

ECE 111 - Make-Up Homework #4

Week #4: Math 129 Linear Algebra - Due Friday, December 12th.

N equations & N unknowns

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

$$7x + 6y = 2$$

$$3x + 5y = 5$$

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

$$4x + 2y - 2z = -6$$

$$3x - 5y + 6z = 2$$

$$2x - 3y - 0z = 9$$

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

$$-2a - 3b + 2c + 5d = -5$$

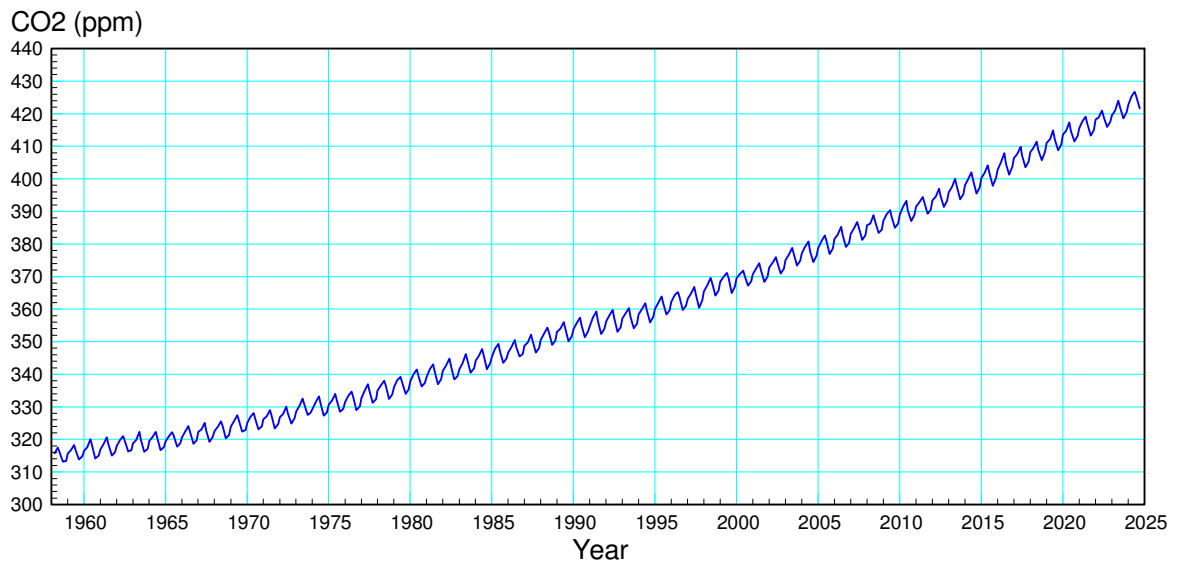
$$7a - 2b + 5c + 3d = 7$$

$$-5a + 2b - 3c = 1$$

$$3b + 2c + 8d = 5$$

Global CO2 Levels

The CO2 levels measured at Mauna Loa observatory for the past 56 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

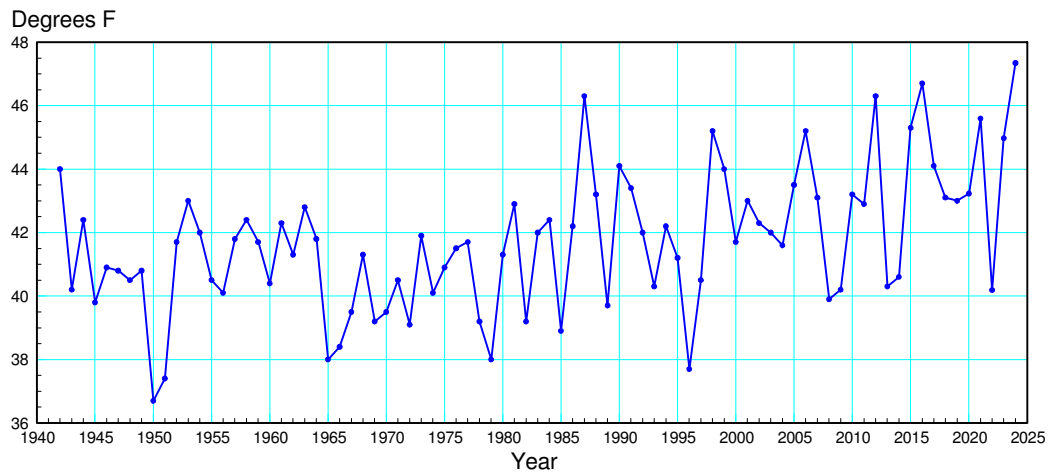
$$CO_2 \approx ay^2 + by + c$$

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

- 400ppm?
- 800ppm?
- 1200 ppm?
- Note: Column #3 of the data set is year, #4 is CO2

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

Fargo Temperatures



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

note: Column #1 of the data set is year, column #14 is yearly average temperature in degrees F

```
year = DATA(:,1);  
T = DATA(:,14);
```

5) Using the average temperature in Fargo from 1942 to 2024:

5a) Determine a curve fit of the form of $T = ay^2 + by + c$

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

5c) What will the average temperature in Fargo be

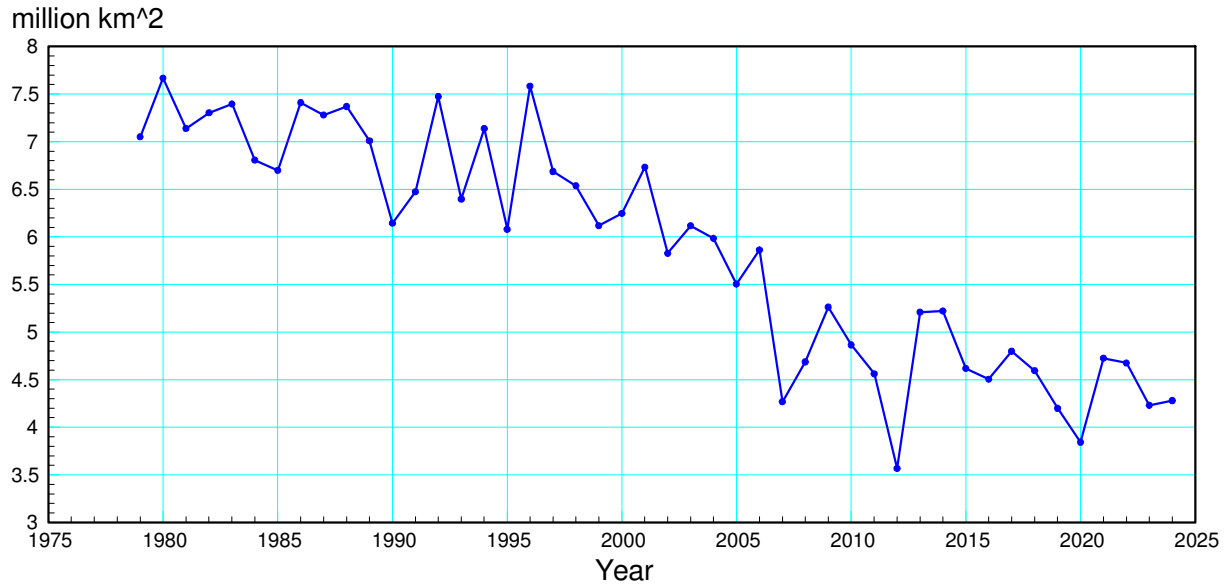
- In the year 2045? (20 years from now)
- In the year 2075? (50 years from now)

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 - 2024 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)



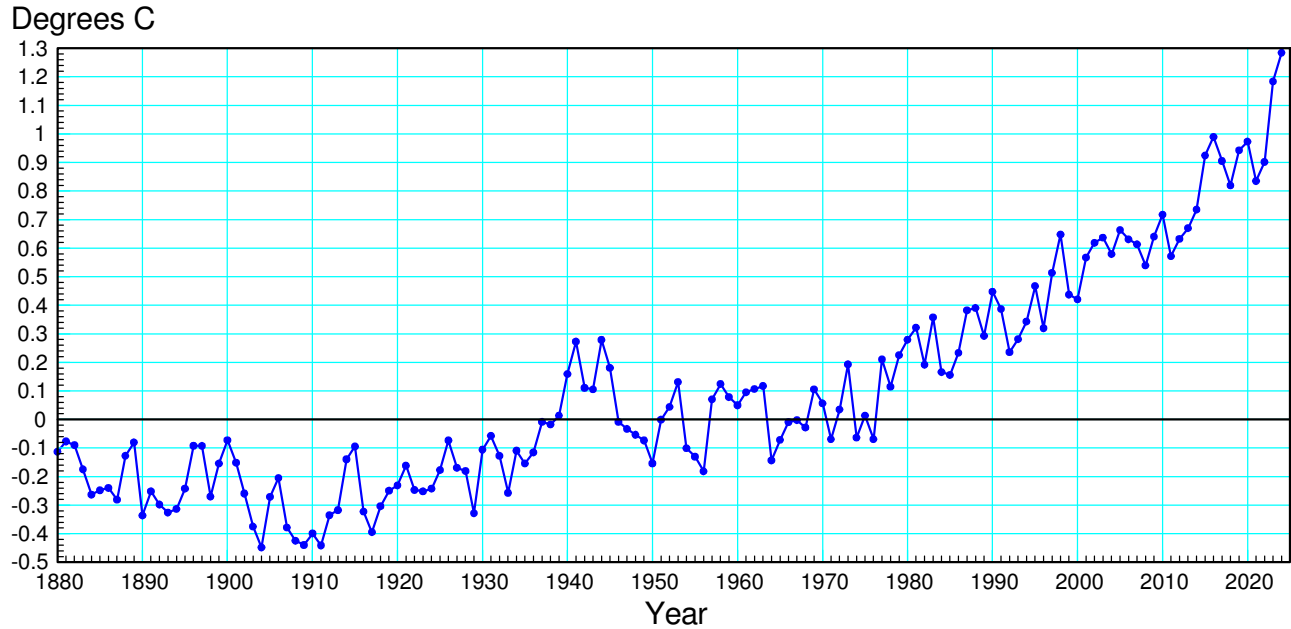
7) Approximate this data with a parabolic curve fit:

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

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 (144 years of data).



8) Determine a least-squares curve fit for this data from the year 1970 - 2024 in the form of

$$\delta T = ay + b$$

Based upon this data, what will the temperature be in the year

- 2045? (20 years from now)
- 2075? (50 years from now)

When will we reach +6 degrees C?

9) Determine a least-squares curve fit for this data from the year 1880 - 2024 in the form of

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

Based upon this data, what will the temperature be in the year

- 2045? (20 years from now)
- 2075? (50 years from now)

When will we reach +6 degrees C?

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