

ECE 111 - Homework #4

Math 129 Linear Algebra. Due Monday, February 5th
Please submit via BlackBoard

N equations & N unknowns

1) Solve for $\{x, y\}$

$$-14x + 5y = -2$$

$$-2x + 14y = 3$$

2) Solve for $\{x, y, z\}$

$$2x + 7y + 2z = 1$$

$$16x + 8y - 12z = 7$$

$$-8x - 2y - 11z = 26$$

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

$$-7a - 4b + c + 5d = -21$$

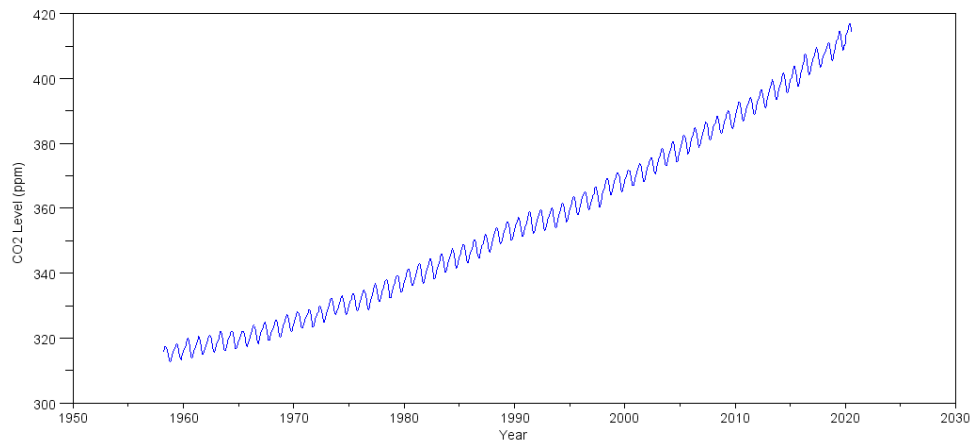
$$2a - 18b - 5c + 7d = -8$$

$$-a + 8b + 3c + 17d = 14$$

$$19a + 9b + 6c + 2d = 11$$

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

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

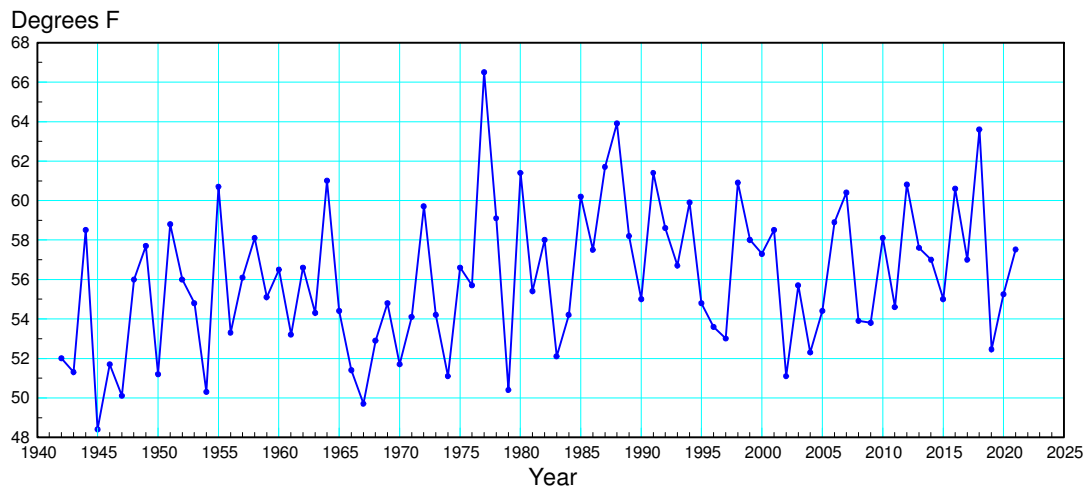
where 'y' is the year. From this data, when do you predict that we will hit

- 500ppm?
- 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 #7 is average temeprature of June in degrees F

```
year = DATA(:, 1);  
F = DATA(:, 7);
```

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?

5c) What will the average temperature in Fargo be in June

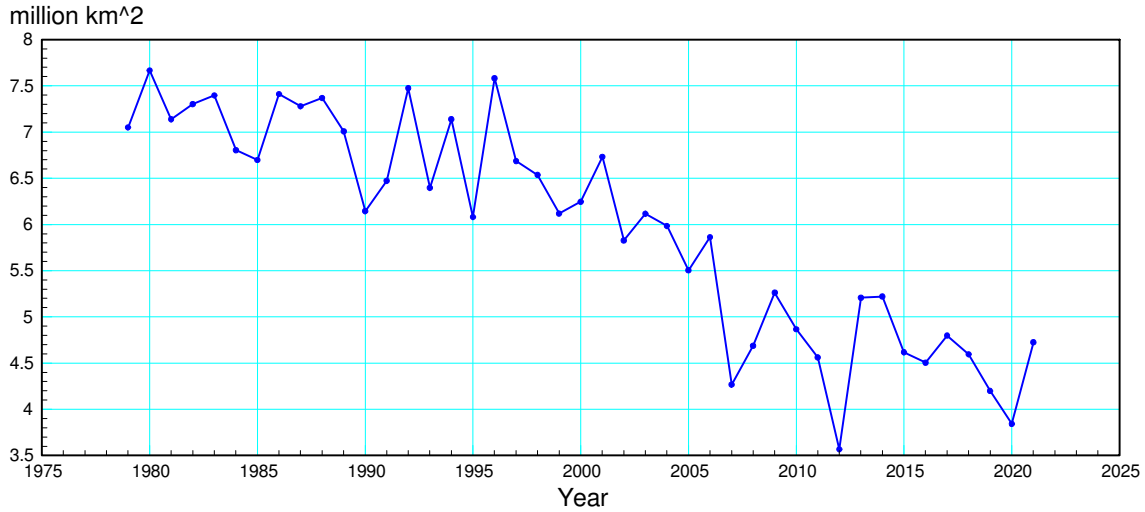
- In the year 2050?
- In the year 2100?

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)



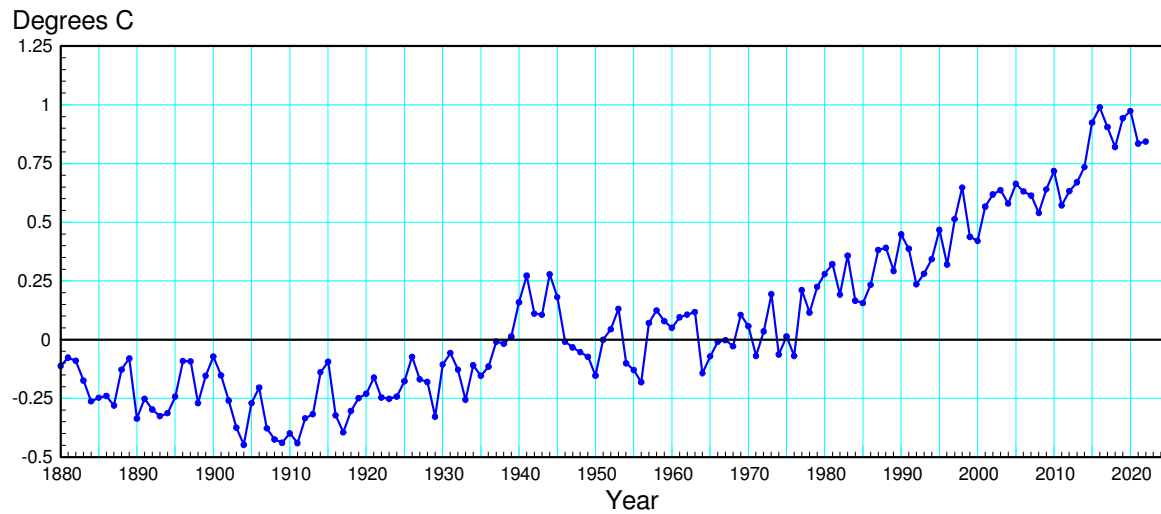
7) Approximate this data with a parabolic curve fit:

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

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 - 1910 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 1970 - 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?