Abandoned Cars

Note: Parts a and b go with Section 2.4 of Calculus with Applications. Part c goes with Section 4.1, and Part d goes with Section 5.3

The number of abandoned cars in New York City has dropped in recent years because of reduced auto theft and increasing scrap metal prices.* The following table, based upon estimates from a graph in *The New York Times,* gives the number of abandoned cars as a function of the year.

Year	abandoned cars (1000's)
1986	82
1987	120
1988	140
1989	148
1990	135
1991	95
1992	75
1993	51
1994	38
1995	27
1996	20

a. Using a graphing calculator, plot the points in the table, using 86 for 1986, and so on.

b. If your graphing calculator has a cubic and quartic regression feature, find the third- and fourth-degree polynomials that best fit the data according to the least squares method. Plot these polynomials on the same calculator window as the data. (On a TI-83 calculator, press the STAT key, and then select the CALC menu. `CubicReg` and `QuartReg` are items 6 and 7. The command `CubicReg` $\texttt{L}_1\texttt{,L}_2\texttt{,Y}_1$ finds the third-degree least squares polynomial for the data in lists $\texttt{L}_1$ and $\texttt{L}_2$ and stores the polynomial in the function $\texttt{Y}_1$.)

c. Your graph from part b should show that the third-degree polynomial fits the data almost as well as the fourth-degree polynomial. We will use the third-degree polynomial because it is simpler than the fourth-degree polynomial. Therefore, the number of abandoned autos (in thousands) in the year x is approximately given by

$$y = .779526x^3 - 214.909x^2 + 19722.4x - 602405.$$

* *The New York Times,* Feb. 15, 1997, p. 25.

Using this function, find the instantaneous rate that abandoned cars were decreasing in 1991 ($x = 91$). Compare this with the average rate of decrease between 1990 and 1991 based on the actual data, and between 1991 and 1992.
d. After decreasing rapidly for several years, the rate of decrease began to slow down. Use the second derivative of the function in part c to find in what year this occurred.

Answers can be found on the next page.

Answers to **Abandoned Cars**

b. $y = .779526x^3 - 214.909x^2 + 19722.4x - 602405$, $y = -.037005x^4 + 14.2492x^3 - 2052.60x^2 + 131097x - 3132340$

c. 25,000 cars per year, 40,000 cars per year, 20,000 cars per year

d. 1992