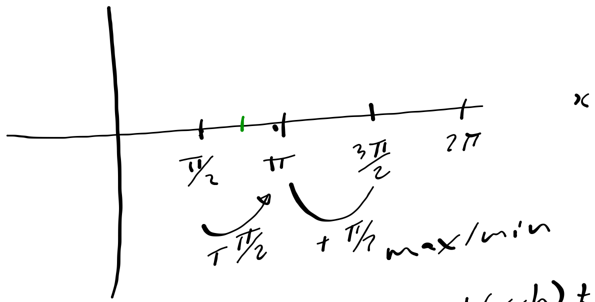


Determining

$f(x) = a\sin b(x-h) + k$

$f(x) = a\cos b(x-h) + k$

$\boxed{x\text{-ints}}$

Unit 5: Graphing Sinusoidal Functions and Determining their Equations

sin/cos

(a/b/h/k)

graph $f(x) = 2\sin\frac{1}{2}(x + 2\pi) + 1$

Recall:

a - up/down flip
- scale factor

Amplitude $A = |a|$

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

b - left/right flip
- scale factor

Period $= \frac{2\pi}{|b|}$

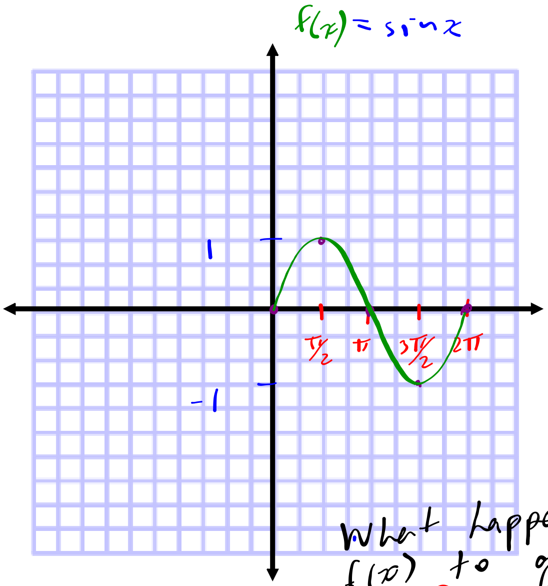
h - horizontal translation
phase shift $D = h$

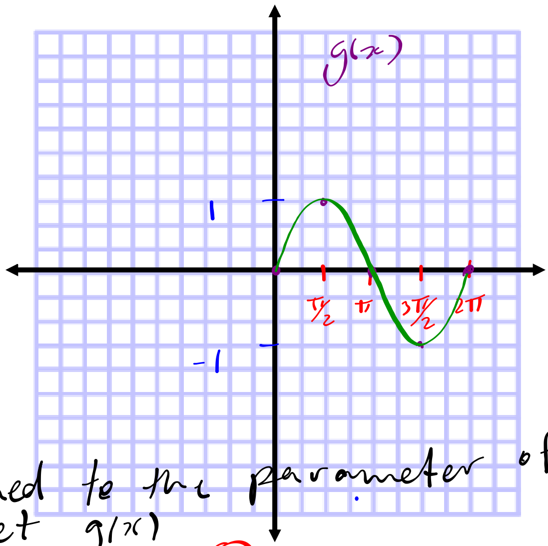
k - vertical translation
central axis
$y = k$

$max = k + |a|$

$min = k - |a|$

For sin x starting point (h, k)	for cos x starting point $(h, k + a)$
k/max/k/min/k a·b +	max/k/min/k/max if a +
k/min/k/max/k a·b −	min/k/max/k/min if a −





What happened to the parameter of $f(x)$ to get $g(x)$

a) increasing h

b) a – $k\downarrow$

c) a – b –

d) $\uparrow h$ $k\downarrow$

graph $f(x) = 2\sin\frac{1}{2}(x + 2\pi) + 1$

$f(x) = a\sin b(x - h) + k$

p 5.31

step i. find parameters and info

$a = 2$ $h = -2\pi$

$b = \frac{1}{2}$ $k = 1$

$A = 2$

$P = \frac{2\pi}{|\frac{1}{2}|}$

$P = \frac{2\pi}{1} \times \frac{2}{1}$

$P = 4\pi$

central axis

$y = k$

$y = 1$

starting point (x, y)

(h, k)

$(-2\pi, 1)$

$max = k + |a|$
$= 1 + 2$
$= 3$

$min = k - |a|$
$= 1 - 2$
$= -1$

Step ii construct TOV.

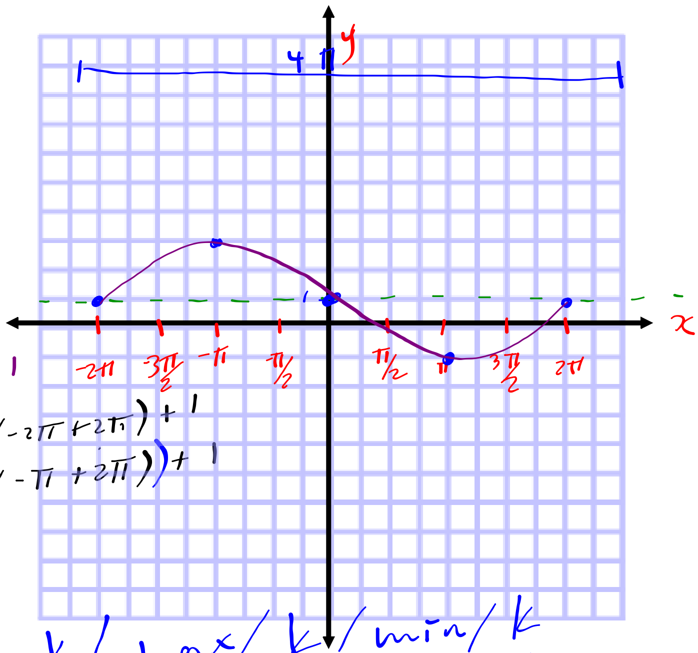
$y = 2\sin\frac{1}{2}(x + 2\pi) + 1$

x	y
h	k
$+\frac{P}{4}$	max
$+\frac{P}{4}$	k
$+\frac{P}{4}$	min
$+\frac{P}{4}$	k

x	y
-2π	1
$-\pi$	3
0	1
π	-1
2π	1

$= 2\sin\frac{1}{2}(-2\pi + 2\pi) + 1$

$= 2\sin(\frac{1}{2}(-\pi + 2\pi)) + 1$



k / max / k / min / k

graph $y = 3\sin -2(x + \frac{\pi}{2}) + 2$

pg 5.35

Finding the x-ints/zeros/solution

ex. find the x-ints of

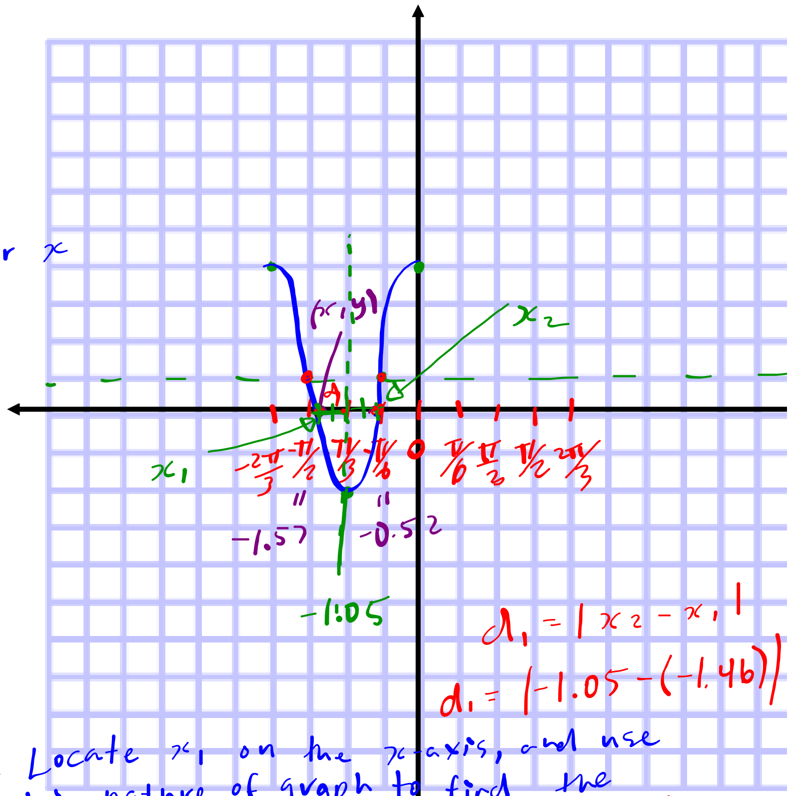
$g(x) = 3\cos 3(x + \frac{2\pi}{3}) + 1$

step i. Do a graph!!

$a = 3$ $A = 3$
$b = 3$ $P = \frac{2\pi}{3}$
$h = -\frac{2\pi}{3}$ s.t. $(h, k + a)$ $(-\frac{2\pi}{3}, 4)$
$k = 1$ $y = 1$

max/k/min/k/max

max = 4
min = 1 - 3 = -2



step ii put y = 0 and solve for x by doing opposite operations. BEDMAS

$0 = 3\cos 3(x + \frac{2\pi}{3}) + 1$

$\frac{-1}{3} = \cancel{3}\cos 3(x + \frac{2\pi}{3})$

$\cos^{-1}(-\frac{1}{3}) = \cancel{\cos}\ 3(x + \frac{2\pi}{3})$

$\frac{1.91}{3} = \cancel{3}(x + \frac{2\pi}{3})$

$\frac{1.91}{3} - \frac{2\pi}{3} = x + \frac{2\pi}{3} - \frac{2\pi}{3}$

$x_1 = -1.46$

$d_1 = |x_2 - x_1|$

$d_1 = |-1.05 - (-1.46)|$

$d_1 = 0.41$

step iii Locate x_1 on the x-axis, and use symmetric nature of graph to find the 2 x-int (x_2) in the same cycle.

$x_2 = \min_x + d_1$

$x_2 = -1.05 + 0.41$

$x_2 = -0.64$

step iv. Express the cyclical nature of the sin function in final answer.

$x_1 = -1.46 + kP$

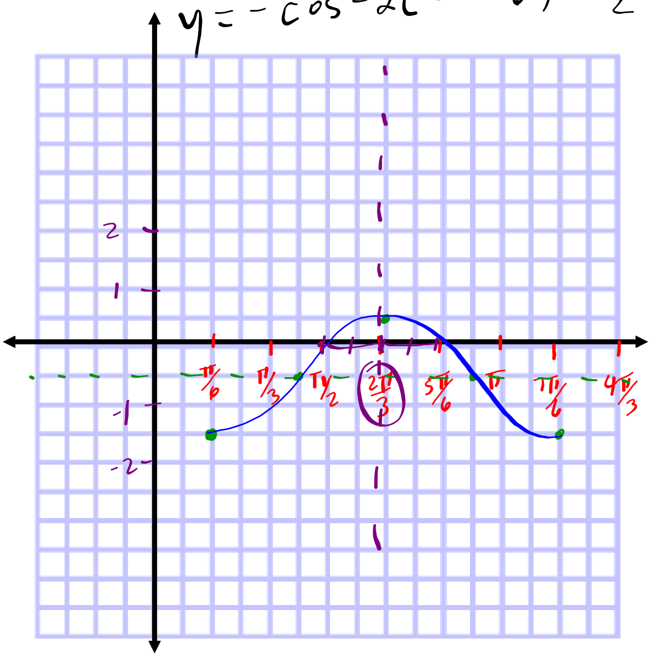
$x_1 = -1.46 + \frac{2k\pi}{3}$

$x_2 = -0.64 + \frac{2k\pi}{3}$

where $k \in \mathbb{Z}$

Find the x-ints

$y = -\cos -2(x - \pi/6) - \frac{1}{2}$



$a = -1$ $A = 1$

$b = -2$ $P = \pi$

$h = \pi/6$ $y = -1/2$

$k = -\frac{1}{2}$ s.p. $(h, k + a)$

$(\pi/6, -\frac{1}{2} - 1)$

$(\pi/6, -1.5)$

max $= -0.5 + 1$

$= 0.5$

min. $= -1.5$ min/k/max/k/min

$x_1 = -0.5236$

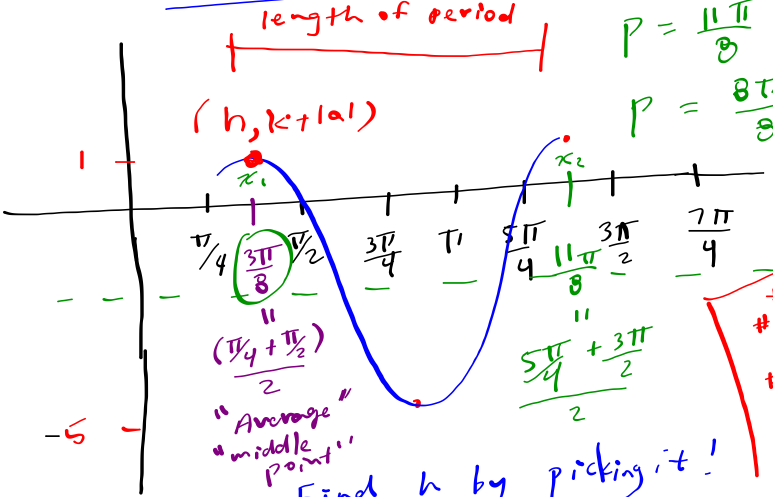
$x_1' = -0.5236 + P$

$+ \pi$

$x_1' = 2.62$

p 5-69

Determining the equation of a sinusoidal function



$p = \frac{11\pi}{8} - \frac{3\pi}{8}$

$p = \frac{8\pi}{8}$

$p = \pi$

#5 p 5.83
#6 p 5.85
#2 p 5.74
#3 p 5.75
#1 p 5.64

step i. fill out x-axis

step ii. find $|a|$

$A = |a|$

$|a| = \frac{max - min}{2}$

$|a| = \frac{1-(-5)}{2}$

$|a| = 3$

step iii find k

$k = \frac{max + min}{2}$

$k = \frac{1+(-5)}{2} = -2$

step iv. Find h by picking it! (Either on central axis, or a max/min)

central axis → sin function; max/min → cos function

step v. Based on h/starting point, pick cos or sin and pick the sign of a.

$\therefore$ cos and a +

$a = 3$

$y = 3\cos b\left(x - \frac{3\pi}{8}\right) - 2$

step vi. Find b by using $p = \frac{2\pi}{|b|}$

p is the length between 2 consecutive max

$d = |x_2 - x_1|$

$p = \pi$

$\pi = \frac{2\pi}{|b|}$

$\frac{|b|\cancel{\pi}}{\cancel{\pi}} = \frac{2\pi}{\pi}$

$|b| = 2$

$b = 2$

$$\boxed{y = 3\cos 2\left(x - \frac{3\pi}{8}\right) - 2}$$