$\qquad$ Date $\qquad$

## Storm Tracker Portfolio Worksheet

## PRECALCULUS: PARAMETRIC FUNCTIONS

Directions: Meteorologists use sophisticated models to predict the occurrence, duration, and trajectory of weather events. They build their models based on observations that they have made in the past. By understanding how previous weather events evolved, meteorologists can apply that knowledge to future weather events.

Parametric equations can be used to graph the path of an object in space. For example, they can be used to describe the path of a storm moving through an area. In this portfolio, you will use historical storm data to trace the path of a hurricane. From this data, you will use parametric equations to model the path of the storm.

## Step 1: Find your hurricane.

- Select the link to access the NOAA's Office for Coastal Management: Historical Hurricane Tracks website to search for a hurricane.

Historical Hurricane Tracks

- Type any state in the search box. (Note: Inland states do not usually have hurricanes. Type in a different state if no hurricanes are listed.)
- Select one hurricane from the list that appears.
- Select Zoom to Storm above the list to view the full hurricane path.


## Step 2: Plot the hurricane path.

- Take a screen shot of the hurricane path and include it below:
- Make a table of the storm's horizontal and vertical movement with respect to time. Hover over a specific point on the path and note the highlighted date in the table on the left. Make this date $t=0$. Note the position coordinates from the lower left corner of the map view and record them in Table 1. Since latitude measures north/south and longitude measures east/west, the first coordinate will be $y$ and the second coordinate will be $x$. Now progress
through the days along the path. Note that you might need to use the scroll arrow closest to the date information. In the table below, choose and record one point from each day of the storm. Mark each point $t=1, t=2$, etc.
Track the storm for a total of at least five days so that you have a minimum of five points in the table. Use the example below to help you find the date, latitude, and longitude.


## Table 1

| Date | t | x <br> (longitude) | y <br> (latitude) |
| :---: | :---: | :---: | :---: |
|  | 0 |  |  |
|  | 1 |  |  |
|  | 2 |  |  |
|  | 3 |  |  |
|  | 4 |  |  |

## Step 3: Create a Mathematical Model.

Work through the following steps to create two parametric equations where x is a function of $t$ and $y$ is a function of $t$.

1. First plot $t$ versus $x$, then plot $t$ versus $y$. What kind of regression should you use for each one based on your graphs?
2. Use your calculator to create a formula for the model you have chosen. Enter the ordered pairs into lists and have the calculator create the line of best fit for your model. For example, if your path appears to be exponential, you will have a model of the form $y=a b^{x}$ using the ExpReg feature on the calculator.
3. Write your final equations:

- $x(t)=$
- $y(t)=$


## Step 4: Check your model.

Plug in the values $t=0,1,2,3$, and 4 into your parametric equations and insert your values for x and y in the table below.

## Table 2

| $t$ | $x$ <br> (longitude) | $y$ <br> (latitude) |
| :---: | :---: | :---: |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

Now graph the $x$ - and $y$-coordinates from Table 1 onto graph paper using one color, and graph the $x$ - and $y$-coordinates from Table 2 onto the same graph paper using a different color. You may either copy and paste your graph here or upload it along with this worksheet.

Compare the model points with the original points and answer the following questions:

1. How does your model compare to the actual path?
2. Why did you choose the graph family that you did? Did you choose well? Why or why not?
3. Is it possible to solve $x(t)$ for t , substitute it into $y(t)$ to eliminate the parameter, t , and write it as a rectangular equation with x and y instead? Why or why not?

## Turn it in:

- Upload this worksheet into the Drop Box.
- If you did not paste a copy of your graph into the worksheet, be sure to also upload the graph into the Drop Box.

