# ECE 111 - Homework #3

Week #3: Linear Algebra.   Due Tuesday, January 31st
Please submit as a hard copy or submit on BlackBoard

## N equations & N unknowns

1) Solve for {x, y}

$$7x + 4y = 5$$
$$9x + 6y = -2$$
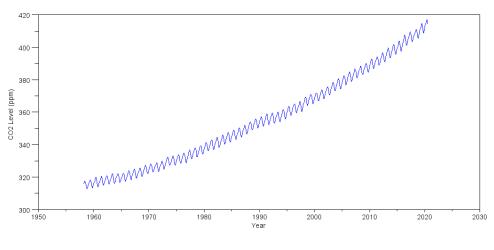
2) Solve for {x, y, z}

$$4x - 9y - 8z = -3$$
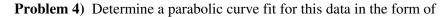$$-6x - 4y + 7z = 10$$
$$5x - 9y + 4z = -9$$

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

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

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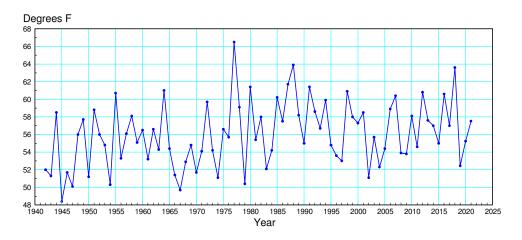
$$CO_2 \approx ay^2 + by + c$$

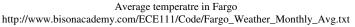where 'y' is the year.  From this data, when do you predict that we will hit

- 400ppm?
- 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
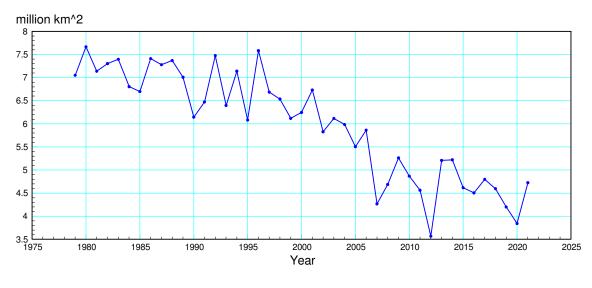http://www.bisonacademy.com/ECE111/Code/Fargo_Weather_Monthly_Avg.txt

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

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

5) Using the average temperature in Fargo,

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 May in the year 2050?


**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)
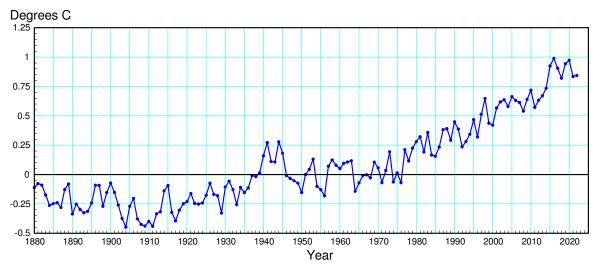

7)  Approximate this data with a parabolic curve fit:

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

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

**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 2022?

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?