \cos(bx \pm c) \pm d$

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

$a = \pm$  value of Amplitude     $b = \frac{2\pi}{\text{period}}$      $c = -b \cdot \text{phase shift}$      $d = \text{up} \rightarrow +d$   
 $\text{down} \rightarrow -d$

**Example 1:** Given specific set of details about a function, write its equation. down → -d

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 ~	$A = \pm 4$ $b = 6$ $c = 3\pi$ $d = +5$	$b = \frac{2\pi}{\text{Per}} \rightarrow b = \frac{2\pi}{\pi/3} = 6$ <i>(KCF)</i> $c = -b \cdot \text{PS}$ $c = -(6) \cdot (-\pi/2) = 3\pi$	$y = \pm 4 \sin(6x + 3\pi) + 5$
b.) amplitude = 1, period = $4\pi$ , right by $2\pi$ , down by 3	cosine v	$A = \pm 1$ $b = 1/2$ $c = -\pi$ $d = -3$	$b = \frac{2\pi}{4\pi} = 1/2$ $c = -(1/2) \cdot (2\pi)$ $c = -\pi$	$y = \pm 1 \cos(\frac{1}{2}x - \pi) - 3$

**Example 2:** Given a specific graph of a function, write its equation. \* DRAW IN YOUR MID-LINE \*

Given Graph	Info About Graph	Work to Find a, b, c, and d	Equation for Function	
a.)	<p><span style="color: red;">* IF 3 points are on the mid-line, it means <math>y = \sin</math>.</span></p> <p>Amp: 3    Per: <math>\pi</math></p> <p>PS: NONE    VS: down! (-1)</p>	$A = 3$ $b = 2$ $c = 0$ $d = -1$	$b = \frac{2\pi}{\text{Per}} = \frac{2\pi}{\pi} = 2$ $c = -b \cdot \text{PS}$ $c = -(2) \cdot 0 = 0$	$f(x) = 3 \sin(2x) - 1$
b.)	<p><span style="color: red;">* IF 2 points are on the mid-line, it means <math>y = \cos</math>.</span></p> <p>Amp: 2    Per: <math>2\pi</math></p> <p>PS: left <math>\frac{\pi}{2}</math> (-<math>\pi/2</math>)    VS: NONE</p>	$A = 2$ $b = 1$ $c = \pi/2$ $d = 0$	$b = \frac{2\pi}{2\pi} = 1$ $c = -(1) \cdot (-\pi/2)$ $c = \pi/2$	$f(x) = 2 \cos(x + \frac{\pi}{2})$
c.)	<p><math>y = \cos</math></p> <p>Amp: 4    Per: <math>8\pi</math></p> <p>PS: right <math>2\pi</math> (<math>+2\pi</math>)    VS: up 2 (+2)</p>	$A = 4$ $b = \frac{1}{4}$ $c = -\pi/2$ $d = +2$	$b = \frac{2\pi}{8\pi} = \frac{1}{4}$ $c = -(4) \cdot (2\pi)$ $c = -\pi/2$	$f(x) = 4 \cos(\frac{x}{4} - \frac{\pi}{2}) + 2$
d.)	<p><math>y = \sin</math></p> <p>Amp: 3    Per: <math>\pi/2</math></p> <p>PS: left <math>\pi/4</math> (-<math>\pi/4</math>)    VS: down 2 (-2)</p>	$A = 3$ $b = 4$ $c = \pi$ $d = -2$	$b = \frac{2\pi}{\pi/2} = 4$ <i>(KCF)</i> $c = -(4) \cdot (-\pi/4)$ $c = \pi$	$f(x) = 3 \sin(4x + \pi) - 2$