

Chapter 4 Project *Fitting a Model to Data*

In this project, you will find and use models relating to the carbon dioxide level of the earth's atmosphere.

Since 1974, the Mauna Loa Climate Observatory in Hawaii has been collecting data on the carbon dioxide level of Earth's atmosphere. The table shows the average monthly readings for January of each year from 1975 through 2006. The readings measure the carbon dioxide concentration in parts per million. (Source: National Oceanic Atmospheric Administration, Climate Monitoring and Diagnostic Laboratory, CarbonCycle-Greenhouse Gases)

1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
330.7	331.7	332.7	335.1	336.2	337.8	339.4	340.9	341.4	343.9	345.1	346.4	348.2

1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
350.2	352.7	353.6	354.9	356.1	356.8	358.0	359.7	361.8	362.8	365.0	367.9	369.0

2001	2002	2003	2004	2005	2006
370.5	372.4	374.9	377.0	378.4	381.4

- Use a graphing utility to create a scatter plot of the data where x represents the year, with $x = 5$ corresponding to 1975. Does the data appear to be modeled best with a linear, quadratic, or exponential model?
- Use the *regression* feature of a graphing utility to find a model for the data using the type of model you chose in part (a).

Questions for Further Exploration

- The data in the table represents the average carbon dioxide levels for January of each year. Throughout each year, the level oscillated as follows.
 - In April, the average reading was about 2.5 parts per million higher than the average reading given by the model in part (b) above.
 - In July, the average reading was the same as the average reading given by the model in part (b) above.
 - In October, the average reading was about 2.5 parts per million lower than the average reading given by the model in part (b) above.

Use a sine function to rewrite the model found in part (b) above so that the model incorporates the described oscillations.

- Use a graphing utility to graph the revised model.
- Make a careful sketch of the model for the year 2006. What physical factors on Earth would contribute to the oscillation in the carbon dioxide level during the year?
- Is the model you found periodic? Explain your reasoning.
- Use the model to estimate the level of carbon dioxide in Earth's atmosphere in the following years.
 - 2010
 - 2020
 - 2030