ECE 111 - Homework #4

Math 129 Linear Algebra.   Make-Up Homework Sets for Fall 2024

N equations & N unknowns

1) Solve for {x, y}

$$4x - 4y = 3$$
$$5x + 4y = -7$$

2) Solve for {x, y, z}

$$8x + 3y - 5z = 4$$
$$0x + 2y - 5z = 8$$
$$9x - 6y - 0z = 9$$

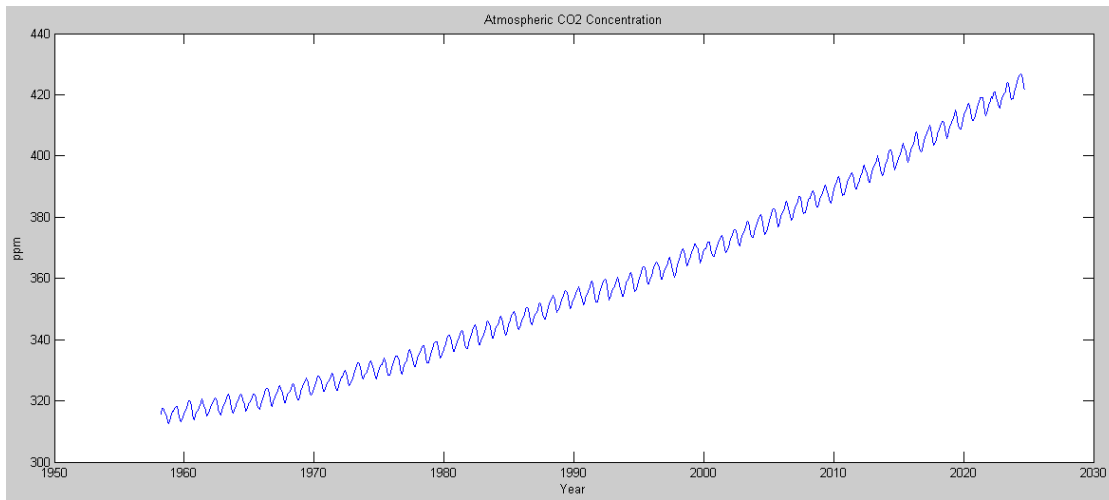3) Solve for {a, b, c, d}

$$1a + 7b + 9c + 2d = 2$$
$$7a + 5b + 3c + d = -1$$
$$7a - 6b + 6c + 3d = -8$$
$$5a + 5b + 5c - 7d = 4$$

Global CO2 Levels

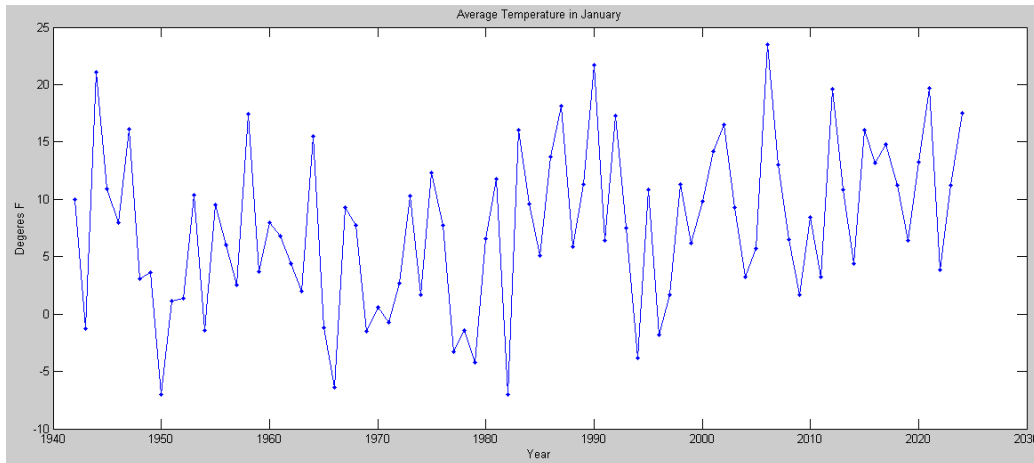The CO2 levels measured at Mauna Loa observatory for the past 52 years are:

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

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

Fargo Temperatures

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

note: Column #1 of the data set is year, column #2 is average temeperature of January in degrees F

```
year = DATA(:,1);
F = DATA(:,2);
```

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?

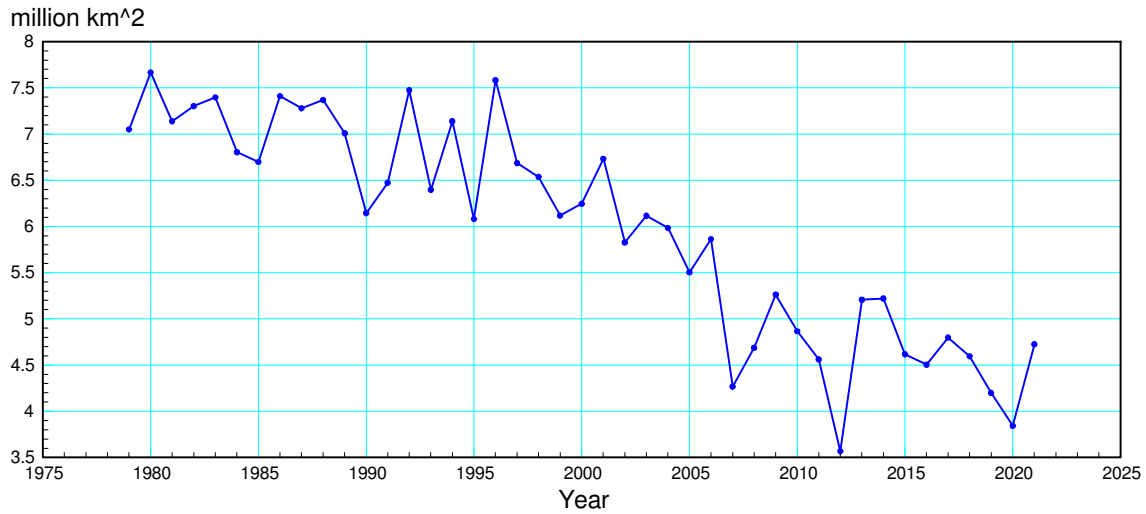5c) What will the average temperature in Fargo be in January
- In the year 2050?
- In the year 2100?

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 - 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)
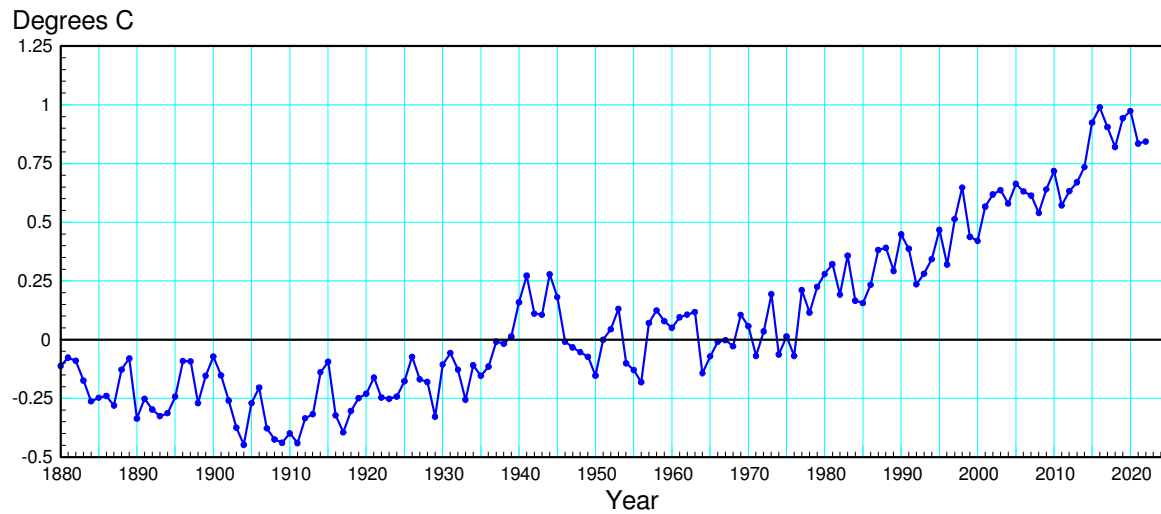

million km^2

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 1880 - 1923 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 1880 - 2023 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?