Fuel Economy The table shows the average fuel economies y (in miles per gallon) for cars from 1998 to 2017, based on adjusted laboratory results for combined city and highway driving. (*Source:* United States Environmental Protection Agency)

DATA

Spreadsheet at LarsonPrecalculus.com

Year	Fuel economy, y
1998	23.4
1999	23.0
2000	22.9
2001	23.0
2002	23.1
2003	23.3
2004	23.1
2005	23.5
2006	23.3
2007	24.1
2008	24.3
2009	25.3
2010	26.2
2011	25.8
2012	27.6
2013	28.4
2014	28.4
2015	29.0
2016	29.2
2017	30.0

(a) Use a graphing utility to plot the data. Let x represent the year, with $x = 8$ corresponding to 1998. What type of model do you think would fit the data well?

(b) Set up and solve a system of the form below to find a least squares regression parabola $y = ax^2 + bx + c$ for the data. Let $x = 8$ correspond to 1998, and note that there are $n = 20$ data entries.

$$\begin{cases} nc + \left(\sum_{i=1}^{n} x_i\right)b + \left(\sum_{i=1}^{n} x_i^2\right)a = \sum_{i=1}^{n} y_i \\ \left(\sum_{i=1}^{n} x_i\right)c + \left(\sum_{i=1}^{n} x_i^2\right)b + \left(\sum_{i=1}^{n} x_i^3\right)a = \sum_{i=1}^{n} x_i y_i \\ \left(\sum_{i=1}^{n} x_i^2\right)c + \left(\sum_{i=1}^{n} x_i^3\right)b + \left(\sum_{i=1}^{n} x_i^4\right)a = \sum_{i=1}^{n} x_i^2 y_i \end{cases}$$

(c) Use the graphing utility to graph the least squares regression parabola from part (b) and the original data in the same viewing window. How well does the model fit the data? Explain your reasoning.

(d) Use the *regression* feature of the graphing utility to find a quadratic model for the data. How does the model given by the graphing utility compare with the model you found in part (b)?

(e) An analyst projects that the adjusted combined fuel economy for cars in 2025 will be 46 miles per gallon. Is this projection reasonable? Explain.

(f) Do you think a different type of model would be a better fit for the data? If so, use the *regression* feature of the graphing utility to find another model for the data.