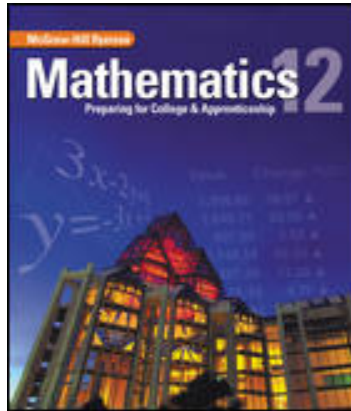# Fathom™ Tutorial

Dynamic Statistical Software

designed for teachers using

McGraw-Hill Ryerson
Mathematics Preparing for College & Apprenticeship

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by Roland W. Meisel
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Please Return This Guide to the Presenter
at the End of the Workshop

if you would like an electronic copy of this guide, please send email to:

rollym@vaxxine.com

Thank you!

Foreword

This tutorial is designed for the teacher who will be using Fathom™ to teach the Grade 12 Mathematics Preparing for College & Apprenticeship MAP4C course. It is keyed to the *McGraw-Hill Ryerson Mathematics Preparing for College & Apprenticeship* text, © 2002, McGraw-Hill Ryerson Limited. All worked examples that specifically make use of Fathom™ are included in this tutorial. Step-by-step keystroke instructions and liberal use of screen shots will ease the novice along the learning curve for this powerful new technology. The user will find it helpful to follow through the text as he or she works through this tutorial. By working through the tutorial, the user will gain a solid knowledge of Fathom™ as applied to the MAP4C course.

About Fathom™

Fathom™ is a powerful dynamic statistical software package published by

An excellent web site, with Fathom™ resources and links to other web sites, is at **www.keypress.com**.

Introduction:

Fathom™ is a statistics software package that offers a variety of powerful data analysis tools in an easy-to-use format. This section introduces basic features of Fathom™ such as entering, displaying, sorting, and filtering data. A complete guide is available on the Fathom™ CD. The real power of this software will be demonstrated in later chapters with examples that apply its sophisticated tools to statistical analysis and simulations.

When you enter data into Fathom™, it creates a **collection**, an object that contains the data. Fathom™ can then use the data from the collection to produce other objects, such as a **graph**, **table**, or **statistical test**. These secondary objects display and analyse the data from the collection, but they do not actually contain the data themselves. If you delete a graph, table, or statistical test, the data still remains in the collection.

Fathom™ considers a collection as a set of **cases**. Each case in a collection can have a number of **attributes**. For example, the **cases** in a **collection** of medical records could have **attributes** such as the patient's name, age, sex, height, weight, blood pressure, and so on. There are two basic types of attributes, **categorical** (such as male/female) and **continuous** (such as height or weight). The **case table** feature displays the cases in a collection in a format similar to a spreadsheet, with a row for each case and a column for each attribute. You can add, modify, and delete cases using a case table.

Section 4.3 Example 3   **Page 171 MHR MPCA**

Example 3   **Drawing a Histogram Using Fathom™**

a) Use the data to create a frequency table and display the data in a histogram using Fathom™.

Note: Appendix B of the Student text contains detailed information on using Fathom™.

Solution

Launch Fathom™ and drag the **case table** icon from the shelf to the workspace. Click on the attribute **<new>**, type the heading **Length**, and press **Enter**. Enter the length data from the table into the length attribute column. When you are finished, your **case table** will look like the following screen shot.
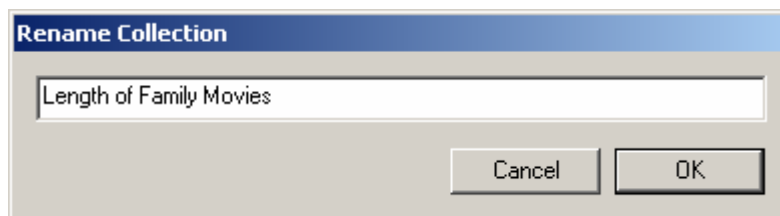
Note: The Interactive Student e-book contains all of the Fathom™ files for the text. For example, navigate to page 171, and look in the **Related Materials** frame. If you click on **Example 3**, the file will be launched.

Movie Title	Release Date	Length (min)
Fantasia	1940	120
Swiss Family Robinson	1940	93
Dumbo	1941	88
Pinocchio	1940	88
Bambi	1942	70
The Jungle Book	1942	94
Song of the South	1946	75
Cinderella	1950	74
Alice in Wonderland	1951	75
Peter Pan	1953	76
Lady and the Tramp	1955	75
Old Yeller	1957	83
Sleeping Beauty	1959	75
101 Dalmations	1961	68
In Search of the Castaways	1962	98
The Sword in the Stone	1963	79
The Love Bug	1968	107
The Aristocats	1970	78
Teenage Mutant Ninja Turtles	1990	93
Beauty and the Beast	1991	84
The Lion King	1994	89
Pocahontas	1995	81
Toy Story	1995	81
The Land Before Time V	1997	74

Related Materials:
Example 3 (ftm)

Note that your collection has been given the generic name **Collection 1**. You can double-click on the collection box and change the name to something more descriptive, such as **Length of Family Movies**.

	Collection 1	
	Length	
16	79	
17	107	
18	78	
19	93	
20	84	
21	89	
22	81	
23	81	
24	74	

Rename Collection

Length of Family Movies

Cancel   OK

Drag the graph icon ⬚ to the workspace.

Drag the **Length** attribute from the **case table** to the horizontal axis of the graph. Your graph will look like the screen shot at the right. Notice that you have a dot plot. To change this to a histogram, use the pull-down menu beside **Dot Plot**, and select **Histogram**.

Length of Family Movies   Dot Plot ▼

✔ Dot Plot
Line Plot
Histogram
Ntigram
Box Plot
Percentile Plot
Normal Quantile Plot
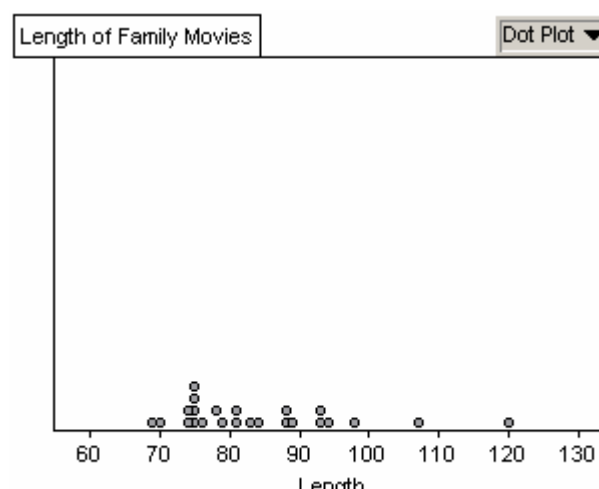
The plot will be changed to a histogram, as shown at the right. Note that the software has chosen the bin widths. You can alter the bin width by moving the pointer over a bin until the horizontal double arrow appears, and dragging the edge of the bin.

You can also alter the appearance of the histogram by selecting **Show Graph Info** from the **Graph** menu.

Information about this graph:
Histogram: Bin width: **5.5000** starting at: **64.500**
The **Length** axis is horizontal from **55.000** to **135.00**
The **Count** axis is vertical from 0 to **8.5000**

Length of Family Movies   Histogram ▼
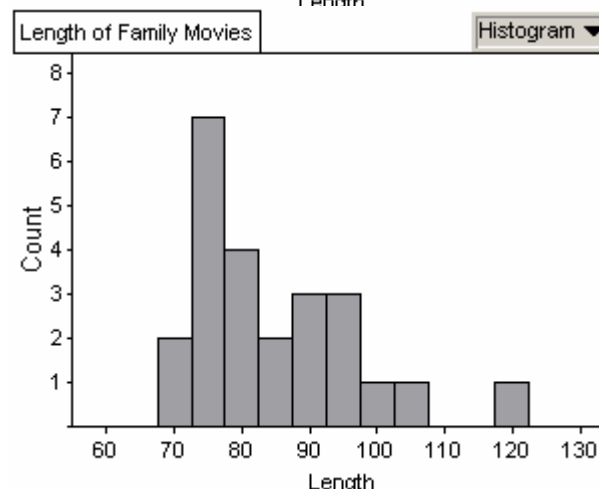
You can change any of the values in **blue** by clicking on the value, and then keying in the desired value.

Example 3   Exponential Distribution

Aircraft components must meet stringent safety regulations. It is essential to know the number of hours of use that can be expected before a part might fail due to stress (constant use in regular conditions). Tests are used to determine and record the lifetime of each component.
In a test situation, the failure times, in hours, for 40 particular components under stress are recorded.

21	36	42	54	59	77	95	100	117	159	184	256	332	428
442	482	596	646	652	738	892	908	918	1088	1220	1348	1384	1433
1744	1893	2341	2516	2671	3000	3044	3229	3989	4297	5390	6531		

a) Using technology, prepare a histogram for these data and draw a curve to represent the distribution.
b) Identify the type of distribution curve.
c) Calculate the mean and median.
d) Locate the mean and median on your graph.

Solution

a) Launch Fathom™ and drag the **case table** icon from the shelf to the workspace. Click on **Collection 1**, and rename it **Aircraft Parts**. Click on the attribute **<new>**, type the heading **Time_hours**, and press **Enter**. Enter the time data from the table into the time attribute column. When you are finished, your **case table** will look like the screen shot at the right.

Drag the graph icon to the workspace. Drag the **Time_hours** attribute from the **case table** to the horizontal axis of the graph. Change this to a histogram, using the pull-down menu beside **Dot Plot**. Your histogram will appear as shown at the right.
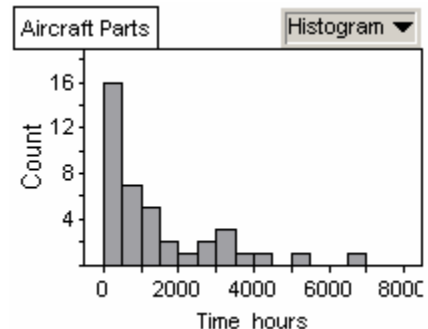
b) This distribution has a decreasing exponential curve.

c) Right-click on the graph, and select **Plot Value** from the menu that appears. The formula box will appear. Navigate **Functions-Statistical-One Attribute-mean**. Select **mean**. Type **Time_hours** between the brackets. Your formula should appear as shown in the screen shot.
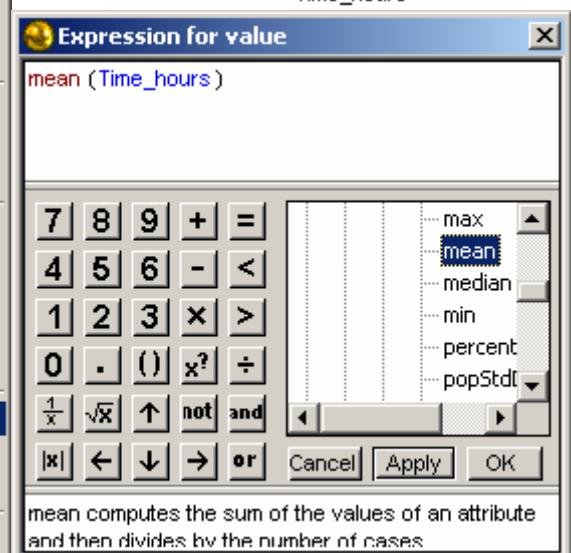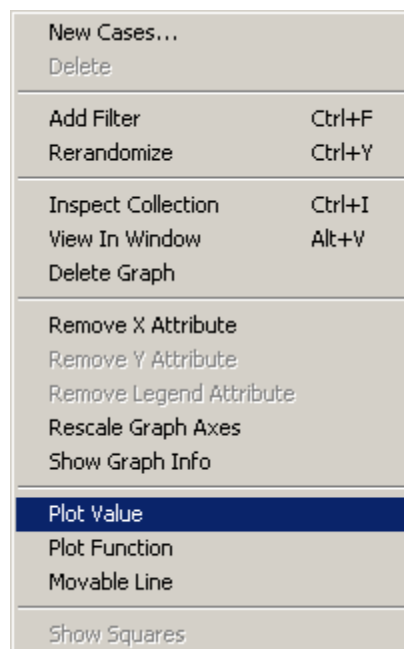
Use a similar process to plot the median. Inspect your graph.

d) Note that the mean and median have been calculated and plotted on the graph.
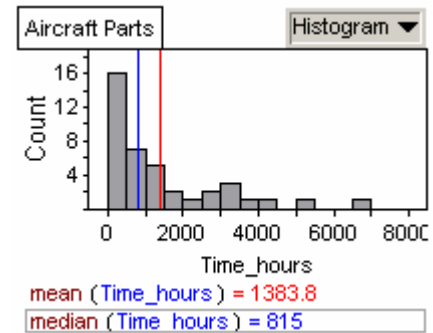
Discover   **Creating Scatter Plots Using Fathom™**

The data in Collection 1 represents the number of community college diplomas in the social sciences and services over a seven-year period.

1. Enter the data into a case table as shown.
2. Create a scatter plot.

Solution

a) Launch Fathom™ and drag the **case table** icon from the shelf to the workspace. Click on the attribute **<new>**, type the heading **Year**, and press **Enter**. Click on the attribute **<new>**, type the heading **Graduates**, and press **Enter**. Enter the data from the table into the appropriate attribute columns. When you are finished, your **case table** will look like the screen shot above.

b) Drag the graph icon to the workspace. Drag the **Year** attribute from the **case table** to the horizontal axis of the graph. Drag the **Graduates** attribute from the **case table** to the vertical axis of the graph. Your scatter plot will look like the screen shot at the right.
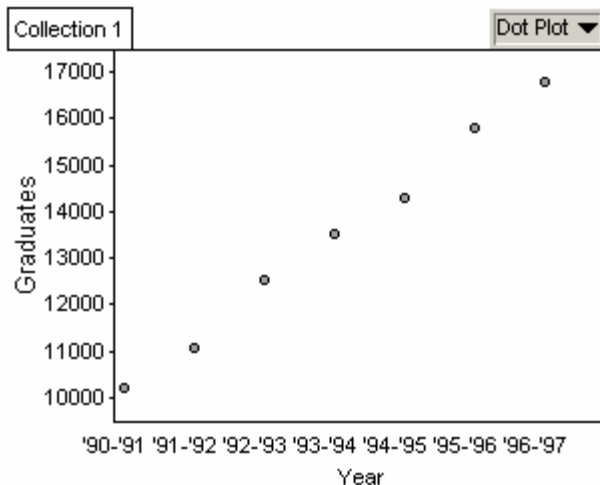
Discover   **Linear Regression Using Fathom™**

Mechanical engineering technicians were randomly surveyed to collect data on their number of years experience and their current salary.

Years of Experience	Salary ($)
1	27 800
2	44 500
2	34 300
5	37 800
6	51 175
6	53 500
8	58 200

1. Create a case table of the data.
2. Create a graph (scatter plot), with Years of Experience along the *x*-axis and Salary along the *y*-axis.
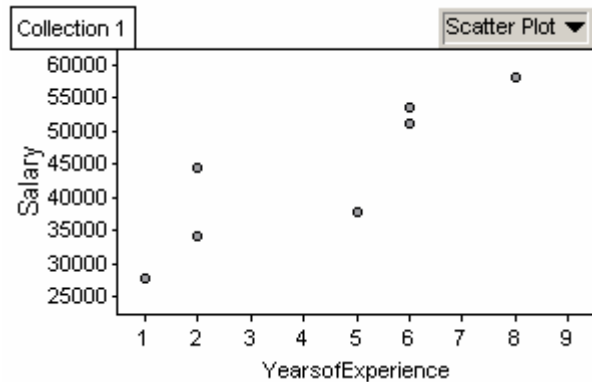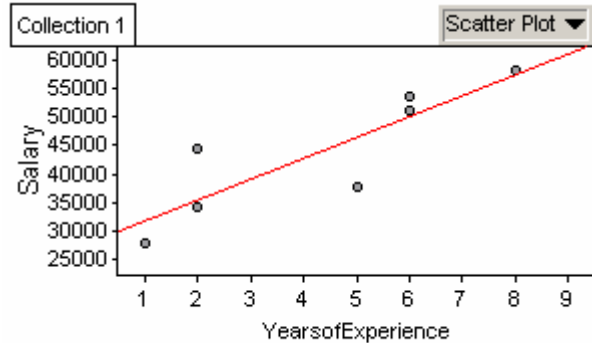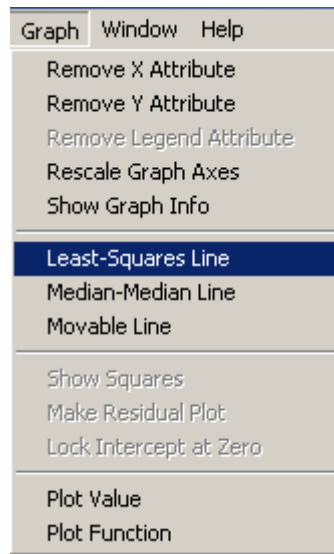**4.** Plot a least squares line.

Solution

a) Launch Fathom™ and drag the **case table** icon from the shelf to the workspace. Click on the attribute **<new>**, type the heading **Years of Experience**, and press **Enter**. Click on the attribute **<new>**, type the heading **Salary**, and press **Enter**. Enter the data from the table into the appropriate attribute columns. When you are finished, your **case table** will look like the screen shot at the right.

	YearsofExperience	Salary
1	1	27800
2	2	44500
3	2	34300
4	5	37800
5	6	51175
6	6	53500
7	8	58200

Collection 1

b) Drag the graph icon to the workspace. Drag the **YearsofExperience** attribute from the **case table** to the horizontal axis of the graph. Drag the **Salary** attribute from the **case table** to the vertical axis of the graph. Your scatter plot will look like the screen shot at the right.

d) Ensure that the graph is selected. From the graph menu, select **Least-Squares Line**. Fathom™ will perform a linear regression, and insert a line of best fit. You will also see the equation of this line displayed below the graph, along with the coefficient of determination.

Graph   Window   Help
Remove X Attribute
Remove Y Attribute
Remove Legend Attribute
Rescale Graph Axes
Show Graph Info

Least-Squares Line
Median-Median Line
Movable Line

Show Squares
Make Residual Plot
Lock Intercept at Zero

Plot Value
Plot Function

$Salary = 3650 YearsofExperience + 28300; r^2 = 0.75$

Example 3   **Quadratic Regression Using Fathom™**

Find the quadratic equation that fits the data shown.

Solution

a) Launch Fathom™ and open a new document, if
necessary. Drag a new collection box to the workspace and
rename it **Quadratic Fit**. Drag a **case table** to the
workspace. Rename the <**new**> column **x**. Also create an
attribute column named **y**. Enter the data shown
above.

Drag a **graph icon** to the workspace. Drag the **x**
attribute to the horizontal axis of the graph and the **y**
attribute to the vertical axis of the graph, as shown in
the screen shot at the right.

b) The simplest curve that might fit the data appears
to be a quadratic.

| x	y	First Differences	Second Differences
0	19		
1	9	10	
2	3	6	4
3	1	2	4
4	3	- 2	4
5	9	- 6	4
6	19	- 10	4
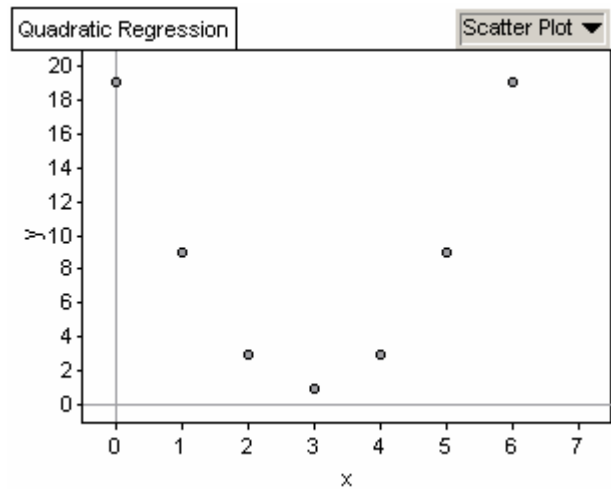
c) The general equation of a quadratic is $y = ax^2 + bx + c$. Therefore, you will need three sliders to plot
this curve such that it can be adjusted dynamically to fit the data. Drag three sliders from the tool shelf to
the workspace, as shown below.
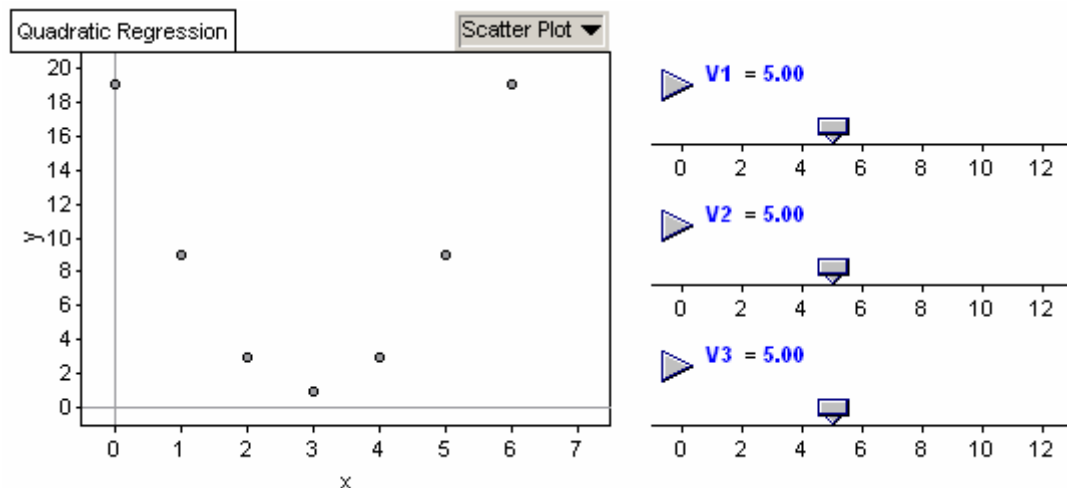
Note that Fathom™ will assign each slider a generic "V" name. You can double-click on each of these
names in turn, and change them to a, b, and c.

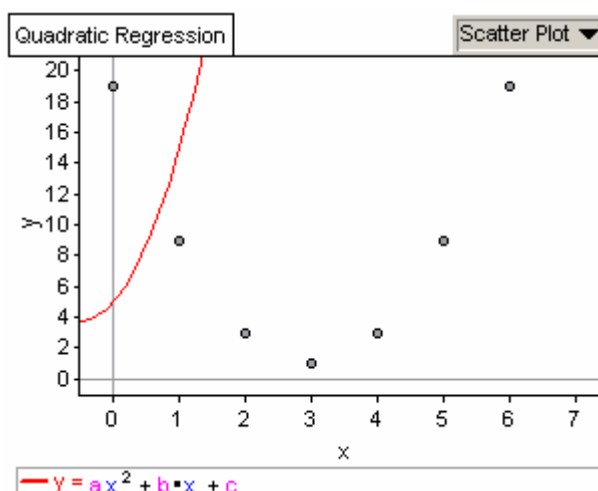Right-click on the graph, and choose **Plot Function**. The expression dialogue box will appear.
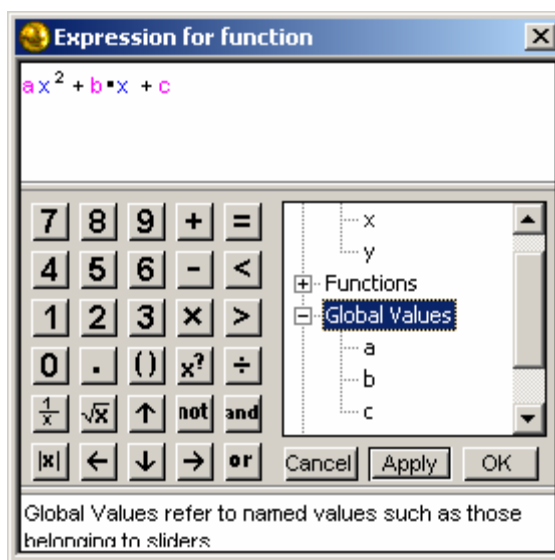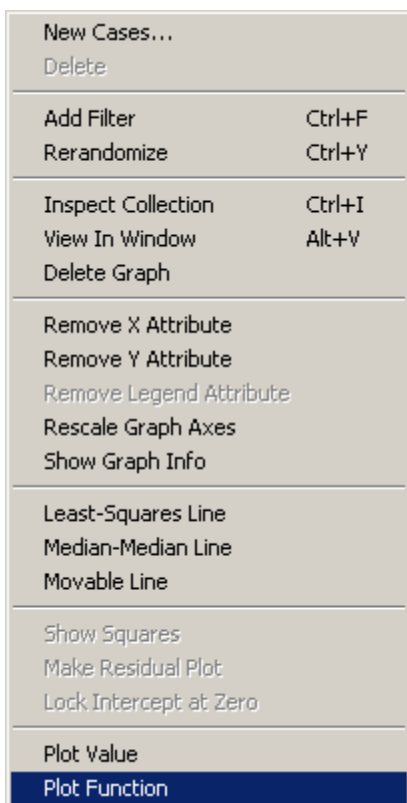
Enter the formula:

a*x^2 + b*x + c

You will find the sliders under **Global Values**. Press the **Apply** button and then **OK**. The quadratic curve will be plotted as shown at the right.

Note that it is nowhere near the scatter plot. You must now adjust the sliders in order to "fit" the curve.

Adjust the sliders until the curve makes its best fit to the scatter plot. In most cases, it will not fit perfectly. You can drag the scale on each slider to obtain a wider or narrower range of values. When you are finished, your screen should look much like the one that follows.

Note: Take your time with this step. Adjusting the sliders and slider scales properly takes some practice. When you have the correct values, you can make small adjustments to each slider, and observe the smooth dynamic effects on the graph.
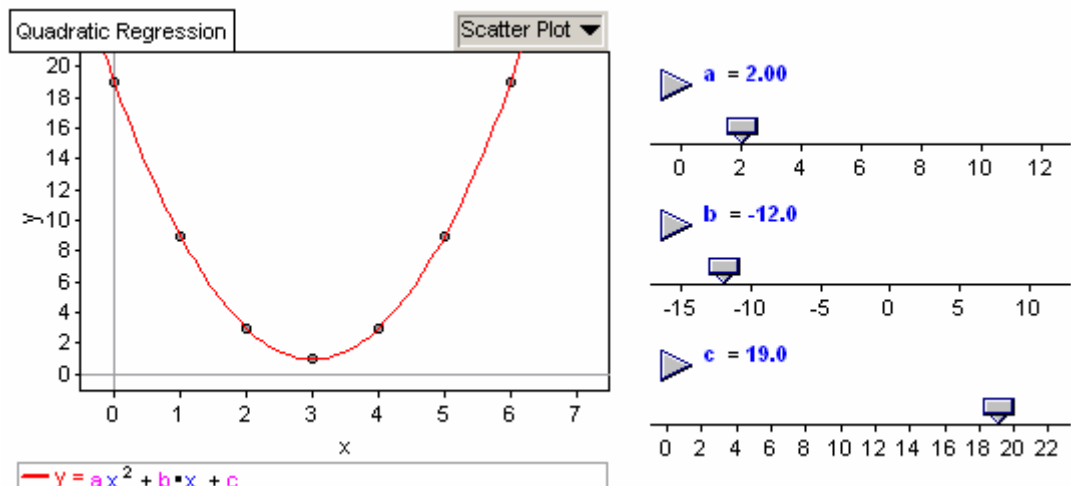
This concludes this Fathom™ Tutorial.

For additional Fathom™ resources, visit the Key Curriculum Press web site at www.keypress.com.