Sometimes the scattergram of a set of data seems to follow the shape of a parabola. In this case a quadratic model might be a good option, better than linear or some other curve. Here, we will look at an example for which a quadratic model is the best choice. The goal is to model a set of data with a quadratic function of the form \( f(x) = ax^2 + bx + c \).

**Task 1. Making the Scattergram**

The following table gives the number of fatal accidents per 100 million miles driven for drivers of various ages.

<table>
<thead>
<tr>
<th>Age of Driver</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>25</th>
<th>35</th>
<th>55</th>
<th>65</th>
<th>75</th>
<th>79</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Accidents per 100 million miles</td>
<td>18</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

Let \( n = f(t) \) represent the number of accidents per 100 million miles at age \( t \) years. We are looking for a function of the form

\[ f(t) = at^2 + bt + c \]

(a) Use a graphing calculator to make a scattergram. Sketch it here. Be sure to label the axes.

(b) Explain why a quadratic model seems to fit the data.
Task 2. Finding the Quadratic Regression Model

(a) Choose three points among the data that appear to lie closest to the best-fit parabola. Then substitute into the generic function \( f(t) = at^2 + bt + c \) to create a system of three equations in the three unknowns \( a, b, \) and \( c \).

(b) Solve the system you created in part (a).

(c) Using the values of \( a, b, \) and \( c \) you found in part (b), write the function here. Graph this with your calculator by entering the equation as \( Y_1 \) in the "Y=" menu, together with the original scattergram. How well does it fit?
(d) Now use your calculator for the best-fit model. Select Quadratic Regression in the CALC sub-menu of the STAT menu as follows. Go to STAT, CALC, and select 5. QuadReg. Type \(L_1, L_2, Y_2\) and press ENTER. If you did this correctly, it will already be placed in the "Y=" editor as \(Y_2\). Write your function for the quadratic regression below.

**Task3.** Using the model to make predictions.

(a) Use the model to estimate the number of fatal accidents per 100 million miles for 30-year olds.

(b) Suppose you worked for an insurance company that would not insure anyone in an age group whose accident rate was more than 9 accidents per 100 million miles. Your task, as the mathematical expert at the company, is to determine what are the age groups that the company will insure.

(c) Use the graph of \(n = f(t)\) and the methods we have developed to solve an equation graphically to solve the equation \(f(t) = 9\). Use a graphing calculator and TRACE. Then demonstrate this on your graph and write your conclusions here.