Student Worksheet Name ______________________

Modeling Engine Power

Engine Speed vs. Engine Power

A manufacturer of a popular sports car states that the car reaches its maximum power (measured in horsepower, hp) at a lower engine speed (measured in revolutions per minute) than other comparable sports cars. The estimated values on which this claim was made are given in the table below.

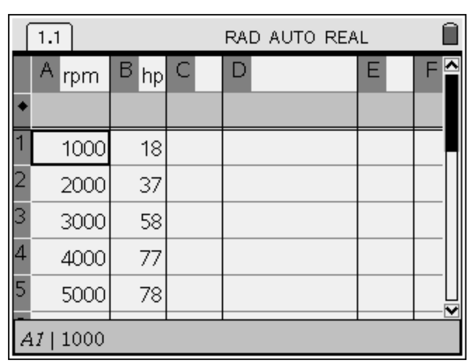
Engine speed (rpm)	1000	2000	3000	4000	5000	6000
Engine power (hp)	18	37	58	73	77	67

Using your TI-Nspire handheld, complete the table using the directions given below:

x	Actual	Linear Model	Deviation, d	d^2
1000	18			
2000	37			
3000	58			
4000	73			
5000	77			
6000	67			
				$\Sigma d^2 =$

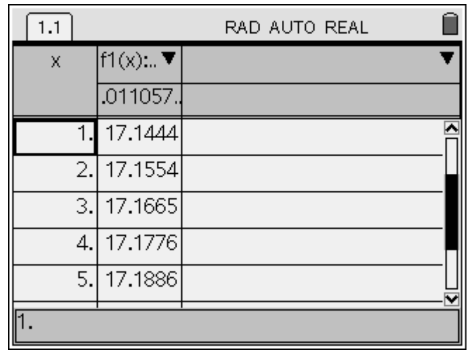
- Enter the given data in a spreadsheet. Label column A “rpm” and column B “hp”.

- Find the least-squares regression line by choosing **menu** →**4:statistics** →**1:stat calculations** → **3:linear regression**



- Choose "rpm" for your X List, "hp" for your Y List, and Save RegEqn to "f1". Skip the rest and choose "OK". The linear regression statistics will now appear in your spreadsheet.

- Substitute the manufacturer's given rpm values to find the hp values based on the least-squares line. Do this by choosing **menu →5:function table → 1:switch to function table**



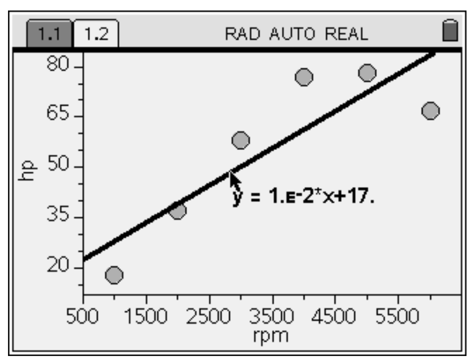
- Find the vertical deviation *d* between each data point and the least-squares line. Use the formula:
  d = actual hp – least-squares hp

- Find the square of each deviation value, d^2, and then find the sum of the squares of the deviations, Σd^2

- Fill in the appropriate values for the linear model, *d*, and d^2 in the table above.

- Return to the spreadsheet by choosing **menu →5:function table → 1:switch to lists and spreadsheets**

- Graph a scatter plot of the data set. Choose **home → 5:data & statistics**. Enter "rpm" and "hp" along the appropriate axes. Add the least-squares line by choosing **menu → 3:actions → 5:regression → 1:show linear**



Do the data points in the scatter plot suggest this is a linear relationship? ______________

If not, what type of relationship do you think the scatter plot represents? ______________

The data points appear to lie closer to a parabola than a straight line. Recall that the general equation for a parabola is: $y = ax^2 + bx + c$

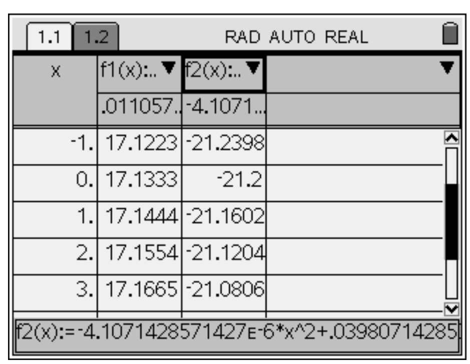
x	Actual	Quadratic Model	Deviation, d	d^2
1000	18			
2000	37			
3000	58			
4000	73			
5000	77			
6000	67			
				$\Sigma d^2 =$

Using your TI-Nspire handheld, find the quadratic regression for the set of data already listed in your spreadsheet.

- Find the least-squares parabola by choosing **menu** → **4:statistics** → **1:stat calculations** → **6:quadratic regression**

- Choose "rpm" for your X List, "hp" for your Y List, and Save RegEqn to "f2". Skip the rest and choose "OK".

- Switch to the function table as before and enter f2 in the column to the right of f1.



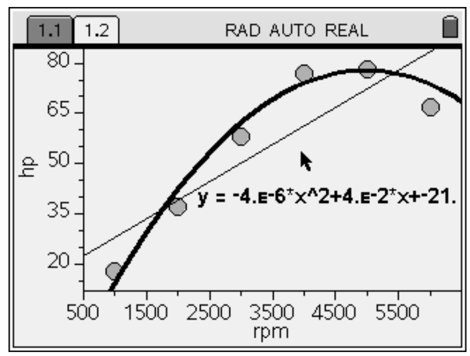
- Again, find the vertical deviation d between each data point and the least-squares parabola. Use the formula: d = actual hp – least-squares hp

- Find the square of each deviation value, d^2, and then find the sum of the squares of the deviations, Σd^2

- Fill in the appropriate values for the quadratic model, *d*, and d^2 in the table above.

- Return to the spreadsheet by choosing **menu →5:function table → 1:switch to lists and spreadsheets**

- Return to the previous scatter plot of the data set. It is on the second page, 1.2. Add the least-squares parabola by choosing **menu → 3:actions → 5:regression → 4:show quadratic**



Based on the graphs of the linear model and the quadratic model, which model appears to be the best fit?

____

Compare the sum of squares of the deviations between each model. What does the sum of squares reveal about the model that fits the data the best?

____

____

____