Sunrise Project

Assignment: In this project, you will use the Sunrise and Sunset Calculator on timeanddate.com to investigate the relationship between sinusoidal functions and the lengths of days throughout the year. You will be working with this website throughout the assignment, so you should spend some time to familiarize yourself with it. You may work with a partner.

https://www.timeanddate.com/sun/

Part 1:

1. Fill in the attached Raw Data Sheet for Cupertino.
   - For each month in 2019, choose two days that month and enter the data for those dates. The dates should not be consecutive.
   - The Day Number will be a number between 1 and 365 e.g. Feb. 2 = Day #33 in the year. (2019 was **not** a leap year.)
2. Now fill in the attached Converted Data Sheet for Cupertino.
   - Each row in the table corresponds to a row on your Raw Data Sheet
   - The Day Number will be the same number from the Raw Data Sheet.
   - The Sunrise Hour, Sunset Hour and Solar Noon Hour are each a number between 0 and 24, rounded to 2 decimal places e.g. if the Sunset Time is 5:36pm, we add 12 hours because it's p.m. and covert the minutes to decimal, and the Sunset Hour is $12 + 5 + \frac{36}{60} = 17.60$.
   - Daylight Length = Sunset Hour - Sunrise Hour
3. Use the Converted Data Sheet to create 4 graphs. You can do this by hand or using Excel, Desmos or some other technology. You should create all 4 graphs on the same axes, and use colors or symbols and a key to make the data that your graph is presenting very clear to the reader. Your 4 graphs will compare:
   (a) Day Number and Sunrise Hour
   (b) Day Number and Sunset Hour
   (c) Day Number and Solar Noon Hour
   (d) Day Number and Daylight Length

4. Each of your graphs should look periodic. For each graph find the amplitude, period, vertical shift and phase shift of the graph. On a separate sheet of paper, clearly state each of these numbers, and use them to find an equation of the form $f(x) = A\sin(Bx - C) + D$ or $f(x) = A\cos(Bx - C) + D$ for each graph. *Accurately* add the graphs of these curves to your graphs from Part 3.

5. Use your equations from Part 4 to predict the Sunrise Time, Sunset Time, Daylight Length and Solar Noon Time for Valentine's Day (Feb. 14) 2020. Note that your equations will give you the *hour* and you will have to convert this to a *time*. Check your predictions against the actual times on the website. How close were they?

Part 2: Choose a city outside of the Bay Area and repeat Steps 1-5 of Part 1 for this city. Your graphs for Part 2 should not be on the same axes as your graphs from Part 1. No two projects may use the same city for Part 2, so please have your city approved by **Thur, Feb 13**.

Part 3: Please **type** answers to the questions below.

1. How might your equations be useful in the real world?

2. Describe how you would physically observe the equations you came up with from season to season in your city in Part 2.

3. Describe *in plain language* how your each of your curves differ in Parts 1 and 2. What does this tell you about the two cities you anayzed?

Grading: Make sure your work is **properly documented**; all city names and dates for data used in this project must be clearly recorded. Graphs should be easy to read and self-explanatory. All answers in Part 3 should be **typed** in **complete sentences** using **plain language**. Point breakdown is as follows:

- **10 points** - Part 1
- **15 points** - Part 2
- **15 points** - Part 3

This project is worth a total of **40 points**.

Each pair may submit a **single** assignment, or you may choose to work alone.

Due date: Your completed assignment is due on **Wed., Feb 19**. Late assignments will not be accepted for full credit. You may turn your project in early if you would like.

Raw Data Sheet (page 1)

City, State: _____

Month	Date	Day Number	Sunrise Time	Sunset Time	Solar Noon Time
January					
January					
February					
February					
March					
March					
April					
April					
May					
May					
June					
June					

Raw Data Sheet (page 2)

City, State: _____

Month	Date	Day Number	Sunrise Time	Sunset Time	Solar Noon Time
July					
July					
August					
August					
September					
September					
October					
October					
November					
November					
December					
December					

Converted Data Sheet (page 1)

City, State: _____

Day Number	Sunrise Hour	Sunset Hour	Daylight Length	Solar Noon Hour

Converted Data Sheet (page 2)

City, State: _____

Day Number	Sunrise Hour	Sunset Hour	Daylight Length	Solar Noon Hour