Lab 1: Biorhythms[1]

Biorhythms were very popular in the 1960s. You can still find many web sites today that offer to prepare personalized biorhythms, or that sell software to compute them. Biorhythms are based on the notion that three sinusoidal cycles influence our lives. The physical cycle has a period of 23 days, the emotional cycle has a period of 28 days, and the intellectual cycle has a period of 33 days. For any individual, the cycles are initialized at birth, so sine functions that start on that day are used for our model. We will also assume that the amplitude for each is 100 units. The idea is that we're at our best at the peak of the curve, and at our worst on days that correspond to the valleys. The best possible days are then when the three local max's are close together (or even all equal, if possible).

Goal of the Lab

Write up a biorhythm for yourself, going from two weeks before a given date to two weeks after (so your graph covers 28 days). Just to be specific, let's set "Today's Date" to February 19, 2014.

Some Questions to Get You Started

Answer the following in LaTeX. You may use the question-answer format (instead of a narrative format), but your answers should use complete sentences, correct grammar, etc.

Once you are finished, upload the tex and PDF copies of your document to a folder labeled "Lab 1" (or `Lab01`) in your CLEo dropbox.

1. Some preliminary questions:

   (a) Assume that t is measured in days since some fixed date in the past (for example, your birthday). Write the three sine functions that would represent the "Physical", "Emotional", and "Intellectual" cycles for you since you were born.

   Hint: The sine curve $A\sin(\omega(t-\delta))$ has amplitude A, period $2\pi/\omega$, and has been shifted forward by δ units (this is the phase shift).

   (b) How many days have you been alive? (Use Maple to compute it)

   (c) Compute the date it will be when you will have been alive for 20,000 days.

2. Write Maple code that will plot your biorhythms for a four week period centered around today's date (See the help file for `TodaysDate`).

   For the $x-$axis, label it as "Date", and put some dates on the axis (Hint: Use the "tickmarks" example from the Maple sheet). Don't use too many dates- Six or so is probably plenty.

[1] Modified from Cleve Moler's "Introduction to Matlab"

3. All three cycles start at zero when you are born. How long does it take to return to that initial condition? How old were you, or will you be, on that date?

   HINT: If you had three functions that were periodic with periods 1, 2, and 3, and they all started at the same point, how long would it take for them all to return to that state? Think about "Least Common Multiple".

4. Is it possible for all three cycles to reach their maximum or minimum at exactly the same time?

   HINT: This problem is different than the previous one, because the maxima (or minima) do not START at the same time. Think about the times each curve reaches its maximum (or minimum- Same reasoning applies).

5. We should have found that we will never have the "perfect day", when all three cycles are 100. However, let's define the "nearly perfect day" to be that day when we get a maximum of the sum of the three cycles.

   Find the date of your nearly perfect day.

   HINT: The maximum is difficult for Maple to find, and cannot be found exactly. Therefore, we have to try a numerical method. The date is between $t = 16900$ and $t = 17100$. See if you can use the `Maximize` function to have Maple give you the value (go to the help file). You'll need to include: `with(Optimization):` for it to work.