

3.3 – Fitting a Line to Data

Objectives:

1. Find a line of fit for data that are approximately linear.
2. Learn and use point-slope form of a line.
3. Use interpolation and extrapolation.
4. Learn the properties of a line of fit.

Point-Slope Form: The formula for slope is $m = \frac{y_2 - y_1}{x_2 - x_1}$, so you can write the equation of

a line with slope m and containing point (x_1, y_1) for any general point (x, y) as $m = \frac{y - y_1}{x - x_1}$ or, equivalently as $y = y_1 + m(x - x_1)$.

This is called the point-slope form for a linear equation.

Example 1: Write the equations for the lines below in point-slope form:

a. $(8, 10)$; slope = -2

$$y = y_1 + m(x - x_1)$$

$$y = 10 - 2(x - 8)$$

b. $(-3, 1)$; slope = 4

$$y = y_1 + m(x - x_1)$$

$$y = 1 + 4(x - (-3))$$

$$y = 1 + 4(x + 3)$$

Example 2: Find the point-slope form for the equation for the line through the points $(12, 6)$ and $(36, -3)$.

$$m = \frac{6 - (-3)}{12 - 36}$$

$$m = \frac{9}{-24}$$

$$m = -\frac{3}{8}$$

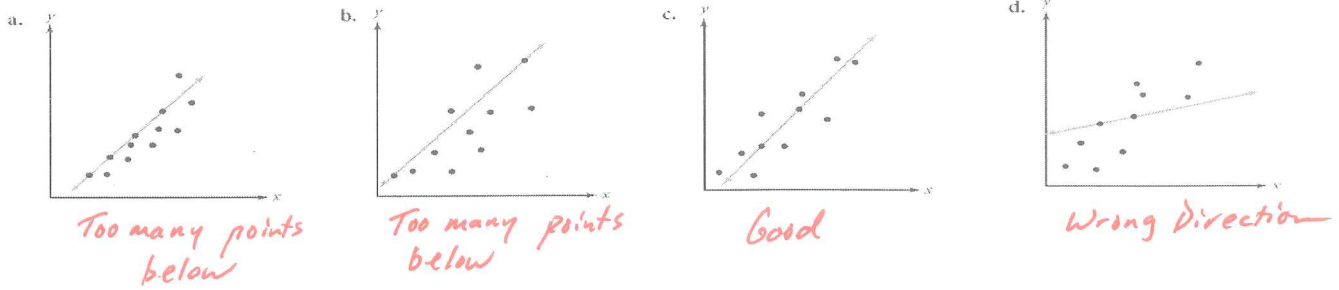
$$y = y_1 + m(x - x_1)$$

$$y = 6 - \frac{3}{8}(x - 12) \quad \text{or} \quad y = -3 - \frac{3}{8}(x - 36)$$

Lines of Best Fit Guidelines:

1. Line must follow the same general direction as the points
2. Line should divide points approximately in half.

Example 3: For each graph below, tell whether or not you think the line drawn is a good representation of the data. **Explain your reasoning.**



Example 4: On a barren lava field on top of the Mauna Loa Volcano in Hawaii, scientists have been monitoring the concentration of CO₂ in the atmosphere since 1959. This site is favorable because it is relatively isolated from vegetation and human activities that produce CO₂. The average concentrations for 13 different years, measured in parts per million (ppm), are shown below:

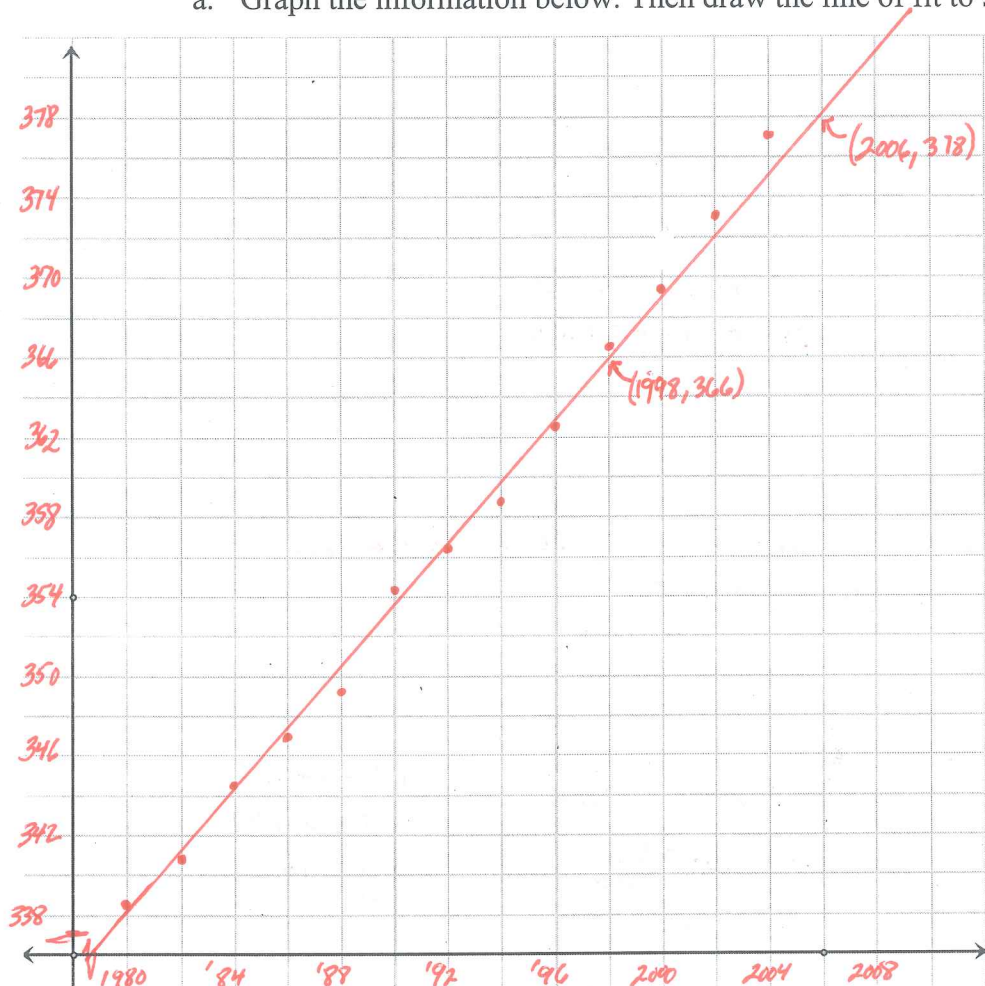
Year	CO ₂ (ppm)	Year	CO ₂ (ppm)
1980	338.69	1990	354.21
1982	341.13	1992	356.37
1984	344.42	1994	358.88
1986	347.15	1996	362.64
1988	351.48	1998	366.63

Year	CO ₂ (ppm)
2000	369.48
2002	373.10
2004	377.38

(Carbon Dioxide Information Analysis Center)

Points used to find equation of best fit line should be from your line - not your table!

a. Graph the information below. Then draw the line of fit to summarize the data.



b. What is the equation of your line of fit.

$$\begin{aligned}
 & (1998, 366) \quad (2006, 378) \\
 m &= \frac{378 - 366}{2006 - 1998} = \frac{12}{8} = \frac{3}{2} \\
 y &= 378 + \frac{3}{2}(x - 2006)
 \end{aligned}$$

c. Predict the concentration of CO₂ in the atmosphere in the year 2050.

$$\begin{aligned}
 y &= 378 + \frac{3}{2}(2050 - 2006) \\
 &= 378 + \frac{3}{2}(44) \\
 &= 378 + 66 \\
 y &= 444 \text{ ppm}
 \end{aligned}$$