5.5 - Writing Trigonometric Equations

Several different equations can represent the SAME GRAPH.

This is because these functions are periodic -> a phase shift of a sine function could look like a cosine function or vice versa.

Ex 1: Write the equation for the sine function that has the following properties

amplitude of 5 → $a = 5$

period of 240° → $\text{period} = \frac{360}{k}$

$240 = \frac{360}{k}$

$k = \frac{360}{240}$

$k = \frac{3}{2}$

phase shift of 45° to the right → $d = 45°$

vertical shift up 3 units → $c = 3$

$\therefore y = 5\sin\left[\frac{3}{2}(x - 45°)\right] + 3$

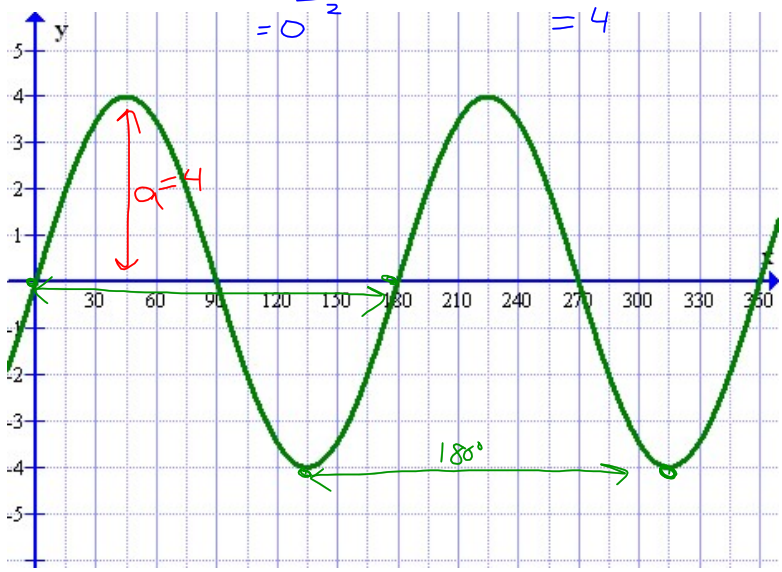
Ex 2: Write an equation for both sine and cosine function that has the following properties

Max = 4
Min = -4

$c = \frac{max+min}{2} = \frac{4-4}{2} = 0$

$a = \frac{max-min}{2} = \frac{4-(-4)}{2} = 4$

a)



amplitude: 4

period: 180°

need k: $period = \frac{360}{k}$

$k = \frac{360}{180} = 2$

phase shift:

for sin fn: $d = 0$

for cos fn: $d = 45°$

vertical shift

$c = 0$

Equation(sin fn):

$y = 4\sin(2x)$

OR $y = 4\sin[2(x-180)]$

OR ...

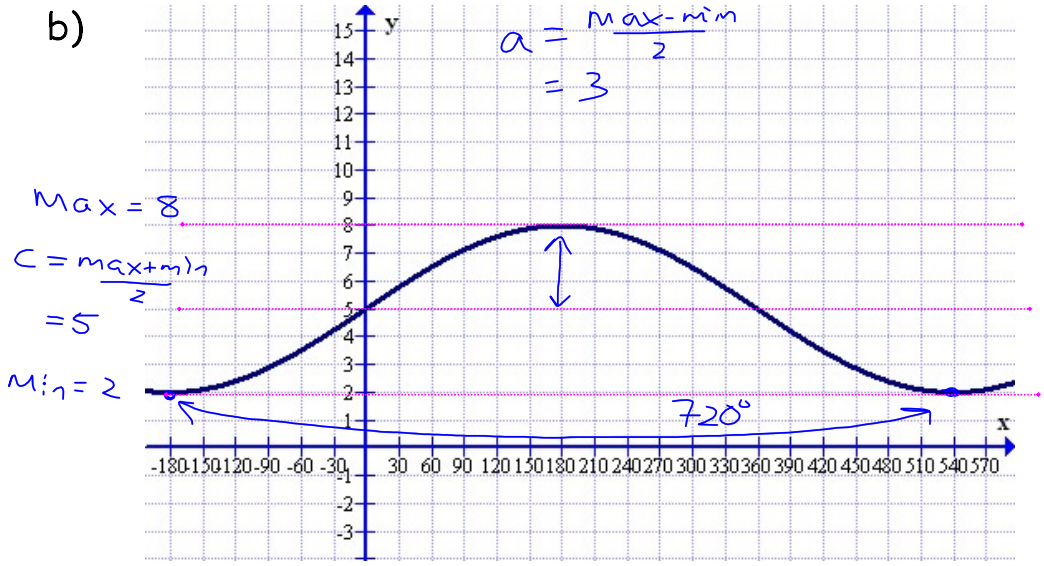
Equation(cos fn):

$y = 4\cos[2(x-45)]$

OR $y = 4\cos[2(x-225)]$

OR ....

b)



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

$= 3$

Max = 8

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

$= 5$

Min = 2

period = $\frac{360}{k}$

k: $\frac{360}{720}$

$= \frac{1}{2}$

phase shift:

for sin fn:

$d = 0$

for cos fn:

$d = 180°$

Equation(sin fn):

$y = 3\sin\left(\frac{1}{2}x\right) + 5$

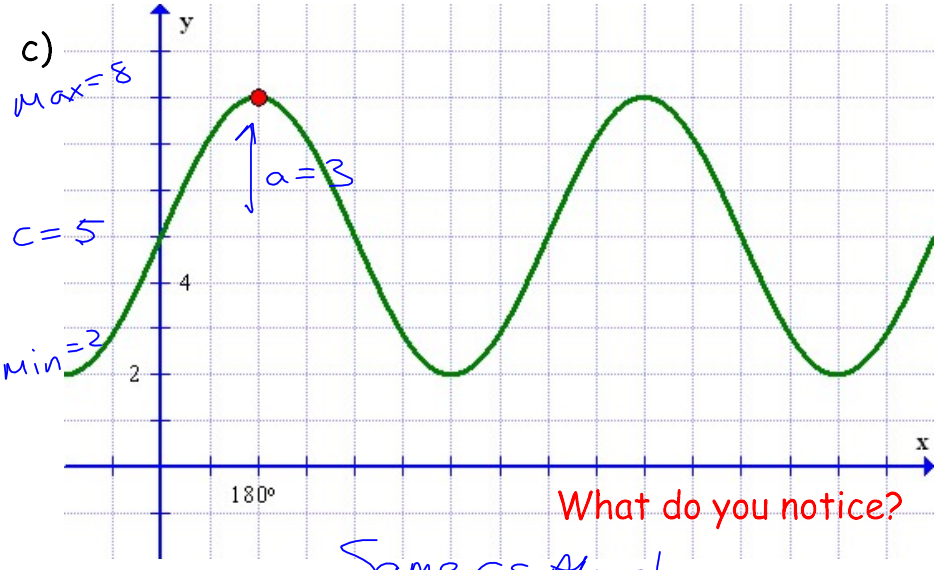
Equation(cos fn):

$y = 3\cos\left[\frac{1}{2}(x - 180°)\right] + 5$

OR

$y = -3\cos\left[\frac{1}{2}(x + 180°)\right] + 5$

c)



Max = 8

a = 3

c = 5

Min = 2

k:

phase shift:

for sin fn:

for cos fn:

What do you notice?

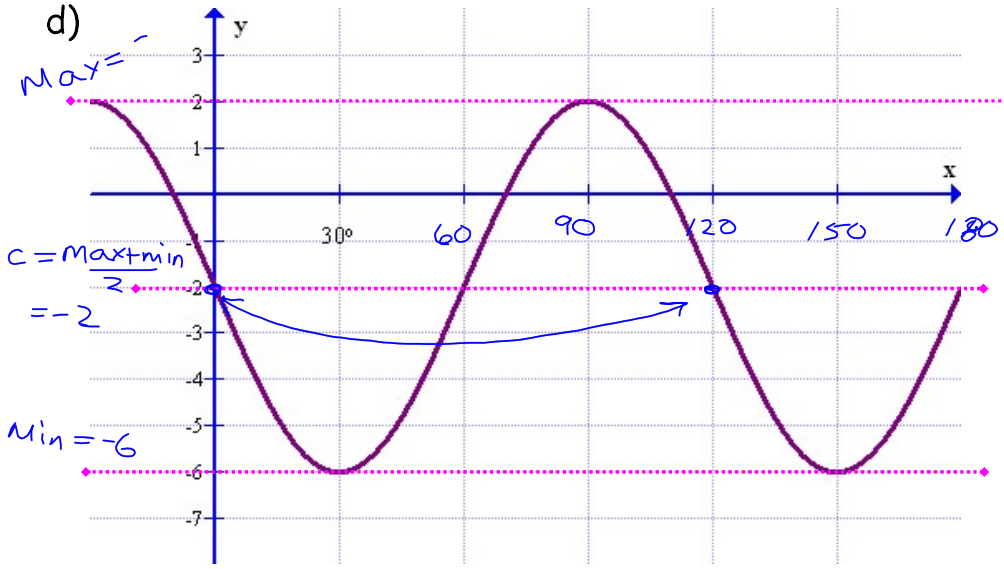
Same as Above!

Equation(sin fn):

Equation(cos fn):

Changed scale makes it look different

d)



Max = -2

$c = \frac{\text{max} + \text{min}}{2}$

$= -2$

Min = -6

period $= \frac{360}{k}$

k: $k = \frac{360}{120}$

$= 3$

phase shift:

for sin fn:

$d = 60°$

for cos fn:

$d = 90°$

OR

$d = -30°$

Equation(sin fn):

$y = 4\sin[3(x-60°)] - 2$

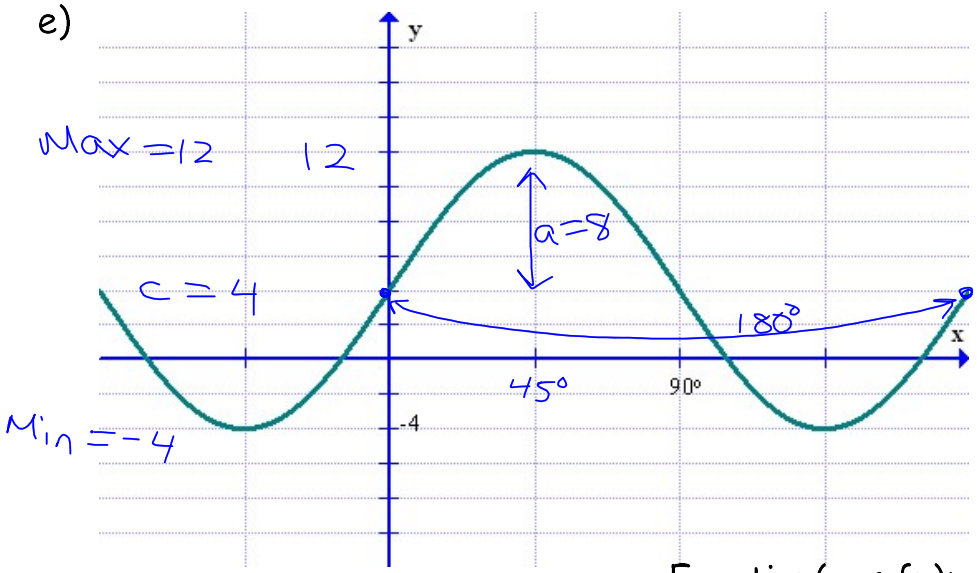
Equation(cos fn):

$y = 4\cos[3(x-90°)] - 2$

OR

$y = 4\cos[3(x+30°)] - 2$

e)



Max = 12

Min = -4

k: $= \frac{360}{180}$

$= 2$

phase shift:

for sin fn:

$d = 0$

for cos fn:

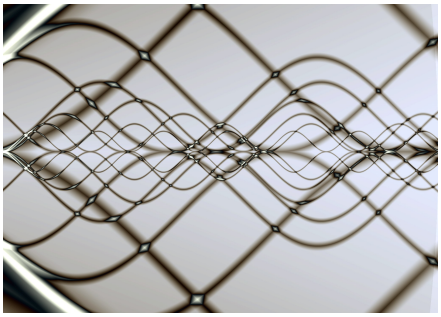
$d = 45°$

Equation(sin fn):

$y = 8\sin(2x) + 4$

Equation(cos fn):

$y = 8\cos[2(x-45°)] + 4$



Homework:
p 309 # 4, 5
p 319 # 5, 6, 7, 9, 14
+ Handout