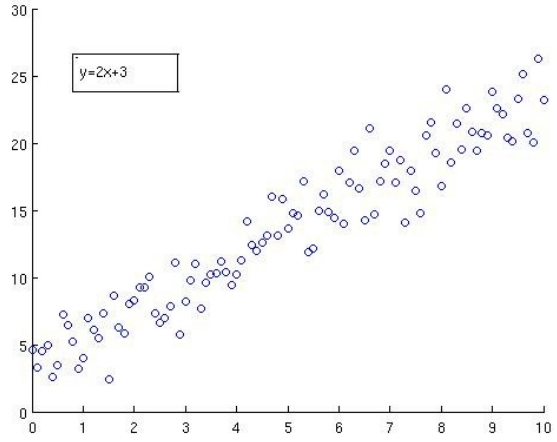
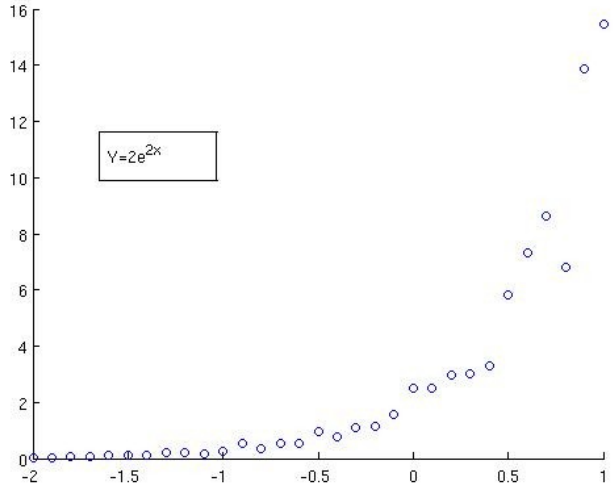
Math 112 Class Project

Parameter estimation for periodic data

In previous courses (math 111) you were introduced to both linear and exponential functions. In those course you learned how to approximate parameters of those functions , for example slope, y-intercepts, base, etc, using data you acquired from a graph. Once these parameters were estimated you developed an actual linear equation or exponential equation that helped you find estimate values of points that were not on the graph. In this project we will be using the data fitting techniques we developed in 6.5 and our ti-89 calculators to approximate Sin functions to periodic data we experience in our everyday lives. We will use these functions to either predict future events or estimate values missing values.



A) linear data

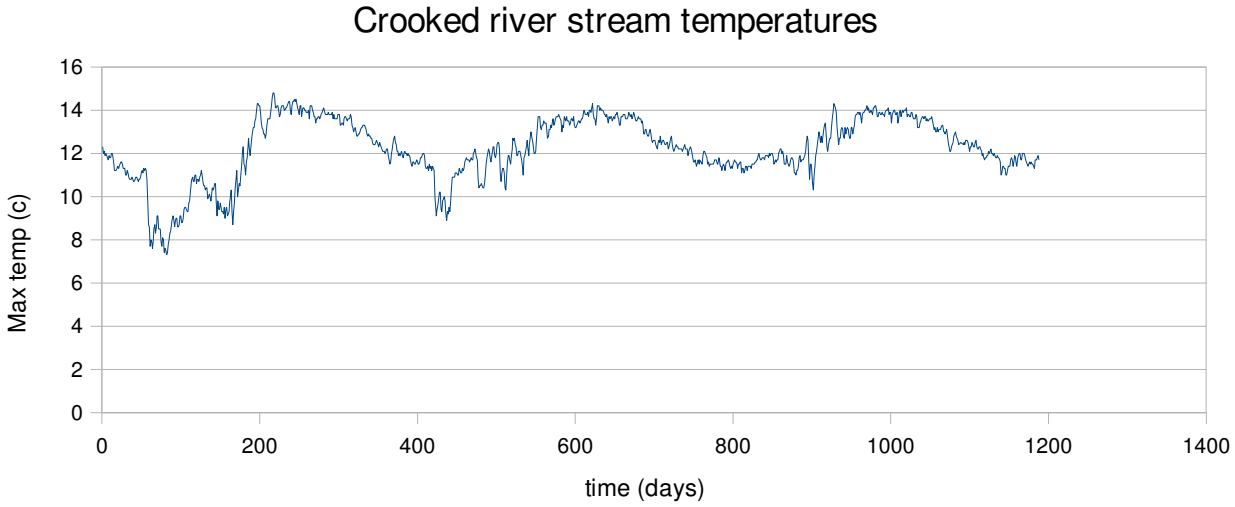


B) Exponential Data

Exampe:

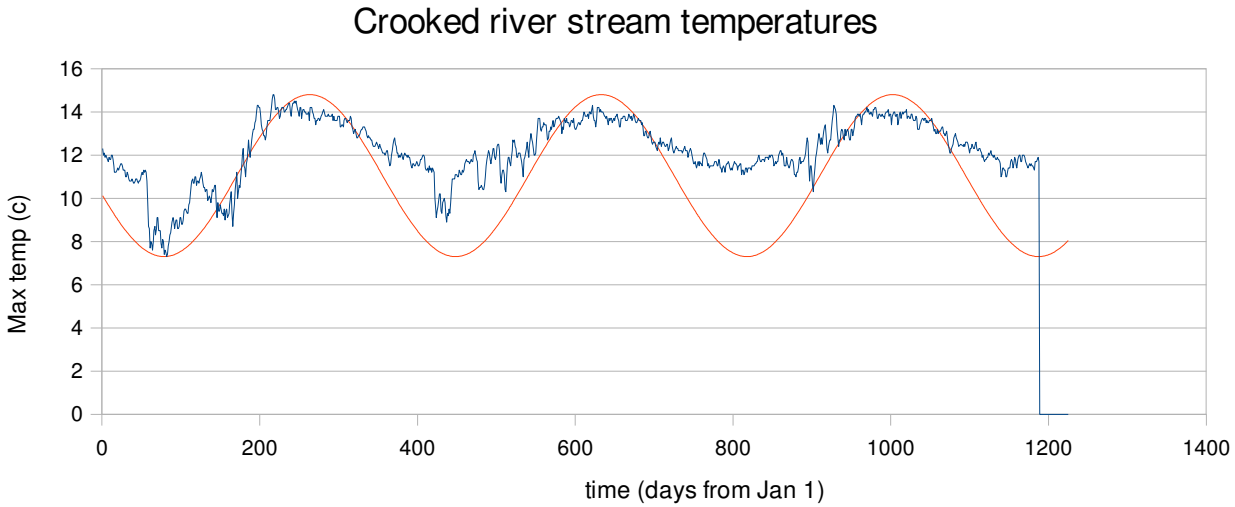
A periodic function is a function that repeats its values in regular intervals or periods. For example the sin and cos functions are periodic. Figure c shows the maximum stream temperature for Crooked river over the past three years. Is this a periodic function?

c)

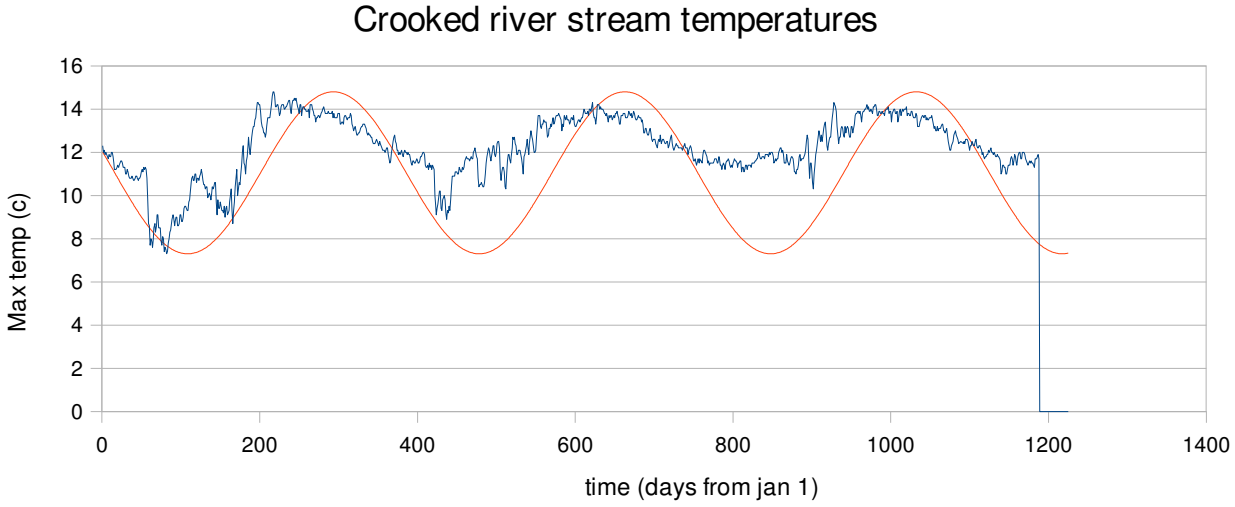


We will attempt to fit this to a sin curve using methods from 6.5:

Period=365 days so b=(2 pi/365)=.017
Amplitude (a) =(max-min)/2=(14.8-7.3)/2=3.75
midline (d) (max+min)/2=(14.8+7.3)/2=11.05
phase shift -by inspection =200

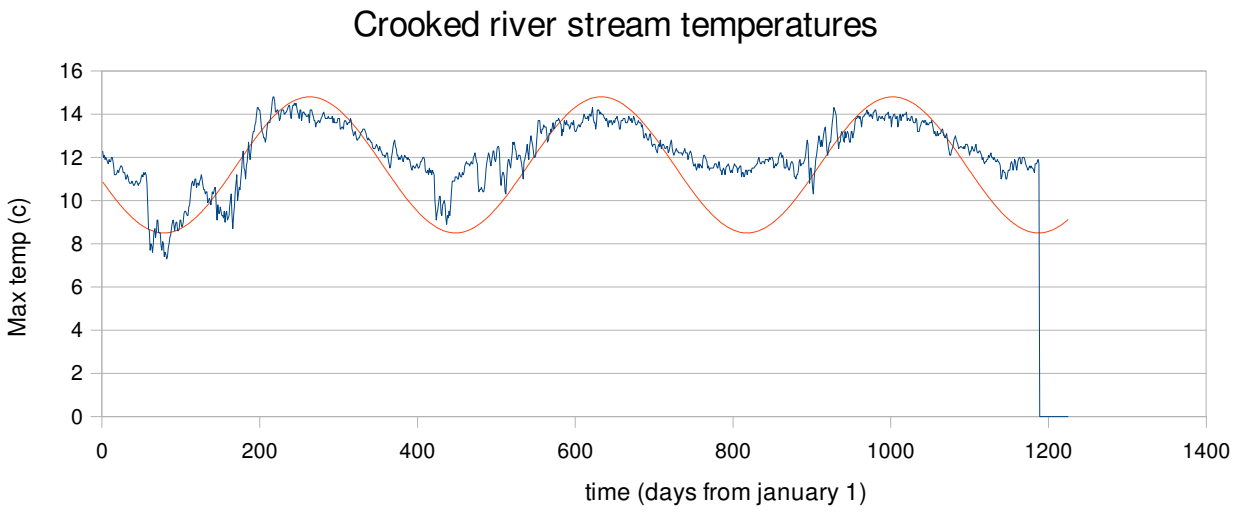


The following graph shows the function temp=a*sin(b*(x-c))+d



temp=3.75*SIn(.017*((t)-200))+11.05 (red)

temp=3.75*SIn(.017*((t)-170))+11.05 (red)



temp=3.15*SIn(.017*((t)-200))+11.65 (red)

Which of these three seems to fit the data best and why?

I would say the third graph is probably the best, although I can't prove it.

I can use this to estimate the stream temperature for Feb 2, 2009. That is 33 days from January.
temp=3.15*SIn(.017*((33-200))+11.65 =9.36 degrees celcius

Your project:

Part I.

1) find some data that is periodic, examples include temperature, precipitation, stream flow, populations, sun spots, stream temperature, etc..

2) Graph this data using microsoft excel or some other graphing utility
3) try to fit a curve using the skills from 6.5
4) Graph your curve next to the observed data
5) Use that curve to estimate either future or missing values

Part II

As you can see visually trying to estimate this sin function is kinda tricky your ti calculators have a function that optimally finds (minimizes the error between predicted and observed values) called sinreg. (a tutorial will be given on my website this weekend.)

1) Using the same data find the optimal parameters for your sin function
2) Create a graph with your estimated function, observed data, and the calculators estimated function
3) compare results

Deliverables:

The project should consist of five type written sections:

1) Introduction – explain to me what your data is and why it would be important to model this.

2) Data- Explain exactly where you got your data from, include time frames, references, locations,etc. You should either include a graph of your data points or a table:

3) Methods: Explain to me how you estimated your parameter values : include equations and formulas;
4) Results: Show me how your estimated values compared to the observed values , and predict a value

5) Conclusion: Is this model acceptable for your interest? How could the model be made better.

*Tutorials for using microsoft excel and you your ti-89 will be up this weekend.

Important dates:

Feb 9: send me an e-mail including your group, your idea, and links to the data you will be using
Feb 23: Project is due