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Studying Mathematical Relationships Using TI Calculator

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CMST SCOLLARCITY Lesson Plan Template-Lesson Plan using **TI Technologies** (Due Tuesday, July 27th)

Submit as hard copy AND electronically through ANGEL

Name: Carneathea Melson
Grade level(s)/Subject taught: 10 – 12/ Algebra II Honors
Objectives: (Remember…*How will the modeling tool help the student better learn the objective?)* The student will learn how to choose a mathematical model (linear, quadratic, exponential, and trigonometric) to model real world data. Students will be able to make predictions from the data.

Items to include in your TI Technologies lesson plan: (use *your* area/discipline/concepts).

For the math teacher:

1. *Write* the Mathematical Concept or "key idea" that TI Technologies will be used to teach: (e.g. Students use mathematical modeling/ multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships)

Students use mathematical modeling/ multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships. They will be able to use the graphic calculator to model the data and choose proper mathematic model to simulate the data.

Real world data most often cannot be modeled precisely with a single equation. Mathematicians, scientists and engineers still need to be able to make predictions from the data. They need to find functions to fit data. It will be the students' job to write an equation of an actual real-world situation.

Using TI 83/84 graphing calculator, I plan to have students plot the data of the daily high temperature in New Orleans, Louisiana for several days of a given year. The students will then write a cosine model for the data using the formula { y = a cos b(x – h) + k }. Next the students' job will be to determine the amplitude, period, horizontal shift and vertical shift (a, b, h and k respectively) from the given data. Then the student will input the equation into the calculator and graph the equation to determine if it fits the data. Once a proper equation is modeled, then the student will use it to estimate the temperature in New Orleans on Sept.1 (day 244) or any day of that year.

To accomplish this task, prior lessons on finding the amplitude, period and translating trigonometric function will have been taught. I would open the lesson with a 10 minute bell work assignment. Students will demonstrate above knowledge by solving various problems

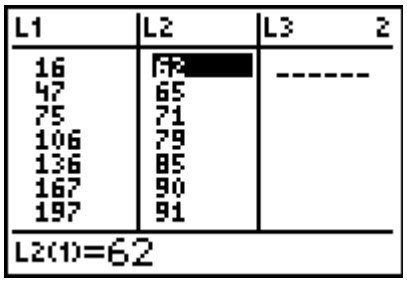
on the translation of the graph "y = sin x" in the interval $0 \le x \le 2\pi$ *on the graphing calculator. The following problems will be given:* $y = 2 \sin x + 3$, $y \sin(x - \frac{\pi}{2})$ *and* $f(x) = \sin(x + \pi) - 2$. *Students will have to graph the equations and identify the amplitude, cycle, horizontal and vertical shifts of each. Three students will be chosen to demonstrate graphs on the overhead and answer the above questions. They will receive bonus points towards their homework grades.*

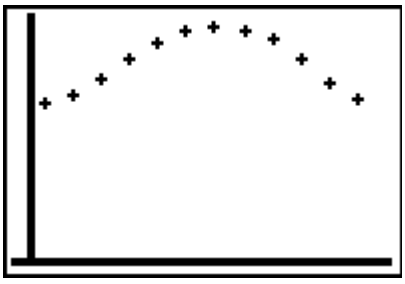
LESSON

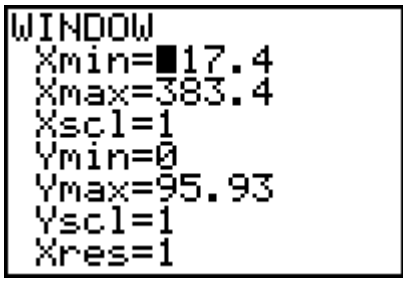
The data from the table is put into the graphing calculator using the STAT, EDIT button. This will take about 5 minutes.

Next the student will graph data using STAT PLOT.

Day of Year	*Temperature (°F)*
16	*62*
47	65
75	71
106	79
136	85
167	90
197	91
228	90
259	87
289	79
320	70
350	64







For the remainder of the period (25 minutes) do the following calculations.

To find the **amplitude (a) use the formula* $a = \frac{1}{2}(\max - \min)$

$$a = \frac{1}{2}(91 - 62)$$

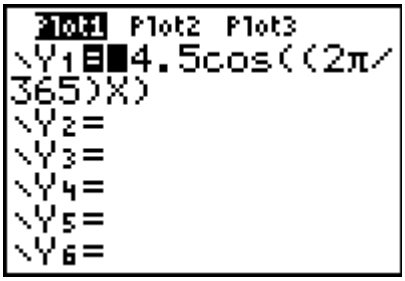
$$a = 14.5$$

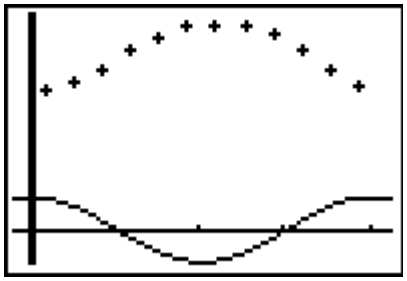
To find the **cycle (b) use the formula* ***period =*** $\frac{2\pi}{b}$***.*** *One complete cycle takes 365 days.*

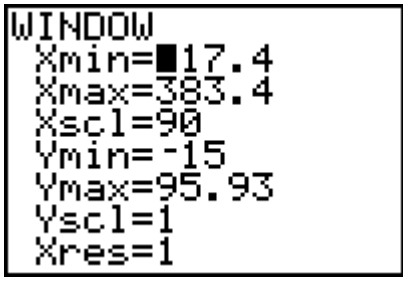
$365 = \frac{2\pi}{b}$ *Now solve for b.* $b = \frac{2\pi}{365}$

*Now substitute **a** and **b** into the equation* $y = a \sin b x$ *to obtain* $y = 14.5 \cos \frac{2\pi}{365} x$.

To find the **translation values **h** and **k**, compare* $y = 14.5\cos\frac{2\pi}{365}x$ *with the plot of the data.*







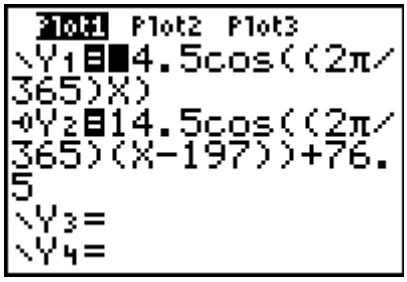
Phase shift (horizontal shift): *h = 197* – 0
= 197

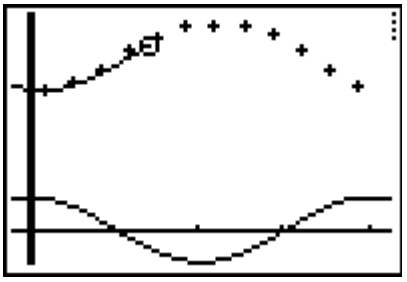
vertical shift: k = 91 – 14.5
= 76.5

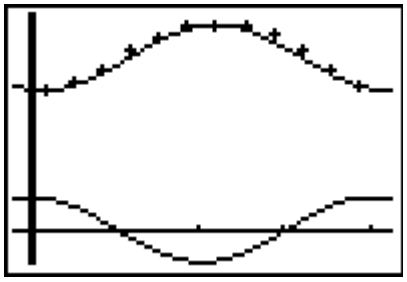
**Using the formula* $y = a\cos b(x - h) + k$ *write the final equation.*

The model for the data is $y = 14.5\cos\frac{2\pi}{365}(x - 197) + 76.5$. *Input equation to see if data fits.*

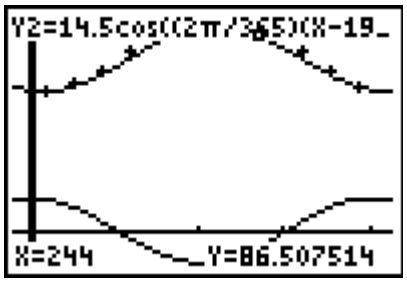
***NOTE**: Make sure you are in radian mode.*







**Now students can estimate the temperature for day 244. Go to trace, make sure the equation shows at the top of the graph, then put in 244 for x to find the value for y. The value for the high temperature for Sept. 1st is 86.5 degrees.*



Assessment

To assess the learning I will give students a homework assignment which uses a sine function to model the normal daily high temperature in New Orleans. Use the equation $y = a \sin b(x - h) + k$. *Then use the sine model to estimate the high temperature on Sept 1 (day 244).*

Day of the year	16	47	75	106	136	176	197	228	259	289	320	350
Temperature	71	69	70	73	77	82	85	86	84	82	78	74

Students will be graded based upon their calculations and final equations. They will have to show the actual simulation on the graphing calculator to receive a passing grade. If they have all the components that we had above and the simulation they will receive 10 points.If they show only calculations without the simulation, they will only receive 5 points.