

## 5.8 Quadratic Regression

- 1.) **PUMPKIN TOSSING** A pumpkin tossing contest is held each year in Morton, Illinois, where people compete to see whose catapult will send pumpkins the farthest. One catapult launches pumpkins from 25 feet above the ground at a speed of 125 feet per second. The table shows the horizontal distances (in feet) the pumpkins travel when launched at different angles. Use a graphing calculator to find the best-fitting quadratic model for the data.



<b>Angle (degrees)</b>	20	30	40	50	60	70
<b>Distance (feet)</b>	372	462	509	501	437	323

**Step 1:** Enter the data into two lists of a graphing calculator.

**Step 2:** Make a scatter plot of the data...watch your window. What do the points look like?

**Step 3:** Use the quadratic regression feature to find the model for the data.

**Step 4:** Check how well the model fits the data by graphing the model and the data in the same view screen on your calculator.

- 2.) **RUNNING** The table shows how wind affects a runner's performance in the 200 meter dash. Positive wind speeds correspond to tailwinds, and negative wind speeds correspond to headwinds. The change  $t$  in finishing time is the difference between the runner's time when the wind speed is  $s$  and the runner's time when there is no wind.



<b>Wind speed (m/sec), <math>s</math></b>	-6	-4	-2	0	2	4	6
<b>Change in finishing time (sec), <math>t</math></b>	2.28	1.42	0.67	0	-0.57	-1.05	-1.42

- Use a graphing calculator to find the best-fitting quadratic model.
- Predict the change in finishing time when the wind speed is 10 m/sec.

3.) Using a graphing calculator and quadratic regression to find a model:

A study compared the speed  $x$ , in miles per hour and the average fuel economy  $y$  (in miles per gallon) for cars. The results are shown in the table. Find a quadratic model in standard form for the data.

Speed $x$	15	20	25	30	35	40	45	50	55	60	65	70
Fuel Economy $y$	22.3	25.5	27.5	29	28.8	30	29.9	30.2	30.4	28.8	27.4	25.3

- a) Enter the data into two lists of your graphing.
- b) Make a scatter plot of the data. Why is it a scatter plot and not a strict parabola?
- c) Use the quadratic regression figure to find the best fitting quadratic model for the data. Write the equation then graph it to see how it matches the scatter plot.
- d) What exactly does the quadratic function represent in terms of gas mileage and the speed?
- e) Find the speed that maximizes the fuel economy.
  - Where is it located graphically?
  - Is it the  $x$  or the  $y$  coordinate? Why?
  - Find the maximum speed by hand.
  - Find the maximum speed on the calculator
- f) Make a prediction about how much fuel you would use if you were going 42 mph?

How about 19 mph?