Writing Equations

Steps:

always same for sine or cosine

1. Find A (amplitude): $A = \frac{max-min}{2}$
2. Find B: Find period, use $p = \frac{2\pi}{B}$, or $B = \frac{2\pi}{p}$
3. Find D (displacement): $D = \frac{max+min}{2}$ ← median (think average)
4. Find C (phase shift):

$y = A\sin(B(x-C)) + D$ or $y = A\cos(B(x-C)) + D$ } sinusoidal

C will not be the same

Cosine:

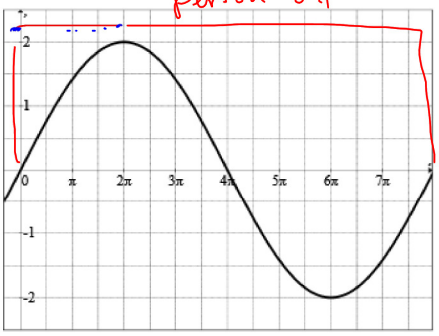
Find ~~max~~, determine translation from *y*-axis

Sine:

Find the closest point where the graph intersects the midline ~~(median~~, centre line, etc.) and determine the translation from the *y*-axis

Ex. 1) Write the equation of the graph given by:

a)



$A = \frac{max-min}{2} = \frac{2-(-2)}{2} = 2$

$B = \frac{2\pi}{period} = \frac{2\pi}{8\pi} = \frac{1}{4}$

$D = \frac{max+min}{2} = \frac{2+(-2)}{2} = 0$

C = 0 for sine

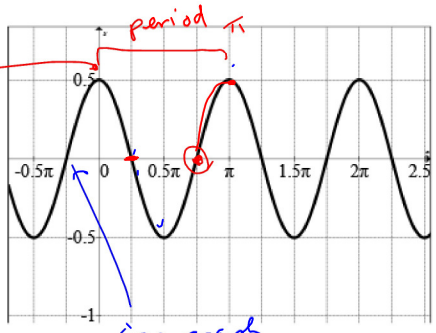
$y = 2\sin(\frac{1}{4}x)$

OR

C = 2π for cosine

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

b)



$A = \frac{0.5-(-0.5)}{2} = \frac{1}{2}$

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

$D = \frac{0.5+(-0.5)}{2} = 0$

C = 0 for cos

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

∴ no phase shift

C = 0 for cos

sine graph moved left $\frac{\pi}{4}$ or 0.25π

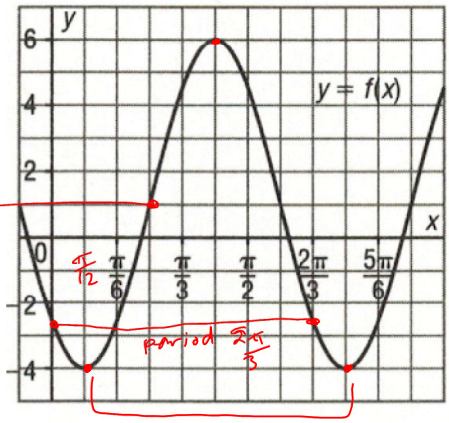
$C = -\frac{\pi}{4}$

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

or $y = \frac{1}{2}\sin(2(x-\frac{3\pi}{4}))$

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

Ex. 2)



median
D = 1
means y value is 1

period $\frac{8\pi}{12}$

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

$A = \frac{6-(-4)}{2} = 5$

$B = \frac{2\pi}{\frac{2\pi}{3}} = 2\pi \cdot \frac{3}{2\pi} = 3$

$D = \frac{6+(-4)}{2} = 1$

max → $\frac{5\pi}{12}$ units right

$C = \frac{5\pi}{12}$ for cos

$y = 5\cos\left(3\left(x - \frac{5\pi}{12}\right)\right) + 1$

$C = \frac{\pi}{12}$

or if reflected

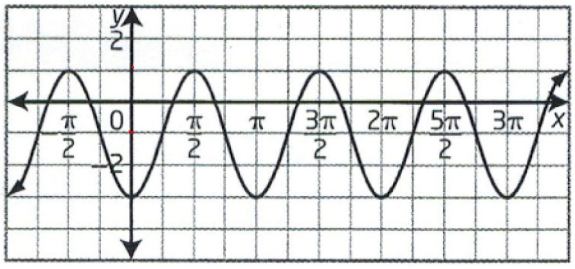
$y = -5\cos\left(3\left(x - \frac{\pi}{12}\right)\right) + 1$

↑ A is -ve when reflected

$C = \frac{3\pi}{12} = \frac{\pi}{4}$ for sin

$y = 5\sin\left(3\left(x - \frac{\pi}{4}\right)\right) + 1$

Ex. 3)



$A = \frac{1-(-3)}{2} = 2$

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

$D = \frac{1+(-3)}{2} = -1$ ← median

or

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

$C = \frac{\pi}{2}$ for cos

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

or

$C = \frac{\pi}{4}$

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

~~Assignment: Pg 243 #1, 5, 6, 7~~

* check variable on x-axis

if θ then eqn is

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

pg. 243 #5

more graphing #1, 3, 6, 7