ECE 111 - Homework #4

Math 129 Linear Algebra. Due Monday, September 18th
Please submit via BlackBoard

N equations & N unknowns

1) Solve for {x, y}

$$3x + 7y = 2$$
$$9x + 6y = -2$$

2) Solve for {x, y, z}

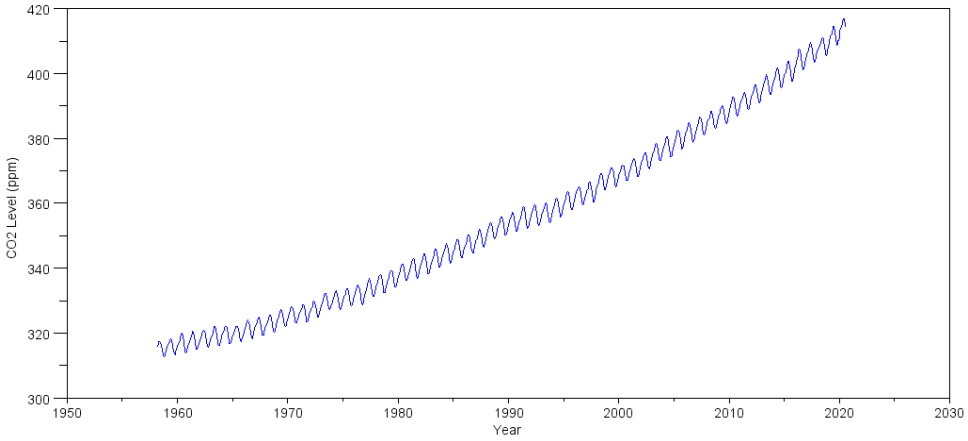
$$2x - 9y - 8z = -3$$
$$-6x - 5y + 7z = 10$$
$$5x - 9y = -9$$

3) Solve for {a, b, c, d}

$$a - 6b + 5c + 4d = 10$$
$$-2a + 6b - 6d = -3$$
$$6a - b - 4c - 7d = 2$$
$$6a + 3b + 4d = -5$$

Global CO2 Levels

The CO2 levels measured at Mauna Loa observatory for the past 52 years are:



https://gml.noaa.gov/webdata/ccgg/trends/co2/co2_mm_mlo.txt
http://www.bisonacademy.com/ECE111/Code/CO2%20Levels.txt

Problem 4) Determine a parabolic curve fit for this data in the form of

$$CO_2 \approx ay^2 + by + c$$

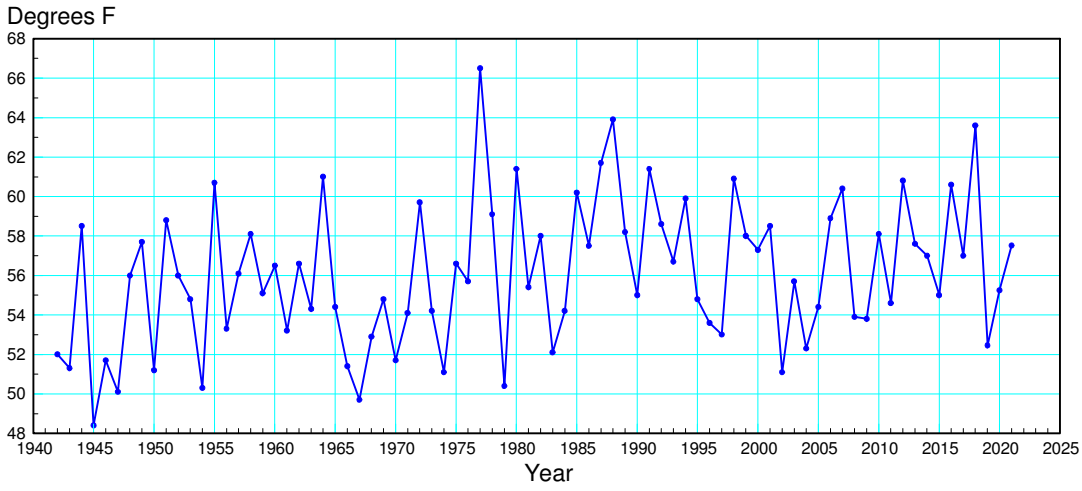
where 'y' is the year. From this data, when do you predict that we will hit

- 400ppm?
- 2000 ppm of CO2? (the same as what was observed during the Permian extinction)

Note: Column #3 of the data set is year, #4 is CO2

```
year = DATA(:,3);
CO2 = DATA(:,4);
```

Fargo Temperatures



Average temperatre in Fargo
http://www.bisonacademy.com/ECE111/Code/Fargo_Weather_Monthly_Avg.txt

note: Column #1 of the data set is year, column #4 is average temeperature of March in degrees F

```
year = DATA(:,1);
F = DATA(:,4);
```

5) Using the average temperature in Fargo from 1942 to 2022:

5a) Determine a curve fit of the form of $T = ay + b$

5b) How much has Fargo warmed up over the past 80 years?

```
>> 80 * A(1)

ans =  4.1847e+000
```

March is 4.18F warmer today than 80 years ago

5c) What will the average temperature in Fargo be in May in the year 2050?

```
>> y = 2050;
>> [y, 1] * A

  2.9610e+001
```

In the year 2050, the average temperature in March should be 29.61F

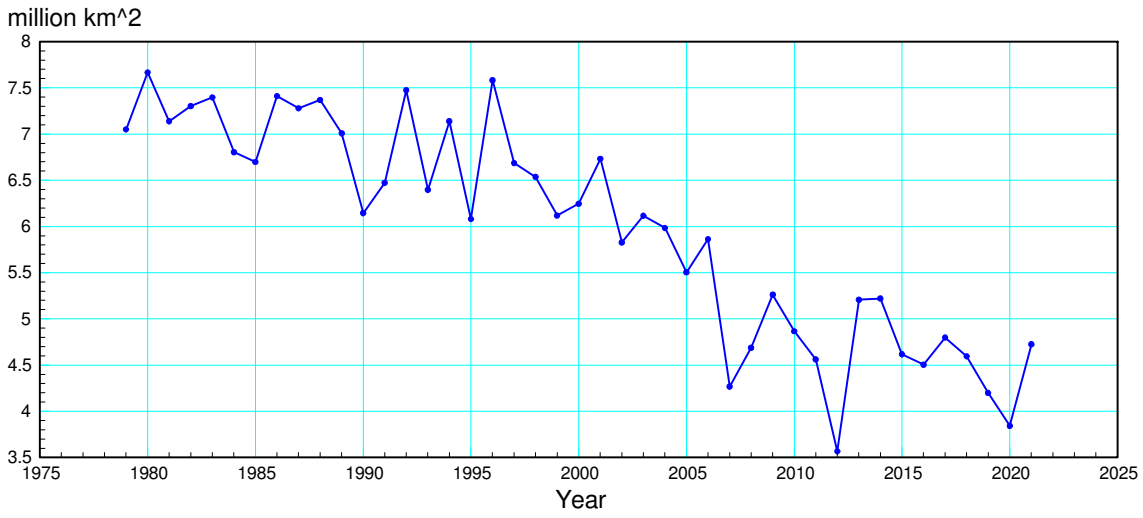
- vs. 17.38F in 2023

Problem 6-7) Sea Ice: The area covered by sea ice is recored by the National Snow and Ice Data Center:

6) Approximate this data from the years 1979 - 2022 with a line

$$Area \approx ay + b$$

From this curve fit, when do you expect the Arctic to be ice free? (First time in 5 million years)



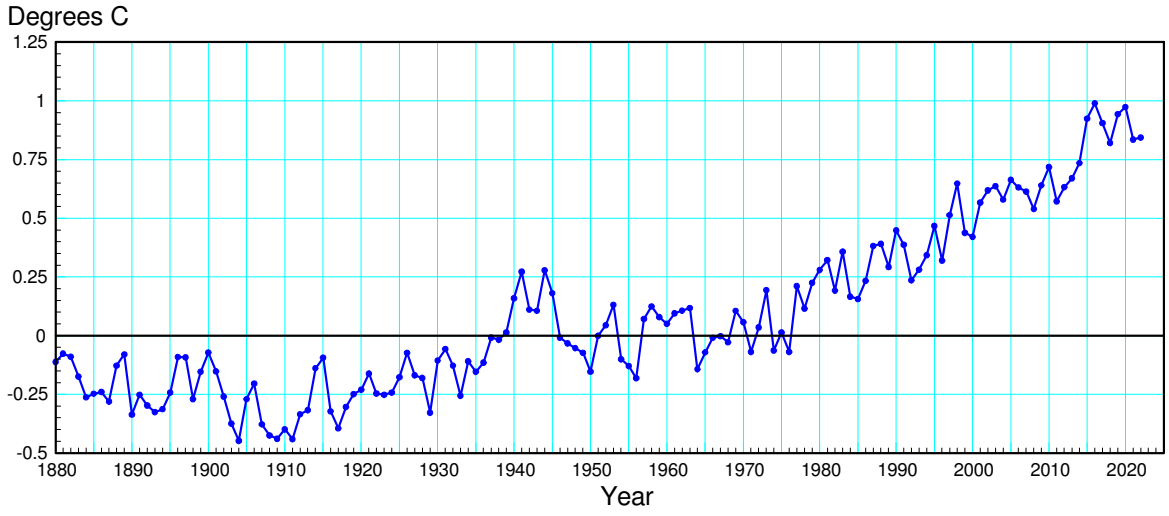
7) Approximate this data with a parabolic curve fit:

$$Area \approx ay^2 + by + c$$

From this curve fit, when do you expect the Arctic to be ice free?

```
>> B = [year.^2, year, year.^0];
```

Problem 8-9: World Temperatures. NASA Goddard has been keep records since 1880 (139 years of data).



8) Determine a least-squares curve fit for this data from the year 1880 - 1930 in the form of

$$\delta T = ay + b$$

Based upon this data, what *should* the temperature deviation be in the year 2023?

9) Determine a least-squares curve fit for this data from the year 1980 - 2022 in the form of

$$\delta T \approx ay^2 + by + c$$

Based upon this data, predict when we will see a 10 degree temperature increase if nothing changes?

10) What does a temperature rise of 10 degrees mean for the planet?