**Activity 6.5.1 Temperatures**

Many different natural and mechanical phenomena appear to be periodic – at least for a few cycles. The trigonometric functions are **periodic**, which means the dependent variable repeats itself exactly after a certain amount of time. Phenomena that have a **regular cycle**, like the tides, temperatures, rotation of the earth, etc., are candidates for a trigonometric model. For various situations presented in this unit, let us assume that the cycle is modeled with a trigonometric function. The sinusoidal or tangent model is a rough approximation of the data.

1. The table shows the average monthly sea temperatures *T* (in degrees Celsius) for a certain location. The time *t* is measured in months with  representing January 1.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  ***t*** | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|  ***T*** | 16 | 15.6 | 14.2 | 13 | 12.1 | 11.2 | 11 | 11.2 | 12.1 | 13 | 14.2 | 15.6 | 16 |

1. Sketch a graph of the data
2. Find a sinusoidal model that gives T as a function of t. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Predict the sea temperature on April 15 (t=4.5).

2. The temperature in an office is controlled by an electronic thermostat. The temperatures vary according to the sinusoidal function: $y=6\sin(\left(\frac{π}{12}x\right))+19$ where y is the temperature (Cº), and x is the time in hours past midnight.

1. Sketch a graph of the function.
2. What is the temperature in the office at 9 A.M. when the employees come to work?
3. What is the minimum temperature in the office?
4. What is the maximum temperature in the office?

3. In Bridgeport, CT, the average low temperature and average high temperatures for 2014 is

 given in the table below. The time *t* is measured in months passed since January 1. Let t=0 represent January 1.

|  |  |  |
| --- | --- | --- |
| Month | Average Low Temperature | Average High Temperature |
| January 0 | 23 | 37 |
| February 1 | 25 | 40 |
| March 2 | 31 | 47 |
| April 3 | 41 | 58 |
| May 4 | 51 | 68 |
| June 5 | 60 | 77 |
| July 6 | 66 | 82 |
| August 7 | 66 | 81 |
| September 8  | 58 | 74 |
| October 9 | 47 | 63 |
| November 10 | 38 | 53 |
| December 11 | 28 | 42 |

 (source: http://www.usclimatedata.com/climate/bridgeport/connecticut/united-states/usct0019)

1. Find a sinusoidal function that models the average low (L) temperature as a function of t measured in months.

(You may use technology such as a graphing calculator or Excel to find the “line of best fit” also called a regression equation; or you carefully graph the data with pencil and paper, sketch a sinusoidal curve through the data. Not every data point will be on the curve you sketch. Then find an equation of the curve you sketched.)

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1. Find a sinusoidal function that models the average high (H) temperature as a function of time t.

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1. On a separate sheet of paper, sketch a graph of both the low temperature data and the high temperature data on the same coordinate axis. Sketch the sinusoidal models L(t) and H(t) on the same axes.
2. Write a paragraph that compares and contrasts L(t) and H(t). For example, comment on: What is the midline for each? How much higher is the average high compared to the average low temperature? Do the functions have the same or similar periods? Do the two functions increase and decrease at the same time? Compare the amplitudes of L(t) and H(t). What does this mean in terms of temperature?