Chapter 6 – Sinusoidal Functions

6.6 – Models of Sinusoidal Functions

In this section we will look at how to develop a sinusoidal function which can explain given information. In essence we will be writing sine or cosine functions based on given transformations.

Just as a reminder:

General Form of the Sine and Cosine Functions

$$f(\theta) = a\sin\left(k(\theta - d)\right) + c \qquad g(\theta) = a\cos\left(k(\theta - d)\right) + c$$

Another reminder (about the pattern of sinusoidal functions):

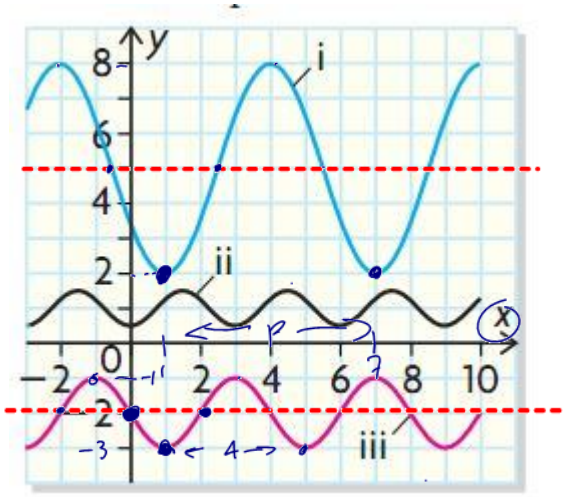
Sine functions "start" at the central axis and go up to a **max** if "***a***" is **positive**, or down to a **min** if "***a***" is **negative**.

Cosine functions "start" at a **max** if "***a***" is **positive**, or at a **min** if "***a***" is **negative**.

Example 6.6.1

From your text: Pg. 391 #4a

Determine a sinusoidal equation for each function:



i) Cosine (negative)

$c = \frac{max + min}{2} = \frac{8+2}{2} = 5$

$a = \frac{max - min}{2} = \frac{8-2}{2} = 3$

P.S. 1 right, $P = 6$

$k = \frac{360}{p} = \frac{360}{6} = 60$

$f(x) = -3\cos\left(60(x-1)\right) + 5$

iii) Sine (negative)

$a = \frac{max - min}{2} = \frac{-1-(-3)}{2} = 1$

$c = \frac{max + min}{2} = \frac{-1+(-3)}{2} = -2$

P.S. = 0, $P = 4$

$k = \frac{360}{p} = \frac{360}{4} = 90$

$g(x) = -\sin(90x) - 2$ (a, k, d, c)

Example 6.6.2

From your text: Pg. 392 #5a)

5. For each table of data, determine the equation of the function that is the simplest model.

a)

x	0°	30°	60°	90°	120°	150°	180°
y	3	2	1	2	3	2	1

cosine (+ve)

max C.A. min C.A. max C.A. min

$a = 1 \rightarrow \frac{max - min}{2} = \frac{3-1}{2} = 1$

$P = 120° \Rightarrow k = \frac{360}{P} = \frac{360}{120} = 3$

P.S. 0°

$\therefore y = 2$

$$f(x) = \cos(3x) + 2$$

Example 6.6.3

From your text: Pg. 392 #6b)

6. Determine the equation of the cosine function whose graph has each of the following features.

	Amplitude	Period	Equation of the Axis	Horizontal Translation
a)	3	360°	$y = 11$	0° P.S.
b)	4	180°	$y = 15$	$d = +30°$ right

a) $f(\theta) = 3\cos(\theta) + 11$ $\quad k = \frac{360}{P} = \frac{360}{360} = 1$

b) $g(\theta) = 4\cos(2(\theta - 30)) + 15$ $\quad k = \frac{360}{180} = 2$

Class/Homework: Pg. 391 – 393 #4b, 5bcd, 6acd, 7, 11 – Also work on the Transformations Sheet!