MATH-1080-401-Sp22
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Project #2 - Daylight Project

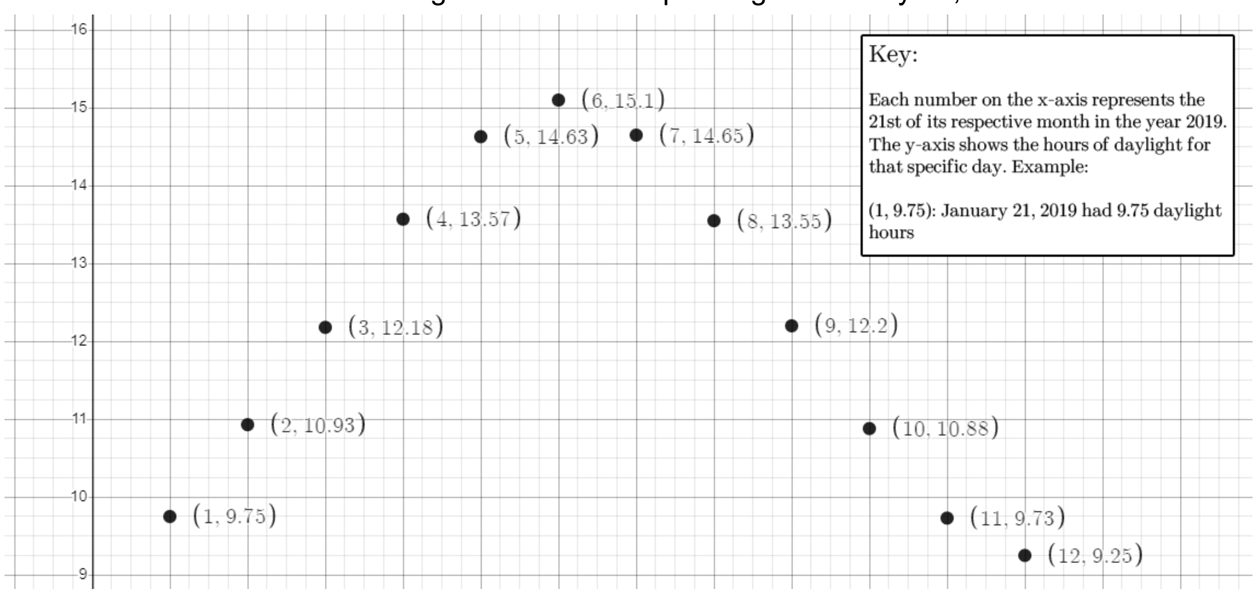
Time and Temperature for Salt Lake City

January 2019 – December 2019

1.) Compute the number of daylight hours with minutes converted into fractional hours.

Date	Sunrise	Sunset	Daylight Hours	High	Low	Average
1/21/2022	7:46 AM	5:31 PM	9.75	38	22	30
2/21/2022	7:13 AM	6:09 PM	10.93	44	27	35
3/21/2022	7:29 AM	7:40 PM	12.18	55	34	45
4/21/2022	6:39 AM	8:13 PM	13.57	62	40	51
5/21/2022	6:05 AM	8:43 PM	14.63	72	48	60
6/21/2022	5:56 AM	9:02 PM	15.10	84	57	71
7/21/2022	6:14 AM	8:53 PM	14.65	93	66	80
8/21/2022	6:43 AM	8:16 PM	13.55	91	64	78
9/21/2022	7:14 AM	7:26 PM	12.20	80	54	67
10/21/2022	7:45 AM	6:38 PM	10.88	66	42	54
11/21/2022	7:21 AM	5:05 PM	9.73	50	31	40
12/21/2022	7:48 AM	5:03 PM	9.25	38	23	31

2.) Make a scatter plot of the number of daylight hours data by letting the independent variable be time in months starting with t = 1 corresponding to January 21, 2019.



Key: Each number on the x-axis represents the 21st of its respective month in the year 2019. The y-axis shows the hours of daylight for that specific day. Example: (1, 9.75): January 21, 2019 had 9.75 daylight hours

3.) Does the data look like it is periodic? Like it is sinusoidal?

Yes. Based on what we know about the cycle of seasons, we can assume that this shape will be repeated each year, forming a repeating sine wave.

4.) Determine baseline so that you find the amplitude, period, and phase shift to fit the data

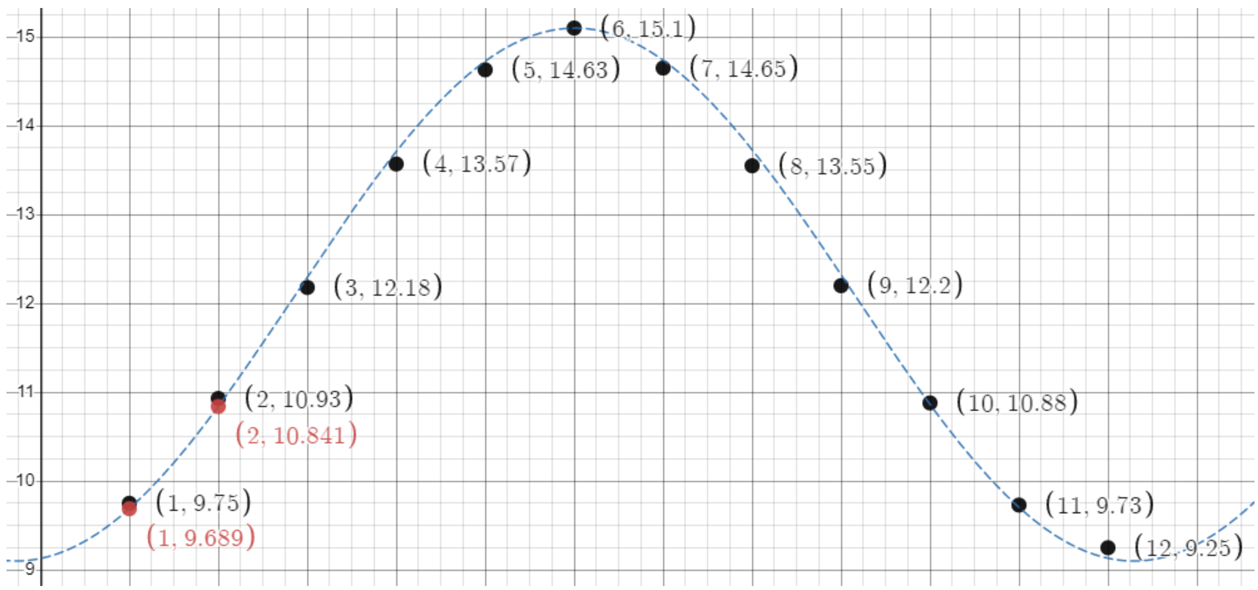
$$y = A\sin(\omega t + \phi) + B$$

to the sinusoidal model:

Adjust the values as necessary to fit the data as best you can.

$$y = 3\sin\left(\frac{1}{2}x + 4.85\right) + 12.1$$

5.) Plot your model along with the data. How good of a fit is the model? Use your model to approximate the number of daylight hours on January 21 and February 21 of this year. What are the actual numbers of daylight hours on those days?

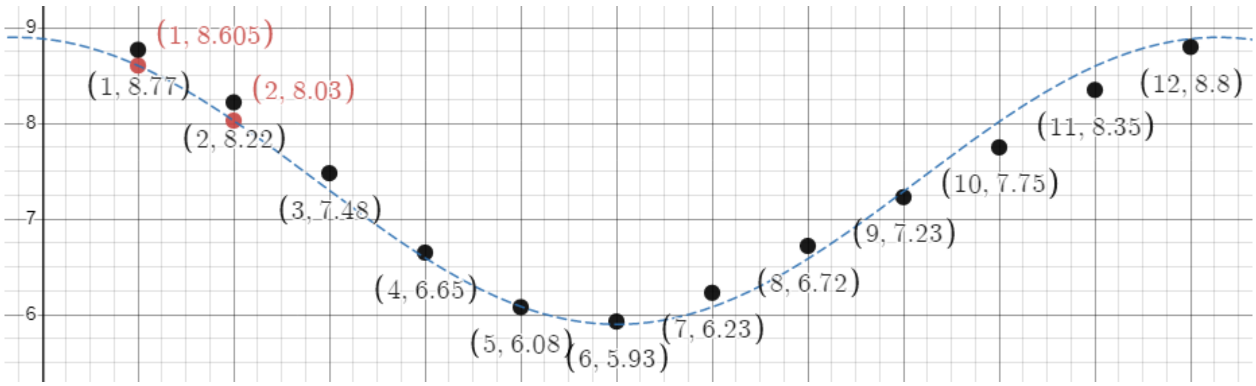


By plugging 1 into our equation above, we get 9.689 for the estimated number of daylight hours for January 21, 2022. Plugging 2 into the equation will give us 10.841 for the estimated daylight hours for February 21, 2022. The actual daylight hours on January 21st were 9.75, and the actual daylight hours on February 21st were 10.93. Both of these values were the same in 2022 as they were in 2019.

6.) Choose either the sunrise or the sunset data and repeat the process. What is your prediction of the sunrise/sunset for January 21 and February 21 as compared to the actual number of hours.

For the sunrise data, I created the following equation:

$$y = -\frac{3}{2}\sin\left(\frac{1}{2}x + 4.85\right) + 7.4$$

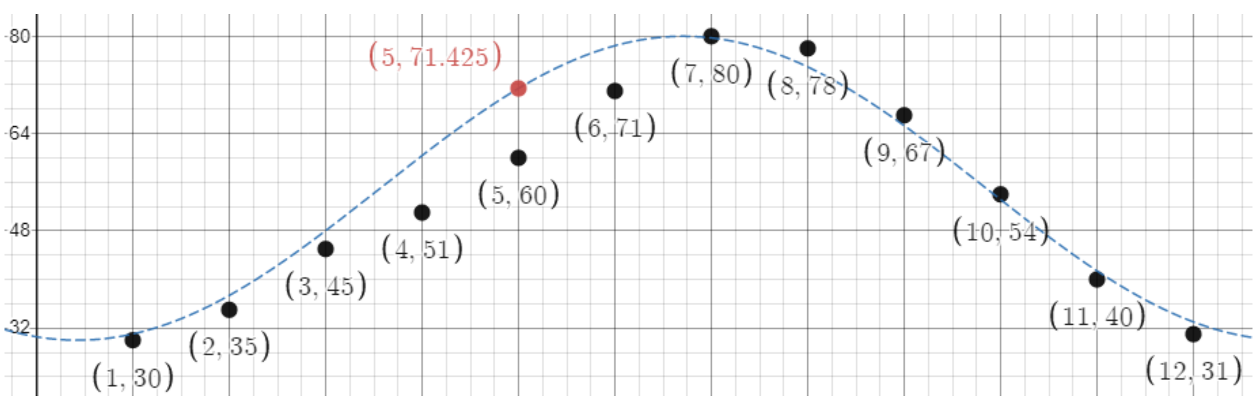


Plugging 1 and 2 into this formula gives 8.605 (about 8:36) and 8.03 (about 8:00) for January 21st and February 21st's respective sunrise times.

7.) Repeat the process on the average temperature for each month. Ideally is the data periodic? Are seasonal changes in weather periodic? What other factors might also impact the mode? How well does your model predict the average temperature for May 2019?

The below equation roughly follows average daily temperatures throughout the year:

$$y = 25\sin\left(\frac{1}{2}x + 4.5\right) + 55$$



We know that every year cycles between seasons, so we can assume that the graph of average temperatures is periodic. However, individual daily temperatures may be affected by other factors like weather patterns (storms, El Niño/La Niña, inversions, etc…). My model is very inaccurate for the average daily temperature of May 21st, instead showing a value that more accurately reflects the average temperature of June 21st.