FST Name _____

4-10 Modeling with Trig Functions Date _____ **A#19**

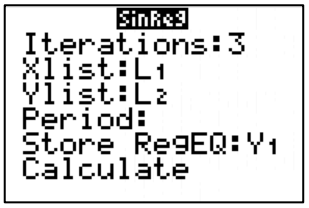
Goal: Show how sine waves model a variety of situations

Questions

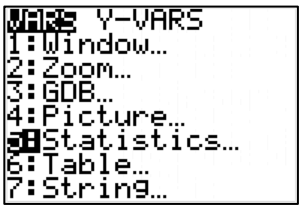
Activity: The tables below show the number *N* of hours of daylight in Jacksonville, FL as a function of the number *D* of days after December 31st of a certain year. The data were collected on the first day of each month over a two-year period. Neither year was a leap year.

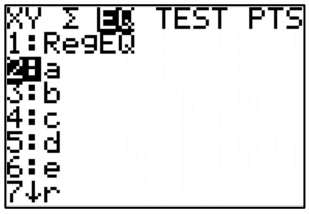
D	1	32	60	91	121	152	182	213	244	274	305	335
N	10.23	10.77	11.55	12.5	13.37	13.98	14.08	13.62	12.77	11.88	10.98	10.35
D	366	397	425	456	486	517	547	578	609	639	670	700
N	10.23	10.77	11.53	12.48	13.35	13.98	14.08	13.62	12.78	11.88	10.98	10.35

1. Enter the data *D* and *N* into L_1 and L_2, respectively, in STAT → EDIT.
2. Graph data. You may need to adjust window. Consider the max and min of each list.
3. Create a regression model of the data by selecting STAT→ CALC → SinReg. Store the equation in Y_1.



4. The equation will be in the form $y = a\sin(bx + c) + d$. These variables are temporarily stored in the calculator under VARS → Statistics… → EQ





5. Find the following. Include units.
   a. Amplitude: $a \approx$ _____
   b. Period: $\frac{2\pi}{b} \approx$ _____
   c. Vertical shift: $d \approx$ _____
   d. Phase shift: $-\frac{c}{b} \approx$ _____

Questions

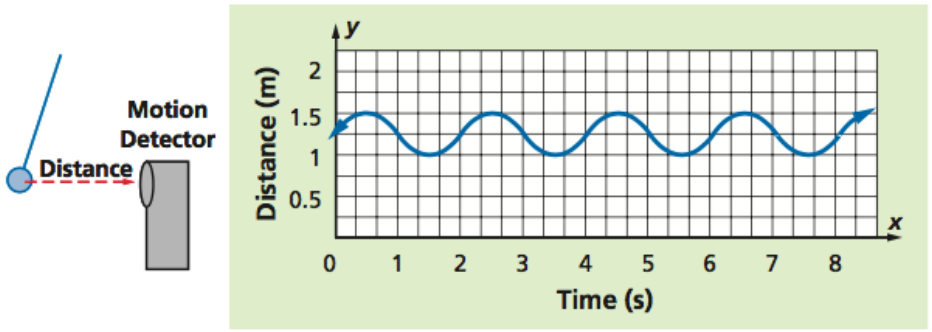
Example 1: The monthly mean temperatures for Memphis, TN are listed in the table below.

Month	J	F	M	A	M	J	J	A	S	O	N	D
Temp °F	40	45	54	62	71	79	83	81	75	64	52	43

Use your handy-dandy calculator to find the following. Round to nearest tenth and include units.

a. Sine function: _____
b. Amplitude: $a \approx$ _____
c. Period: $\frac{2\pi}{b} \approx$ _____
d. Vertical translation: $c \approx$ _____
e. Phase shift: $\frac{c}{b} \approx$ _____

Example 2: A pendulum swings back and forth in a vacuum. Its distance from an object is captured using a motion detector for the object. The setup is pictured below at the left; at the right is a graph of the pendulum's distance from the motion detector. Write an equation for the distance from the pendulum to the object as a function of time.



Amplitude: Period:

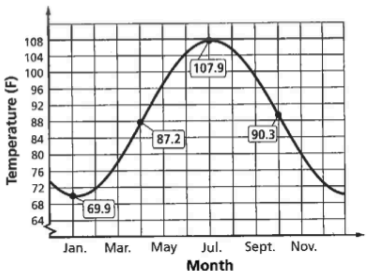
Vertical Shift: Phase Shift:

Form: $\frac{y-k}{b} = \sin\left(\frac{x-h}{a}\right)$

Example 3:

A sine wave model for the average temperature T for Yuma, AZ, during month n of the year can be found using the data below and the graph at the right.

Month	Jan	Feb	Mar	Apr	May	Jun
Temperature (°F)	69.9	75.2	80.1	87.2	94.7	104.4
Month	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°F)	107.3	106.1	101.0	90.3	77.3	69.0



Amplitude: Period:

Vertical Shift: Phase Shift:

Form: $\frac{y-k}{b}=\cos\left(\frac{x-h}{a}\right)$

Example 4: When an oven is set to a particular temperature, the heat level rises and falls, actually fluctuating slightly above and below that level as time passes. Assume that when a particular oven is set to 425ºF, the oven temperature t in degrees Fahrenheit m minutes after the burner first shuts off satisfies $t=425=6\cos(0.9m)$

a. What are the maximum and minimum temperatures of the oven at this setting?

b. What is the period of this sine wave? What does the period represent?

Summary: