Lesson Plan 5 Phase Shift, Modeling Math 48C Mitchell Schoenbrun

1) Attendance
2) Quiz
3) Homework 3
4) Homework 4 questions

Review of Phase Shift

Definition: A Phase shift is the portion of one period shifted horizontally.

Question: If a function has a phase shift of 1, what function do you get?

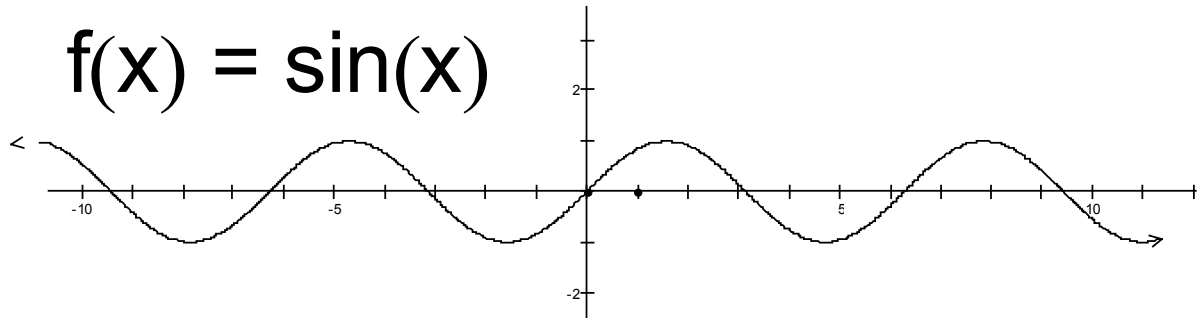Units: Sometimes Phase shifts are measured in degrees, $1 = 360°$.

Application: Power in an AC circuit.

US Current is AC 60hz 120 Volts:

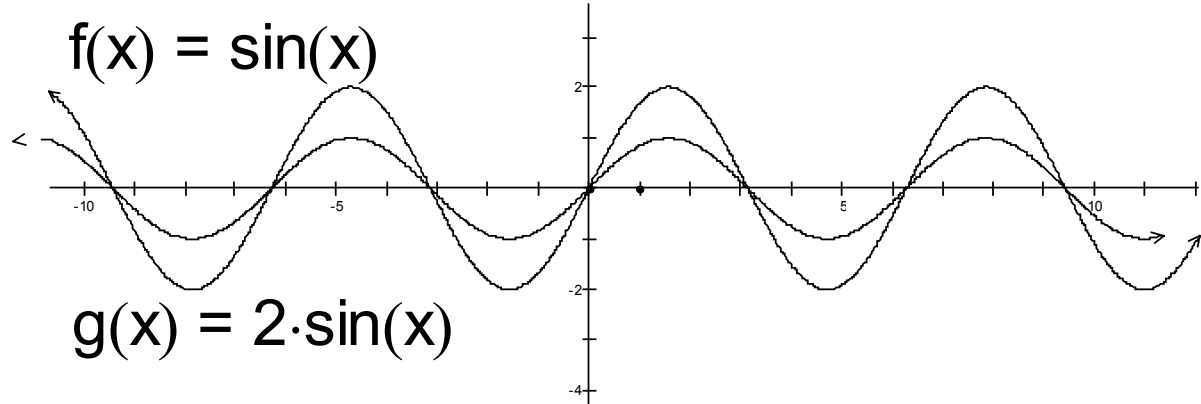Amplitude is 120 Volts, so Voltage varies from +120V to -120V.
The period is 1/60 second and the frequency is 60hz or 60 times per second

AC uses two wires, with the Voltage between the wires changing over time:

f(x) = sin(x)

With and without ground wire.

European and some US homes also have 220Volt 60hz AC

$f(x) = \sin(x)$

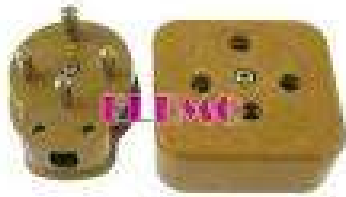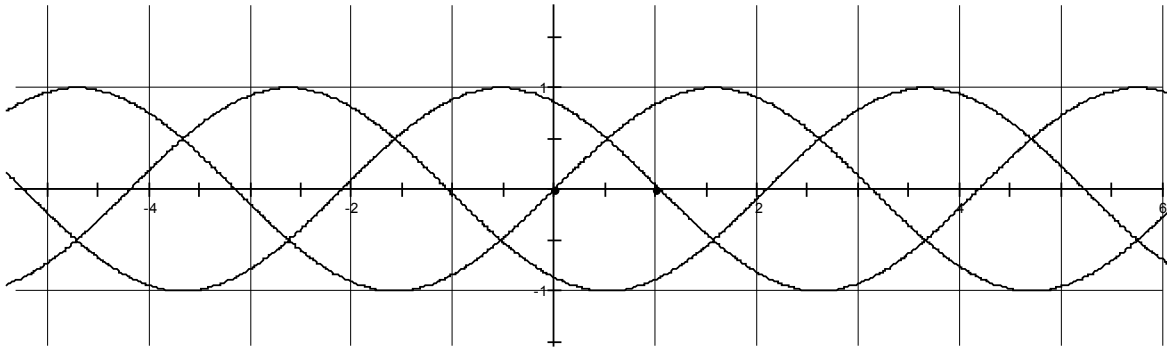$g(x) = 2 \cdot \sin(x)$

| European 220 | US 220 with ground wire |

For Industrial Applications, a 4 wire 3 Phase 120 Volt system is used to provide more and smoother power.   One ground wire and three hot wires each carry 120V 60hz, but at a phase shift of 1/3 and 2/3, or 120° and 240°.

First page of handout

Modeling a Sinusoidal Function

Today we are going to learn about modeling sinusoidal functions to real world phenomenon.

Recall that sines and cosines are merely phase shifted functions:

$$\sin\left(\theta + \frac{3\pi}{2}\right) = \cos(\theta)$$

So we can use either function in our model.   Typically we will use the sine function.

Recall our general sine function:

$$f(\theta) = A\sin\big(B(\theta - C)\big) + D$$

What are the following:

A = _____ |A| = the Amplitude

B = _____ |B|/2π = the frequency, or   2π/|B| = the period

C = _____   C/Period = the phase shift or Horizontal Shift

D = _____   D = The Vertical Shift or the midline

Example of modeling from Data:

X	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
Y	4	5.2	6	6	5.2	4	2.8	2	2	2.8	4	5.2

Max = _____

Min = _____

A = Amplitude = (Max - Min)/2 = _____
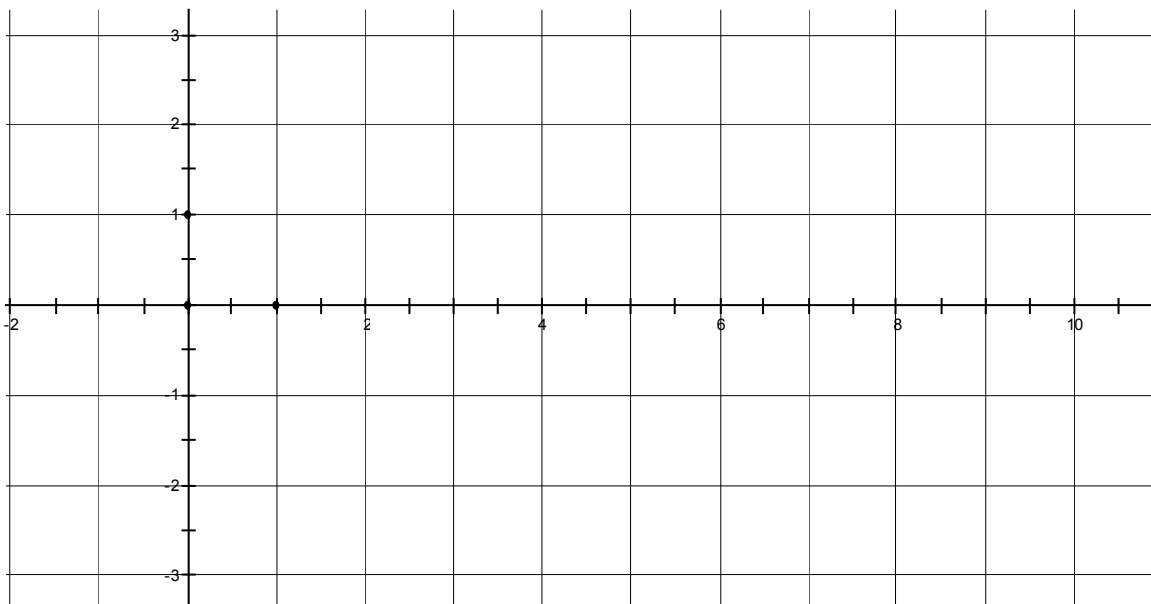
D = Midline = (Max + Min)/2 = _____

Period = _____

so

B = _____

f(x) = A sin(B(x-C)) + D   So pick a starting point to figure out C, the horizontal offset
Graph it

Example of modeling from Data:

X	0	5	10	15	20	25	30	35	40	45	50	55
Y	1	1.3	1.5	1.5	1.3	1	.7	.5	.5	.7	1	1.3

Max = _____

Min = _____

A = Amplitude = (Max - Min)/2 = _____
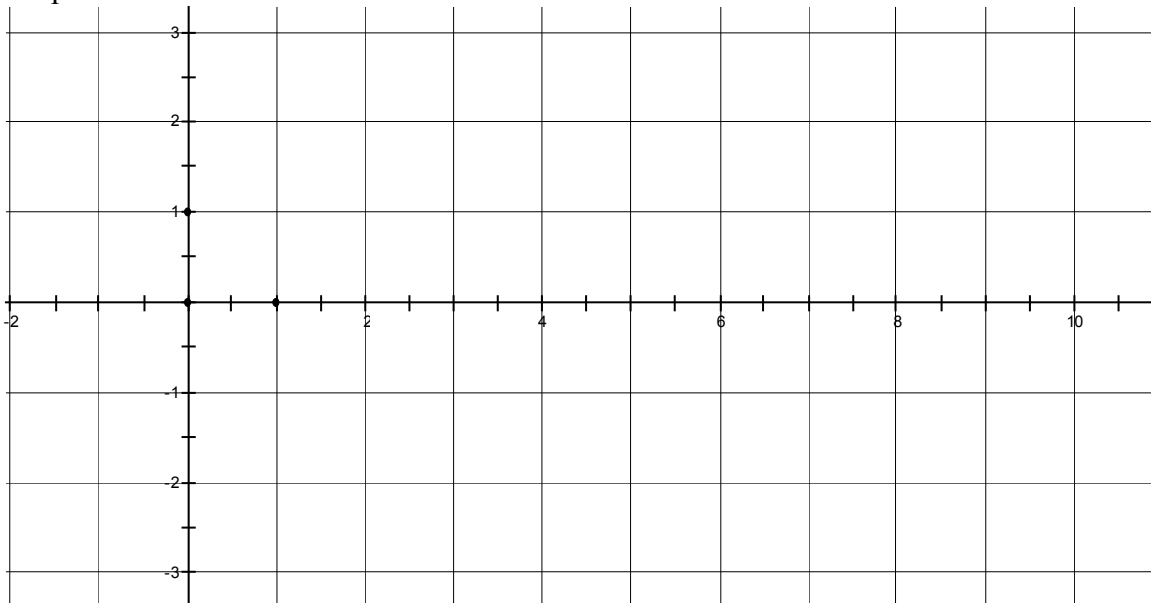
D = Midline = (Max + Min)/2 = _____

Period = _____

so

B = _____

f(x) = A sin(B(x-C)) + D   So pick a starting point to figure out C, the horizontal offset

Graph it

Homework for Wednesday

8.4 P. 558 #1-5, 35-37