

ECE 111 - Homework #4

Week #4: Math 129 Linear Algebra

N equations & N unknowns

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

$$13x + 4y = 13$$

$$15x + 11y = 6$$

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

$$4x + 7y + 8z = 1$$

$$7x + 2y + 8z = -2$$

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

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

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

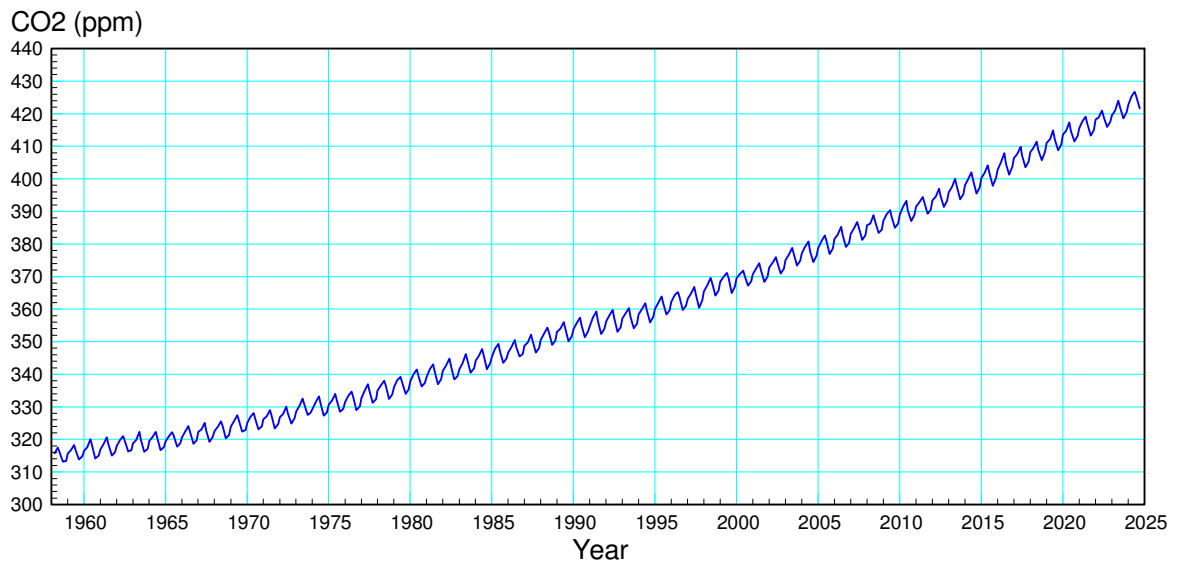
$$9b - 5c + d = 5$$

$$-3a - 3b - 8d = -9$$

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

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

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

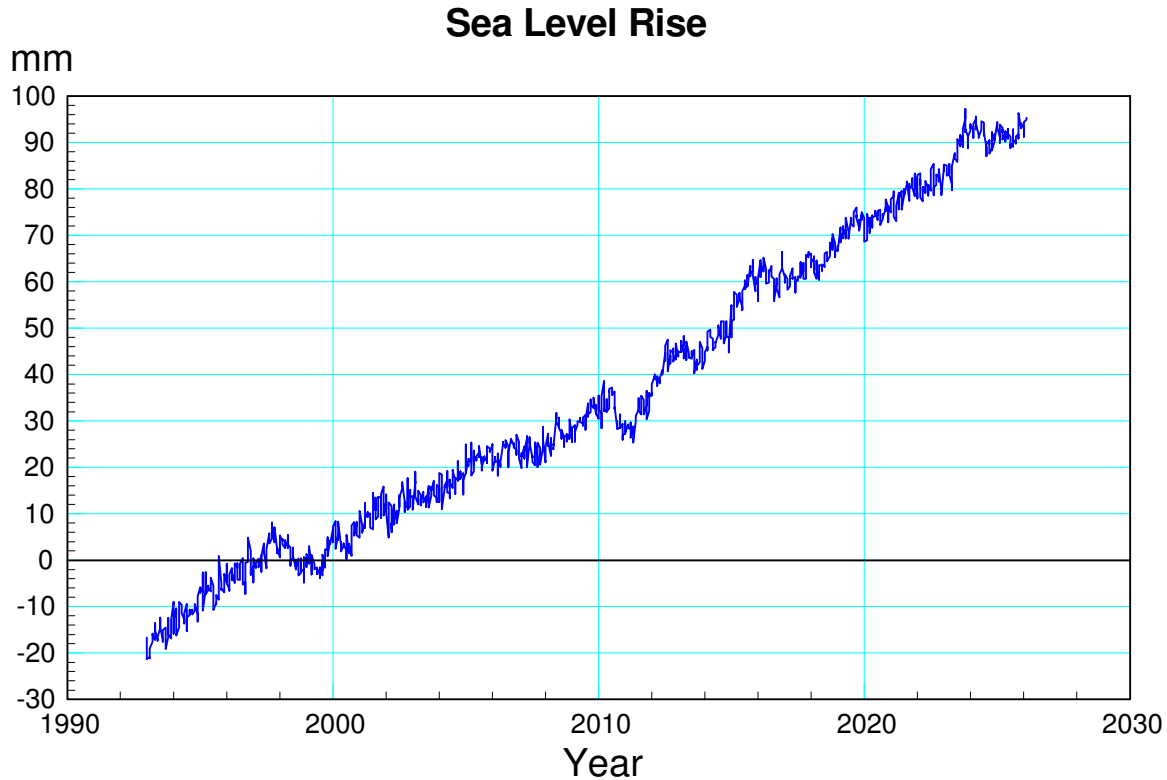
where 'y' is the year. From this data, when do you predict that we will hit

- 350ppm?
- 450ppm?
- 550 ppm?
- Note: Column #3 of the data set is year, #4 is CO2

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year = DATA(:, 3);
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CO2 = DATA(:, 4);
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Sea Level



One indication of a warming planet is a rise in ocean levels. The coefficient of expansion of water is $0.000214 / ^\circ C$ - meaning that as the oceans warm up, you should see sea levels rising.

5) Using the change in global sea levels since 1992 to present:

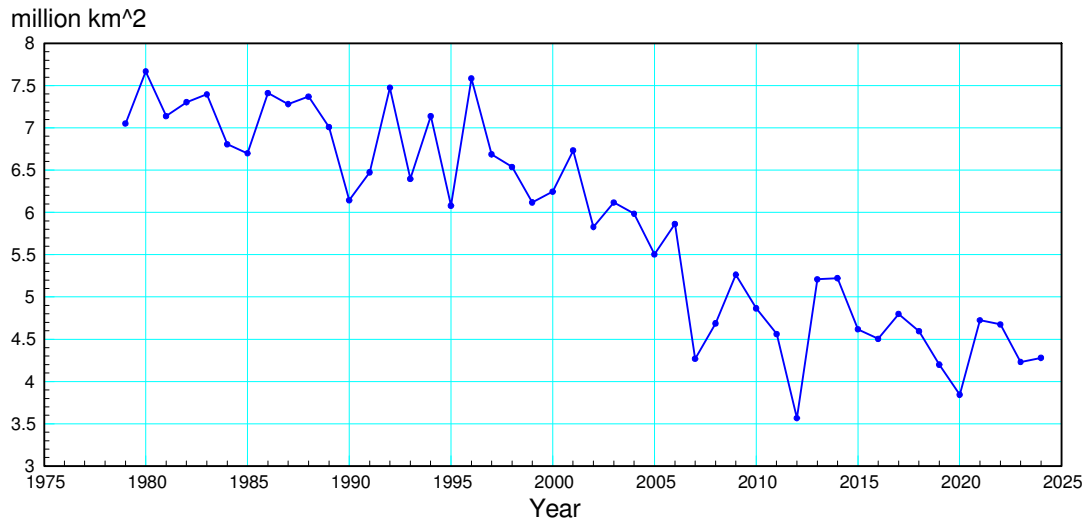
5a) Determine a curve fit of the form of $mm = ay + b$

5b) What will global sea levels be

- In the year 2050? (24 years from now)
- In the year 2080? (50 years from now)

5c) The average elevation of Miami, FL is 1.0 meters above sea level at high tide. How long will it take for sea levels to rise 1.0 meters?

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 - present with a line

$$Area \approx ay + b$$

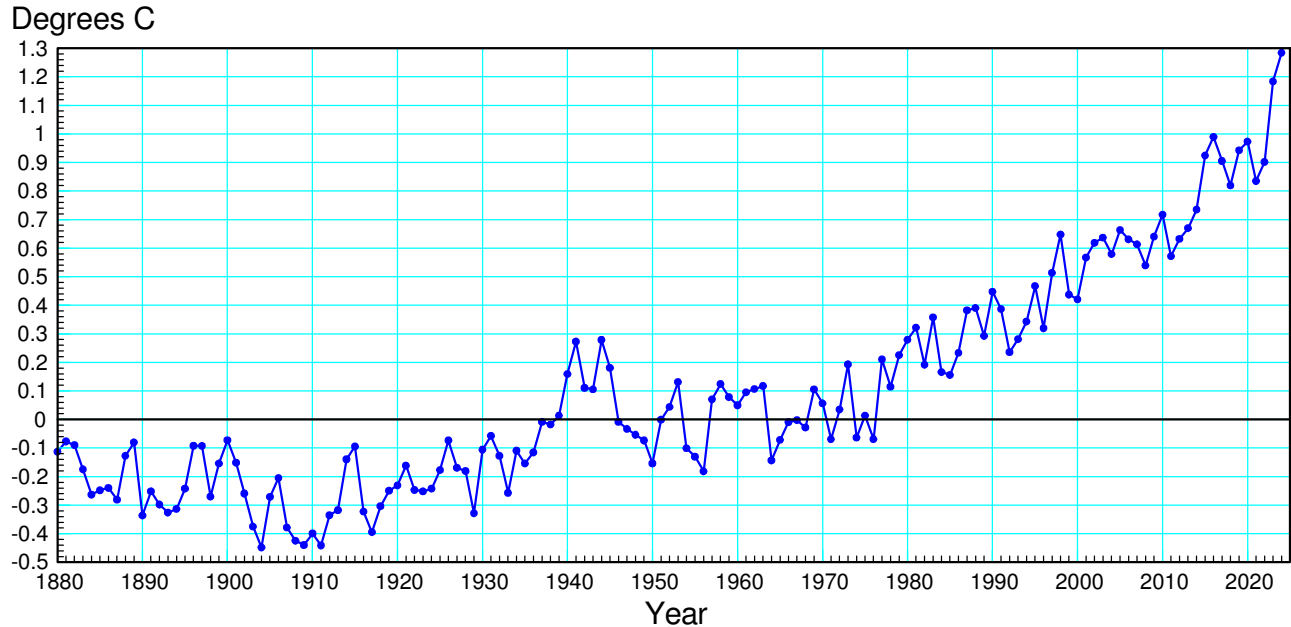
From this curve fit, when do you expect the Arctic to be ice free? (First time in 5 million years)

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 (144 years of data).



8) Determine a least-squares curve fit for this data from the year 1960 - resent in the form of

$$\delta T = ay + b$$

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

- 2050? (24 years from now)
- 2080? (50 years from now)

When will we reach +6 degrees C?

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

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

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

- 2050? (24 years from now)
- 2080? (50 years from now)

When will we reach +6 degrees C?

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