"I Gotta Go Where It's Warm!"

After 15+ years of cold winters, you vow to never again suffer a cold, wet, raw winter. Your new goal is to remain in climates where the weather is perfect—between 70°F and 80°F. However, you also find that you get bored if you stay in one place for too long. You decide to visit at least three different cities every year and while in each city, take in some of the local culture.

From this task, you are going to use **Fodor's** (**Fodors.com**) to decide on countries and then specific cities. With specific cities selected, go to **Weatherbase.com** and get the data for the average monthly temperature for a year. **At some time during the year, the temperature must go above 80°F, go below 70°F, or both.** With this data, you will determine what times of year you can visit each city and come up with a yearly itinerary. Finally, you will use Fodor's to determine three destinations you will visit while in each city.

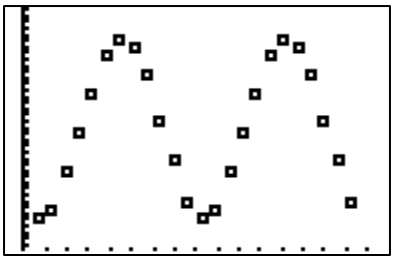
Specifically:
Go to Fodor's and select several cities you would like to visit and might have temperatures in our desired range. For this example, we will visit Baltimore, Maryland. Here is the data from Weatherbase.com:

Baltimore, Maryland
Elevation: 196 feet Latitude: 39 11N Longitude: 076 40W

Average Temperature Years on Record: 45

	YEAR	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
°F	56	33	36	44	54	64	73	78	76	69	57	47	37

Figure 1



When you have a city selected, graph the average monthly temperatures for two years. Graph the data as coordinate pairs (month, temp). You will need two years of data to determine the curve that models the data. (This example is Baltimore, MD)

We are going to calculate the **cosine equation** that models this data. First, we need three points; two maximum values and one minimum value. Since they will go in order of Maximum, Minimum, Maximum, we will call the first **Maximum (x_1, y_1)** (7, 78), the **Minimum (x_2, y_2)** (1, 33), and the **second Maximum (x_3, y_3)** (19, 78).

To determine the Amplitude, calculate $\left|\frac{y_1 - y_2}{2}\right| = A$

$$\left|\frac{78-33}{2}\right| = 22.5$$

Since the period is the amount of time it takes for the graph to repeat, we will calculate the time between the two maximum points. Consequently, the B-value is the Fundamental Period divided by the period

Period = $x_3 - x_1 = 19 - 7 \rightarrow$ pd = 12 $\qquad B = \frac{2\pi}{pd} = \frac{2\pi}{12} = \frac{\pi}{6}$

The Phase Shift is how far the graph is "moved" to the right. For a cosine curve, this value will be the same as the time it takes to reach the maximum temperature.

$C = x_1$ $C = 7$ (Maximum Temperature takes place in the month of July)

The Vertical Shift is how far the graph is moved Up or Down from the X-Axis. We calculate this by determine the average of the maximum and minimum values.

$$D = \frac{y_1 + y_2}{2}$$

The equation for the cosine curve will then be: $y = A \cos (B (X - C)) + D$

$$y = 22.5\cos(\frac{\pi}{6}(x-7)) + 55.5$$

Figure 2

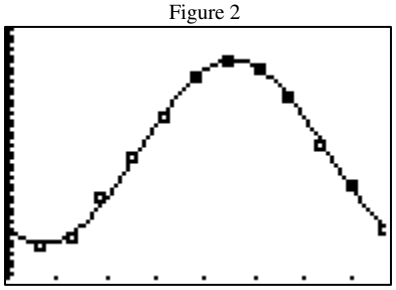
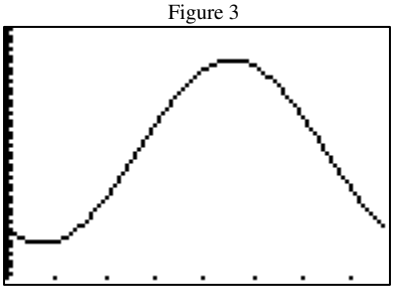


Figure 3



After you determine the equation of the curve of best fit, change the domain to [1, 13] so only one year is selected (figure 2). With this domain, x = 1 represents January 1st and x = 12.99 represents December 31. Next, turn off your plot data and graph just the curve of best fit (figure 3).

Figure 4

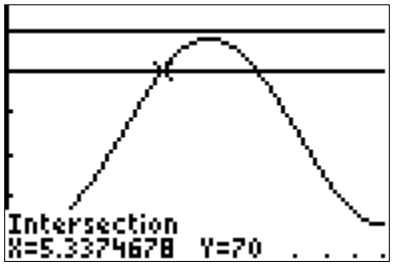
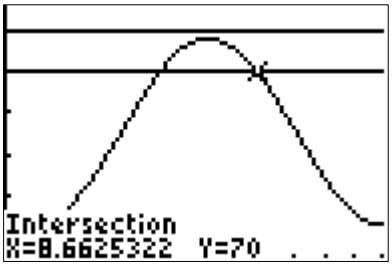


Figure 5



Now we are ready to see where the city falls within 70°F and 80°F. Graph the lines y = 70 and y = 80 to determine the intervals where you can stay within that city (use the calculator's INTERSECTION feature). This will help you determine for what parts of the year you can stay in any one city.

For the specific day, multiply the decimal portion by the number of days in that month. Since the decimal in 5.3374678 is ~ 0.337, multiply it by 31 (31 days in May ➔ 0.337 * 31 = 10.45 ➔ 10 days)

If you decided to choose this city during this time period, you would need to arrive here by May 10th (x = 5.337 in figure 4) and leave by August 21st (x = 8.663 in figure 5).

Your completed project will include:

- Cover sheet with your partner's and your name.

- Data for a minimum of three cities. For each city, this data will include a table of the average monthly temperatures, the work you completed to determine the curve of best fit (done on the computer using MS Equation Editor), the graph showing one year's data and the section where the data lies within 70^{o}F and 80^{o}F (see figure 5), and the specific dates showing when the temperature equals either 70^{o}F or 80^{o}F. Each city will be completed on a separate piece of paper.

- A yearly itinerary explaining when you will be traveling in each city. This will also be apparent in your graphs. In addition, you will include three destinations you will visit while in each city (specific beach, ancient ruins, famous restaurant, etc.)

Grading:

- Data for the cities: 75%
  (including temperatures, graphs, mathematical work, marked sections)
- Itinerary: 15%
- Destinations: 10%