Calc Guide

Chapter 4
Creating Charts and Graphs

OpenOffice.org

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Publication date and software version

Published 20 October 2006. Based on OpenOffice.org 2.0.4.

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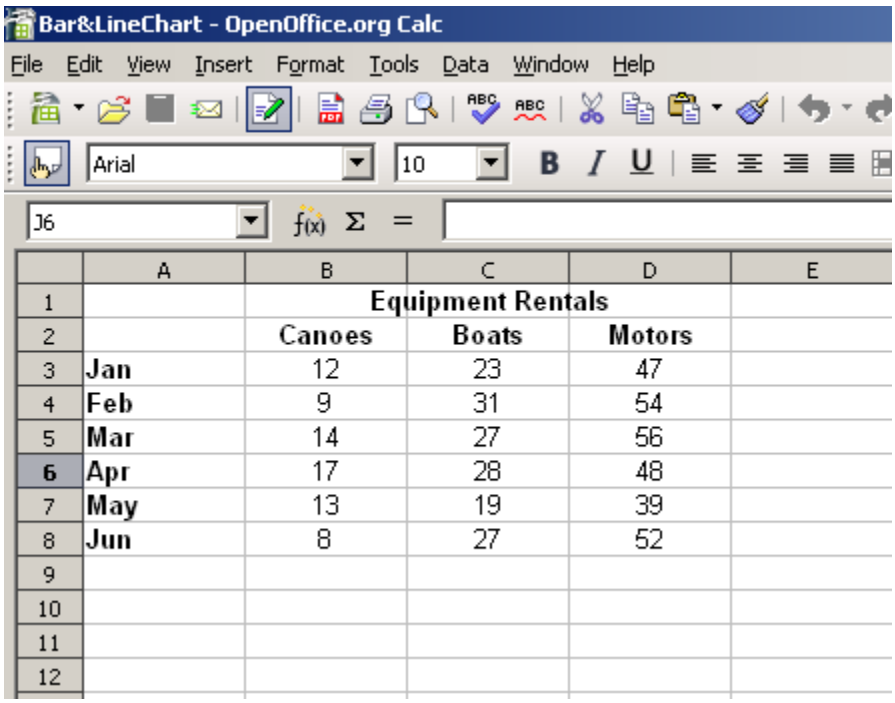
Introduction

Charts and graphs can be powerful ways to convey information to the reader. OpenOffice.org Calc offers a variety of different chart and graph formats for your data.

Calc allows you to customize charts and graphs to a considerable extent. Many of these options enable you to present your information in the best and clearest manner. For readers who are interested in effective ways to present information graphically, an excellent introduction to the topic is Cleveland, W. S. (1985), *The elements of graphing data*, Wadsworth Advanced Books and Software.

Creating a chart

We will use the small table of data in Figure 1 to demonstrate what we can do with Calc's charting and graphing capabilities.



	A	B	C	D	E
1		Equipment Rentals			
2		Canoes	Boats	Motors	
3	Jan	12	23	47	
4	Feb	9	31	54	
5	Mar	14	27	56	
6	Apr	17	28	48	
7	May	13	19	39	
8	Jun	8	27	52	
9					
10					
11					
12					

Figure 1: Table of data for charting examples

To create a chart, first highlight (select) the data to be included in the chart, as shown in Figure 2.

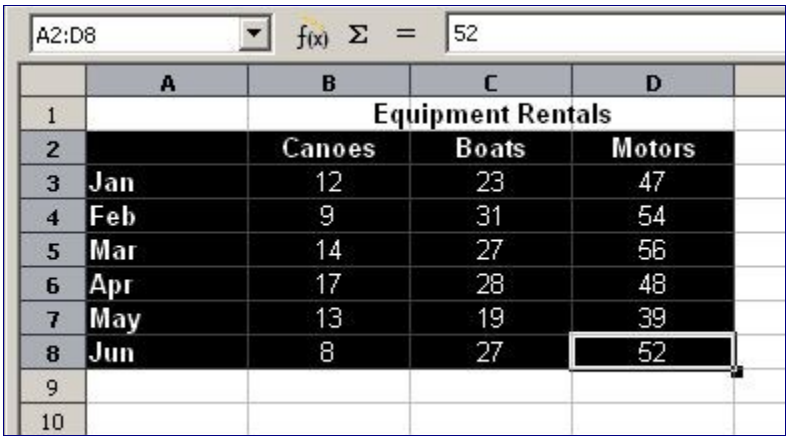


Figure 2: Selecting data for plotting

Next, open the AutoFormat Chart dialog using one of two methods.

- Click on a cell in the area of the spreadsheet where you want the chart to appear, and then select **Insert > Chart** from the menu bar as shown in Figure 3.

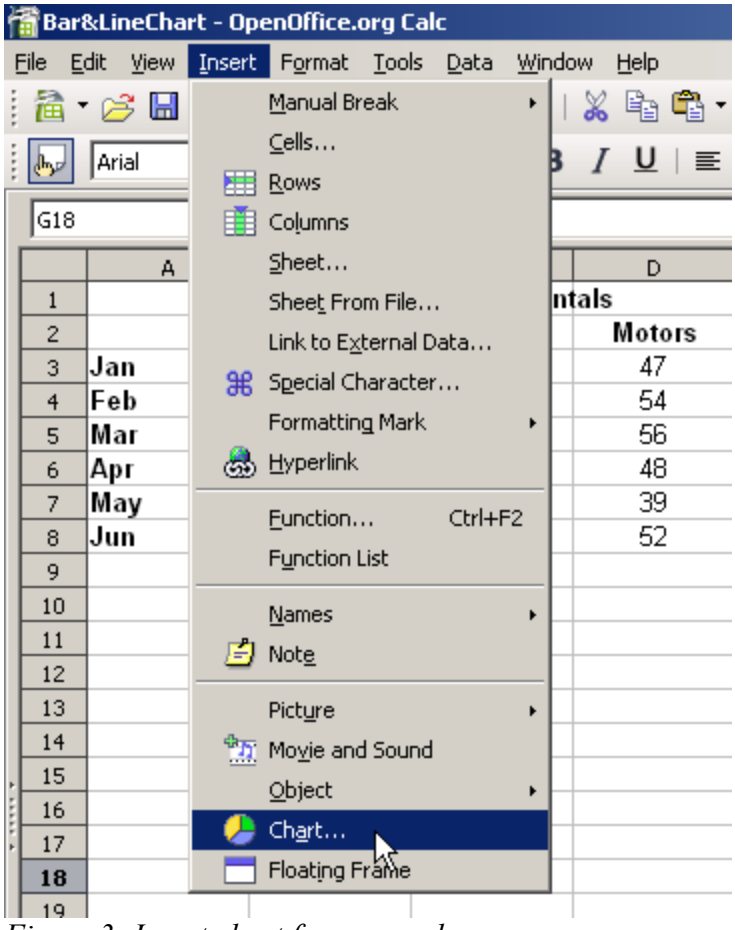


Figure 3: Insert chart from menu bar

- Or, click on the **Chart** icon on the main toolbar (Figure 4) and then click in a cell in the area of the spreadsheet where you wish the chart to be.

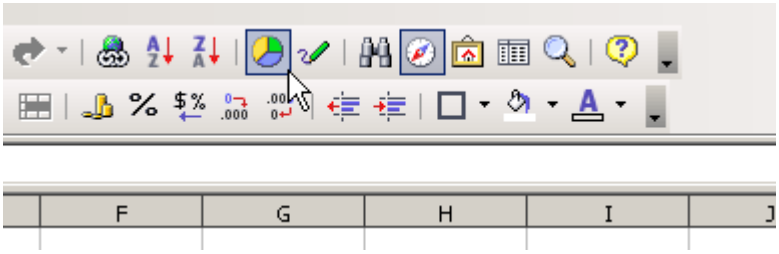


Figure 4: Insert chart from menu tool bar

Either method will bring up the Auto format Chart dialog (Figure 5).

Using the AutoFormat Chart dialog

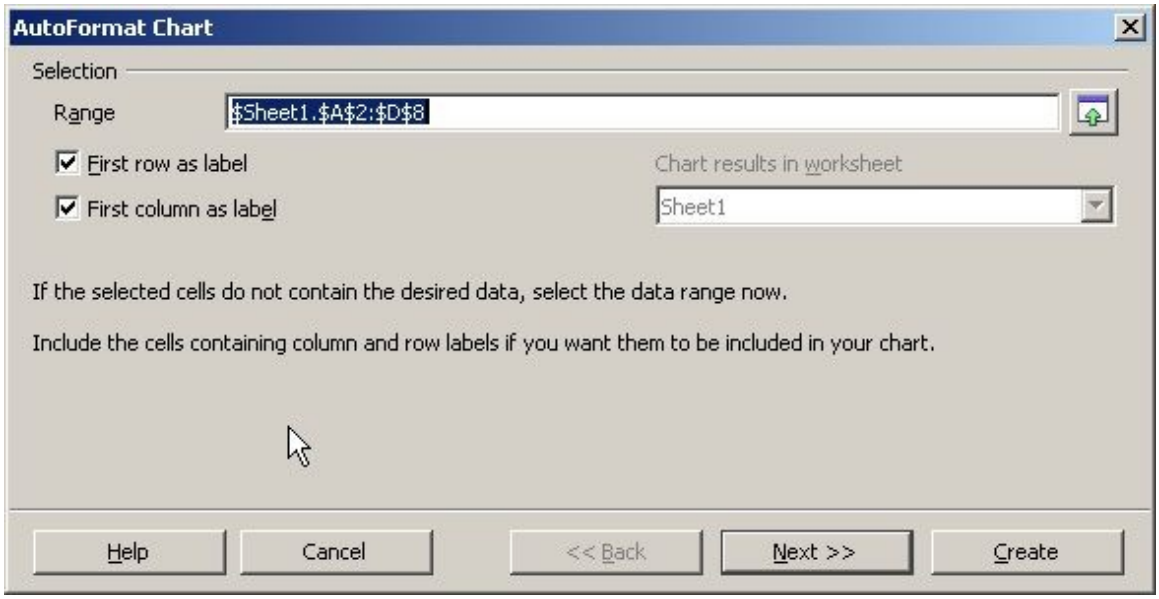


Figure 5: AutoFormat Chart: Screen 1

Data range and labels

The data range includes the numbers that we wish to chart. The checked boxes indicate that Calc has recognized that the entries in the first column and the first row are not numbers and it is suggesting that we may want to use them to supply labels (names). We will accept the suggestion.

The labels in the First column will be used to label the x-axis and the labels in the first row will be used in the Legend. If we did not want to use these labels we could uncheck the boxes and Calc would just ignore the column and the row in creating the chart.

To select the type of chart or graph required, click **Next**.

Note If the AutoFormat Chart dialog was opened from the Insert menu, the *Chart results in worksheet* option is available. From this list box you can select the sheet on which the new chart will reside. Opening the dialog from the toolbars requires you to select a location for the new chart before it is opened, so this list box is not available. Since the data range is specified in Absolute references no matter where the new chart is placed in the current spreadsheet, it will update as the data change in the source ranges.

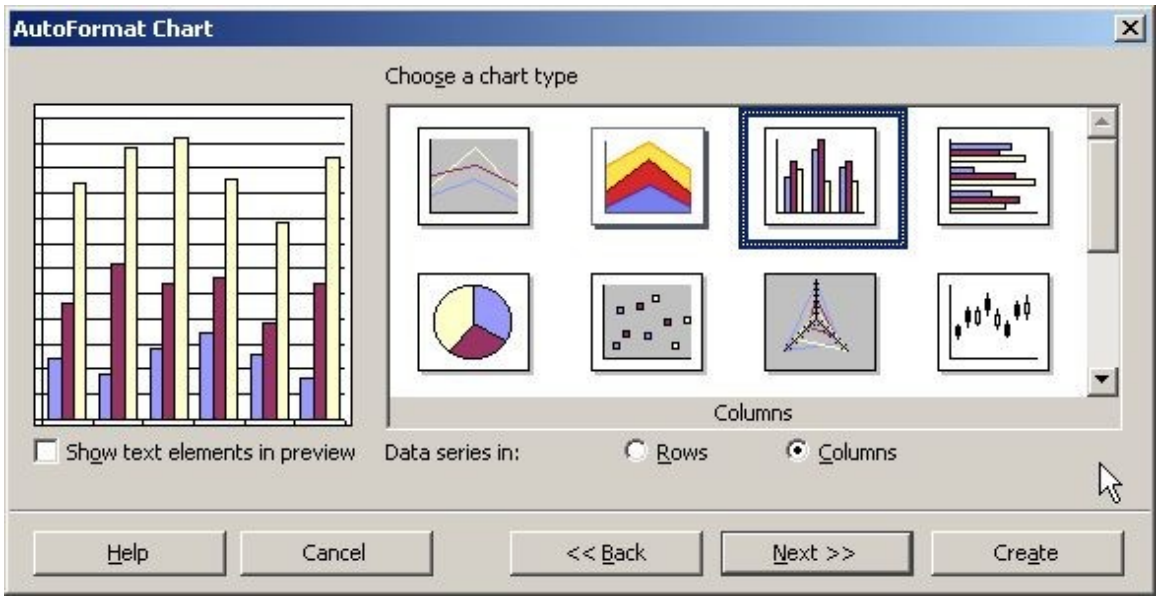


Figure 6: Choose a chart type

Calc offers a choice of 13 different main chart types, a mixture of 2-dimensional and faux 3-dimensional types. Only 8 of the 13 types are shown; scroll down to see the other selections.

On the *Choose a chart type* (Figure 6) page, select one by clicking on its icon. To view a preview of the chart that displays the title, labels and legend, select the **Show text elements in preview** checkbox at the left of the dialog. This preview will update every time you select a different type of chart, and provides you with a good idea of what your finished chart will look like.

The current selection, shown with a border around it, is the Columns chart. The selected chart's name is shown just below the icons. For the moment, we will stick with the Columns chart and click on **Next** again.

This takes us to the *Choose a Variant* page (not shown here) where we have a choice of five different types of column chart. Again we need to scroll down to see all the choices. We will stay with the suggested format, Normal, and click on **Next** again.

Chart and axis titles, and legend

As shown in Figure 7, we can set titles for the chart and the axes on this page. Since the option box for Chart Title is already checked, type in a new title *Equipment Rentals*. Accept the Legend option.

The default for the axes is No Label, shown by the unchecked boxes and the grayed out text. Check the option boxes and add the x-axis label Months and the y-axis label Volume.

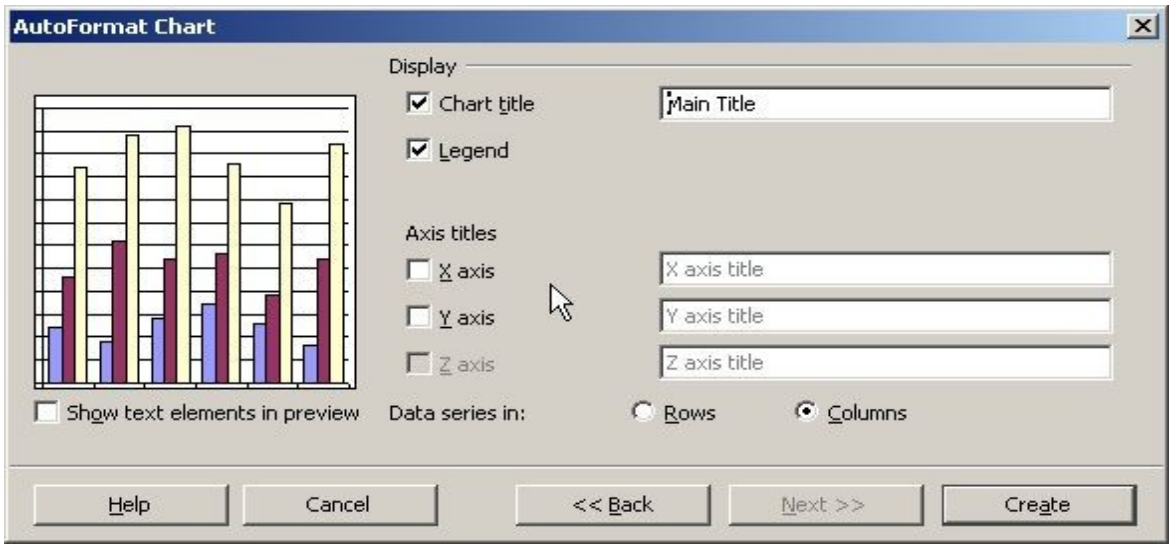


Figure 7: Title, legend and axes labels

Strangely enough, this page also allows us to change the way we are plotting the data by letting us use the rows as data series rather than the columns.

Next click on **Create** to get a column chart complete with title and and axes labels and the default legend.

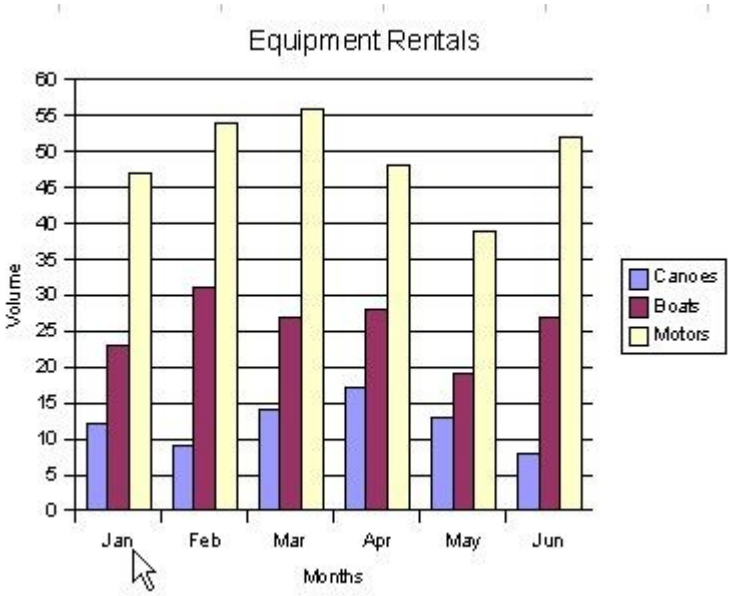


Figure 8: Basic column chart with title and axes

Selecting data ranges

In the example in Figure 3 we selected a contiguous data range by highlighting it and then proceeding to insert a chart. To plot any non-contiguous columns of data we can select the data by selecting the first data series and then selecting the next series while holding down the *Ctrl* key.

You can also type in the columns. The columns must be separated by a semi-colon. Thus if we wanted to Chart B3: B11 against G3:G11 we can write the selection range as *B3:B11;G3:G11*.

The two data series you are selecting must be in separate columns or rows. Otherwise Calc will assume that you are adding to the same data series. This last, however, can be handy if you are doing a column or bar chart but only want to chart some of the data. For example we would do this if we only wanted to compare January with June.

Examples of different chart types

We will use the same data that we used to create the chart in Figure 8 to illustrate some of the other charts that Calc can produce.

Columns (2D & faux 3D)

These chartscreate vertical columns to represent data. The columns can be normal, stacked, or by percent.

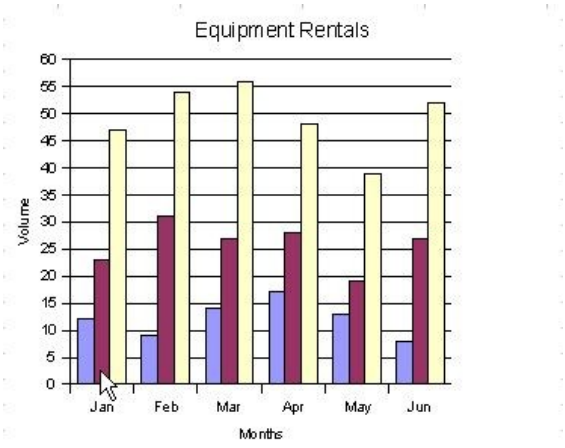


Figure 9: Basic column chart

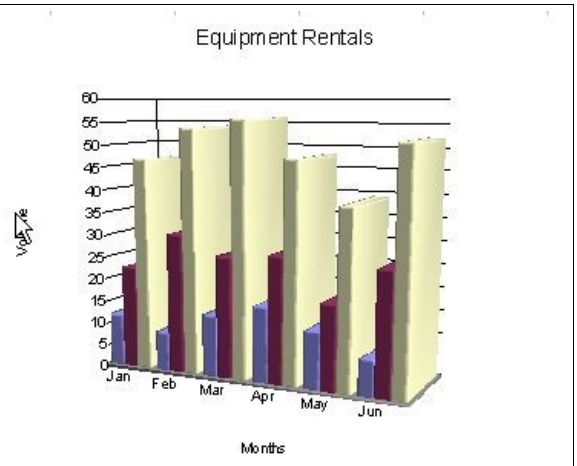


Figure 10: Column chart with 3D perspective

A useful variation of a column chart is the Combined chart, which presents data in both line and column format, as shown in Figure 11.

Figure 11: Combined column and line chart

In 3D mode the data can also be represented by cylinders and cones. It is very difficult to see any reasonable use of any of the faux 3D chart forms if the intention is to accurately convey information.

Bars (2D & 3D)

These charts provide the same features as columns, but they are horizontal.

Figure 12: 2D bar chart

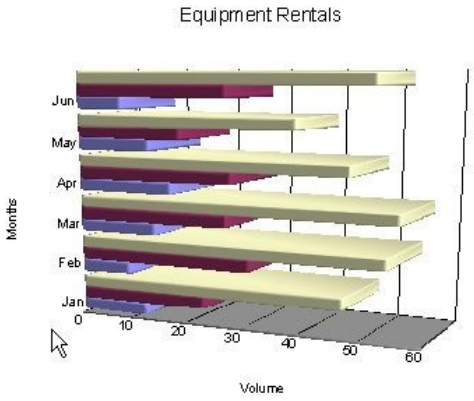


Figure 13: 3D perspective bar chart

Lines (2 & 3 D)

These charts are another way of displaying the same data against a set of categories as a bar chart. The choice of which to use, a bar or a line, depends on the purpose of the chart.

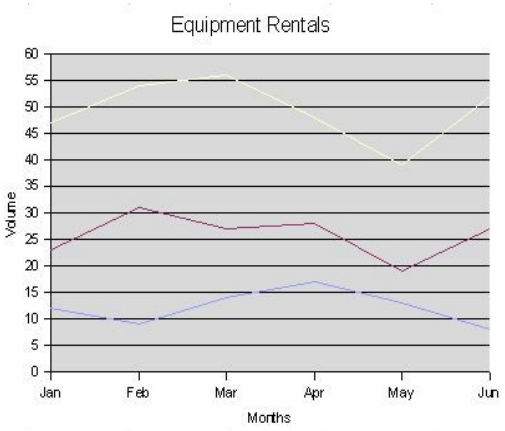


Figure 14: Normal 2D line chart

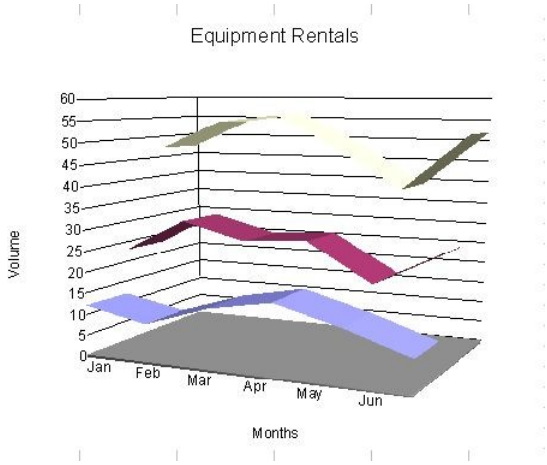


Figure 15: Line chart - deep

In general the faux 3-D charts do not convey information very well and should be avoided if your need is to accurately transmit information.

Pies (2D & 3D)

Pie charts can be used for showing the parts of a whole. The pie chart can be separated or keep as a solid circle.

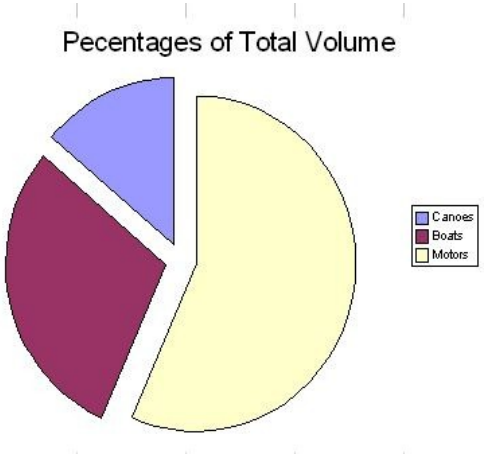


Figure 16: 2D pie chart–Offset 2 (exploded pie chart)

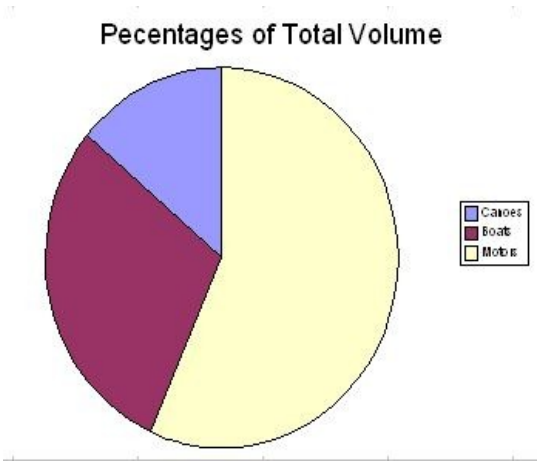


Figure 17: 2D pie chart–normal

Pie charts can effectively present information in some cases, particularly when there are only 2 or 3 pieces in the pie. However, they are not usually a good choice for presenting data as the number of pieces in the pie increases. A bar chart may often be a better choice.

Note	When producing a pie chart, we often find that we want to chart a row of values rather than a column. To do this, select the relevant row(s) (one for the values, and once for the labels) and select **Data series in rows** on the *Display* page (the fourth or last page) of the AutoFormat Chart dialog.

Net

Net charts provide a circular graph with a separate Y axis for each item on the X axis. Points within a data series are connected with a polygon. This type of chart is also known as a polar area or honeycomb chart.

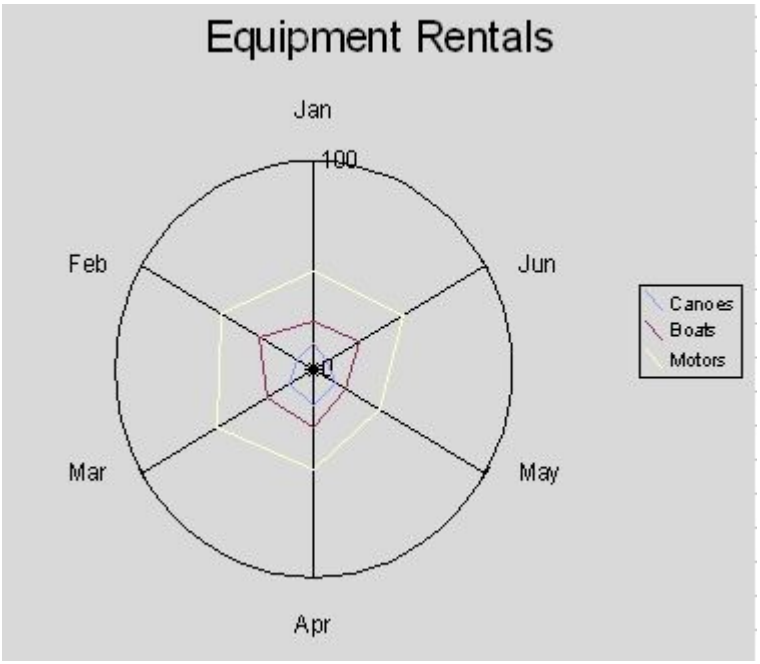


Figure 18: Net or honeycomb chart

XY graphs

XY Graphs are used to show the relationship of one or more variables to other variables. An XY graph assumes that the variables are continuous rather than categorical. This is an important difference between an XY graph and a Line chart which assumes that the x-axis variable is categorical. An example of an XY graph is Figure 20 on page 11.

Modifying the appearance of the chart

Calc gives you considerable control over how a chart or graph is presented. To illustrate this we will work through an example based on the XY graph which was created from a small table of weather data, freshly invented for this purpose and shown in Figure 19.

	A	B
1	Wind speed (km/hr)	Cloud cover
2	14	11
3	13	17
4	15	23
5	27	39
6	17	22
7	18	31
8	33	47
9	25	48
10	23	41

Figure 19: XY graphing data - basic weather data

A simple scatter plot

To begin we will construct a a simple scatter plot:

1) Select (highlight) the data to be graphed.
2) **Insert > Chart > Next.**
3) Select the XY chart > **Next.**
4) Accept the symbols only selection > **Next.**
5) Add a title: Weather Conditions.
6) Check the box beside the x-axis label to accept the label Wind speed (km/hr).
7) Check the box beside the y axes label and type in a title. Percent Cloud Cover.
8) Uncheck the legend box (we do not need a legend for only one y-variable).
9) Click **Create.**

This gives us the graph in Figure 20. This basic graph could use some improvements.

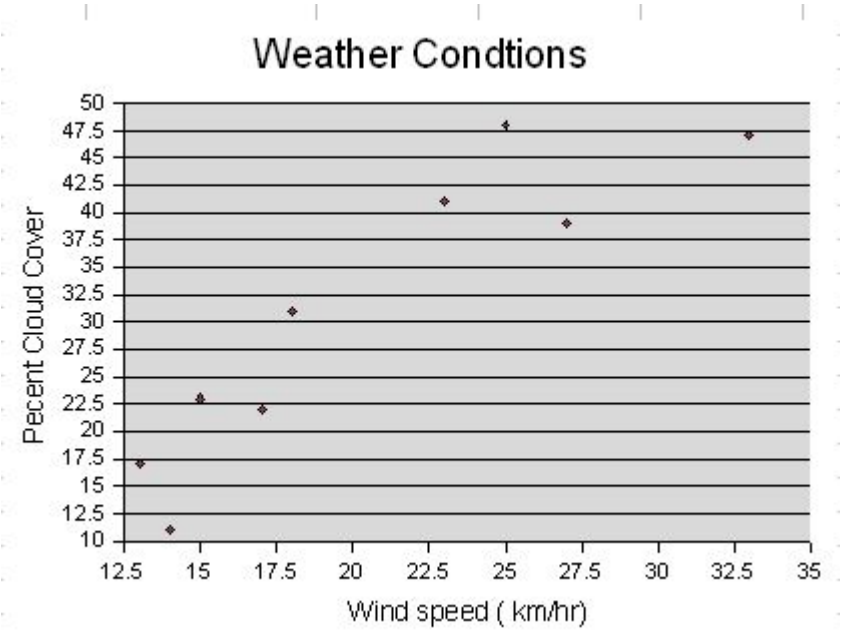


Figure 20: XY graph - scatter plot

Moving and resizing a chart

To move a chart, click and hold down the left mouse button and drag the chart across the window. (If the chart is in Edit mode, you need to click the very edge of the chart in order to move it.)

To resize the chart, click and hold down the left mouse button on one of the green handles and drag the mouse. Dragging on a handle on one of the corners of the chart will increase or decrease the height and/or width. Hold down the *Shift* key while dragging to increase or decrease the height and width in proportion. Dragging on a handle on the side of the chart increases its width and on the top or bottom of the chart increases its height.

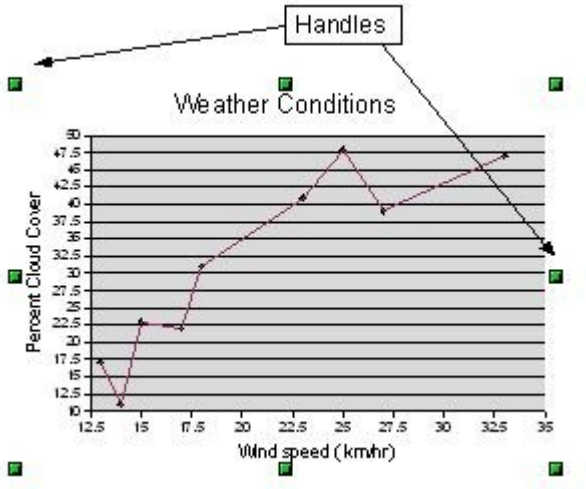


Figure 21: Chart handles for sizing a chart

Changing axes scales

The numbers on the y-axis of our example chart are cluttering things up and it makes sense to start the y-axis at zero percent cloud cover. To do this:

1) Right-click with the cursor inside the graph and select **Edit** (See Figure 22).You can also double-click on the graph to place it in Edit mode.

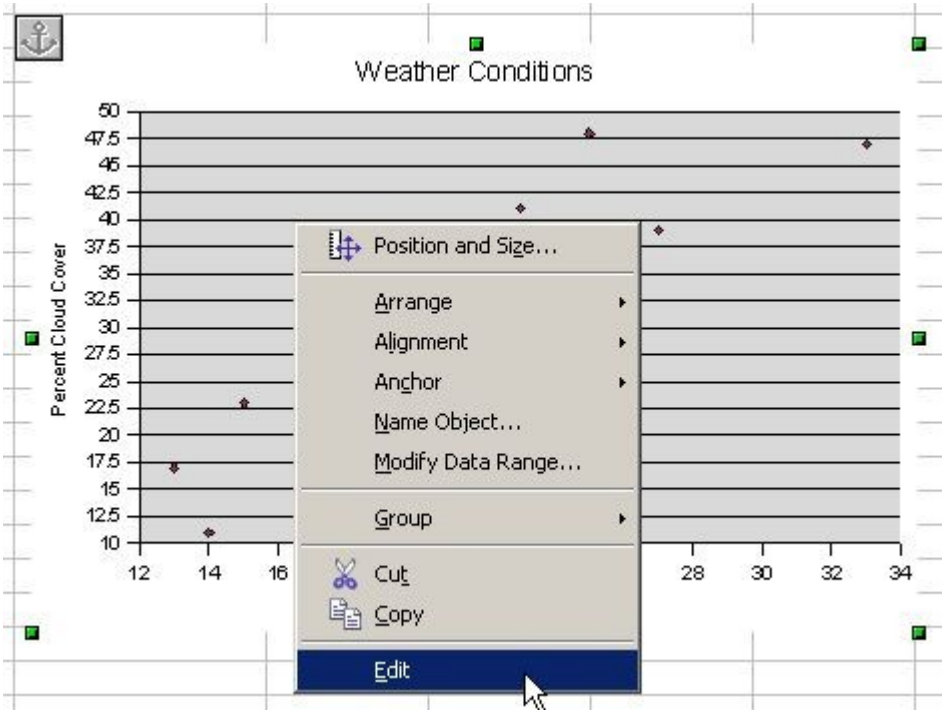


Figure 22: Chart editing menu

2) From the menu bar, select **Format > Axis> Y Axis** and select the **Scale** tab.

3) Set the Minimum value to 0 and Major Interval to 5. Leave the other settings as they are.

   These changes produce the graph shown in Figure 23. This is a bit better, but the scale on the x-axis could be improved.

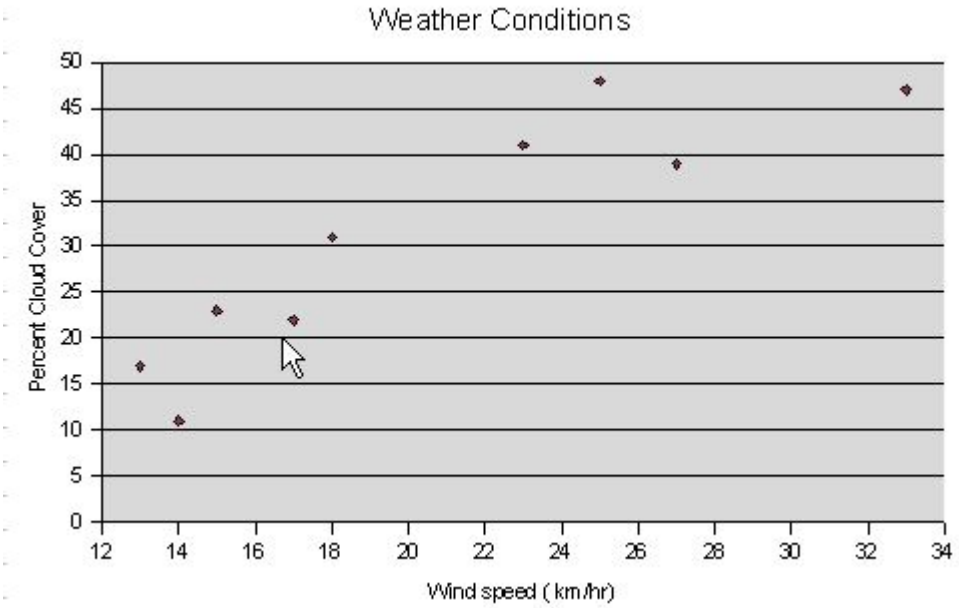


Figure 23: XY graph with modified y-axis scale

4) Again right-click in the chart and select **Edit**. Then from the menu bar, select **Format > Axis > X Axis**. Leave the Minimum value at 10 km/hr but reset the maximum value to 40 km/hr and the major interval to 5.

Figure 24 looks better and is much less cluttered.

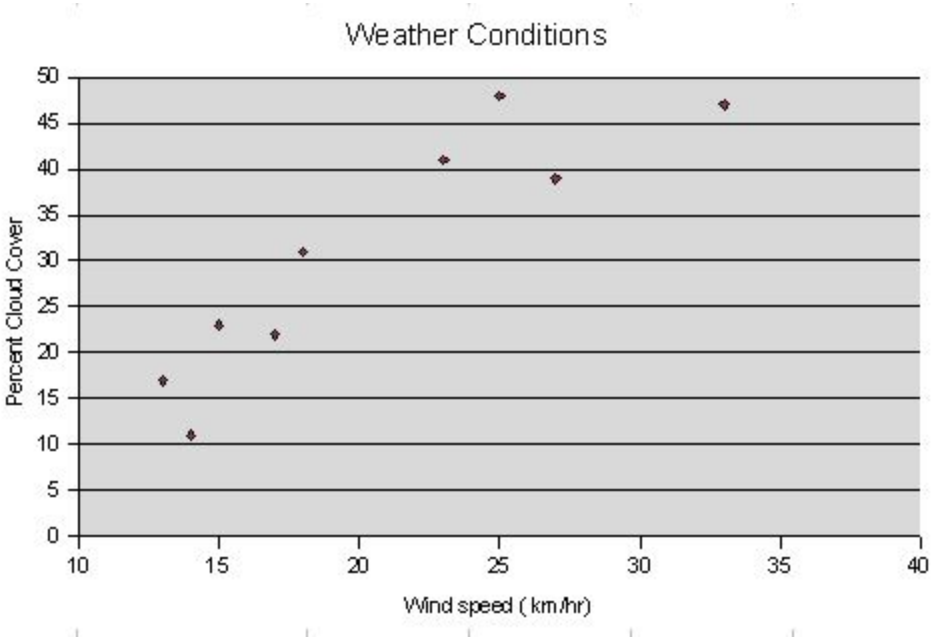


Figure 24: XY graph with modified x- and y- axis scales

We could have reset the Minimum value to 0 as we did with the y-axis but we would have ended up with a lot of unused space on the left side of the graph. Try it and see what you think. Graphs do not need to start from a (0,0) origin.

Modifying the data area of the chart

Grid lines and background

The horizontal grid lines are a distraction and the gray background is unnecessary. To remove them:

1) Right-click on the chart and select **Edit**.
2) On the menu bar, select **Edit > Grid > Y-Axis Main Grid > Invisible** to remove the grid.
3) Select **Format > Chart Wall > Area > None** to remove the gray background. This looks better.

Defining the data area

To finish off the graph we will enclose the entire data wall of the graph. To do this, select **Edit > Chart Wall,** select the **Lines** tab and select **Continuous** from the drop-down Style menu. Figure 25 shows the result.

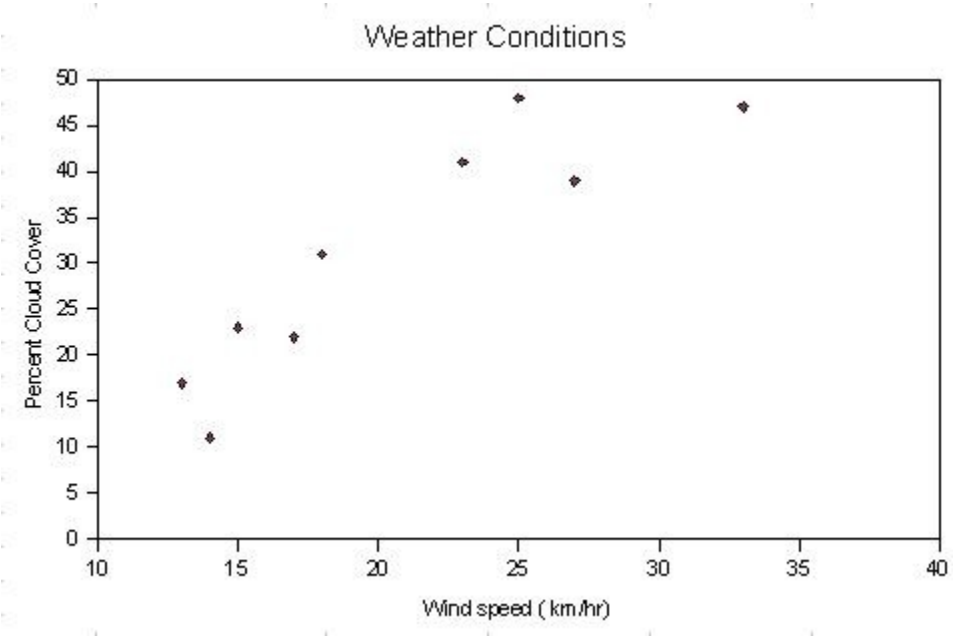


Figure 25: XY chart with enclosed chart wall area

It is possible to do much of this editing from the pop-up menu shown in Figure 22 when you right-click on the graph. Also, the spreadsheet toolbar is context sensitive; when you click on **Edit** in the pop-up menu, the toolbar at the top of the spreadsheet changes to gives a number of chart editing icons as shown in Figure 26.

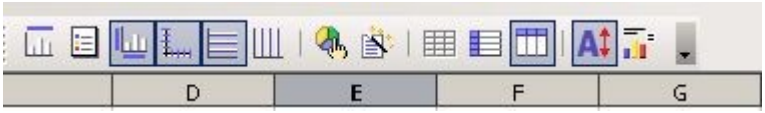


Figure 26: Context sensitive chart editing icons on main tool bar

Fitting a regression line to the data

So far we have been working with a simple scatter plot, but if we look at the data points on the graph, it looks like there is a fairly strong relationship between wind speed and the amount of cloud cover. Let's add a regression line to this graph and see what we get.

1) Right-click in the graph and select **Edit**.

Note From now on, we will omit 'right click in the chart' in our instructions. Unless otherwise specified, the command **Edit** assumes that this has been done and that we are selecting **Edit** from the pop-up menu that we first saw in Figure 22.

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2) Select **Insert > Statistics** and then **Linear Regression**.

The linear regression line is now on the graph. This freshly invented data does show that cloud cover increases as the wind speed picks up. However, to make the graph look a little better, we should have increased the y-axis from a maximum of 50 to 55 or even 60.

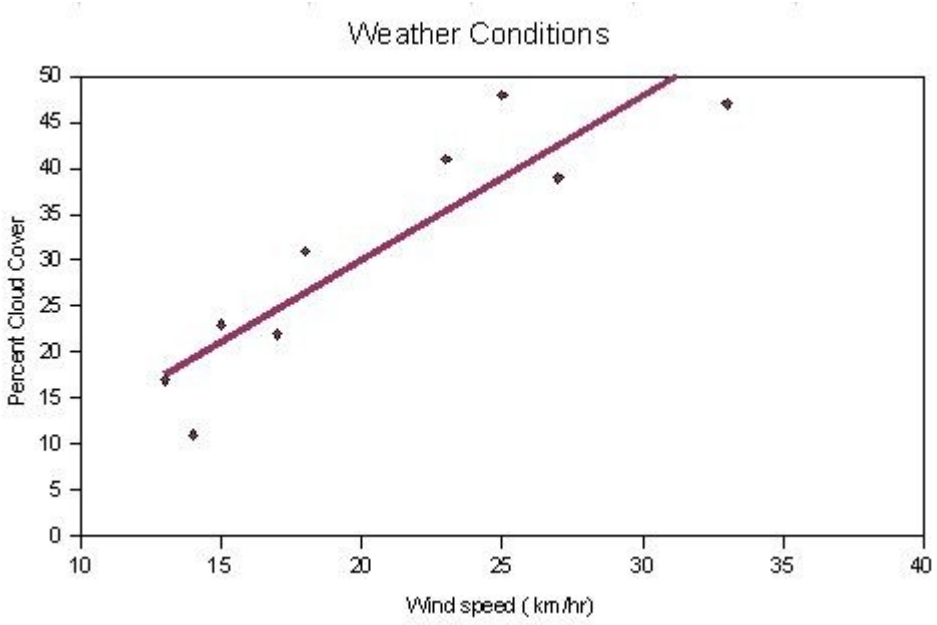

Figure 27: XY graph with linear regression line

Note Calc will graph four different kinds of regression line: Linear, logarithmic, exponential and power. If you need the coefficients for these lines, you must use the statistical functions to calculate the regressions.

Multiple data series

Thus far we have only graphed one variable against another but there are many circumstances where we wish to graph more than one y-variable against the same x-variable. For our weather graph we might want to compare the cloud cover at two different cities. We now have data from two cities. The original city was Toronto, Canada. Now a friend has sent us the same type of data for Madrid, Spain.

To update our table we will insert a new row in the spreadsheet for a new heading, add some new column labels and the data from Madrid. Figure 28 presents our new data table.

	A	B	C
1	**Weather Conditions**		
2	**Wind speed (km/hr)**	**Percent Cloud Cover**	
3		**Toronto**	**Madrid**
4	14	11	2
5	13	17	5
6	15	23	3
7	27	39	7
8	17	22	8
9	18	31	9
10	33	47	14
11	25	48	12
12	23	41	10

Figure 28: XY graphs : Modified weather data table for Toronto and Madrid

Let's see how Toronto and Madrid compare. To do this we will add another data series to our existing graph. To makes things a bit easier to see, let's get rid of that regression line for the moment. Select **Insert > Statistics > No Regression**.

To add the new column of data, right-click on the graph, select **Modify Data Range** and select the entire table again by dragging with the mouse and then click **Create**. We now have our two data series, but which one is which? We need a legend. Select **Insert > Legend**. The result is in Figure 29.

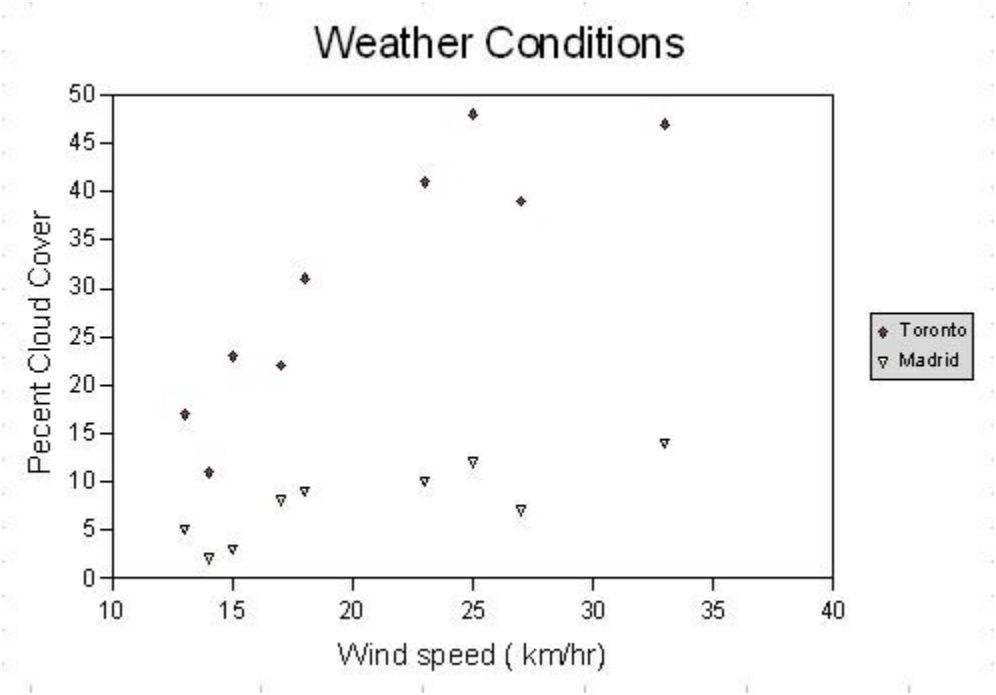

Figure 29: XY scatter plot with two data series

Editing and moving elements of the graph or chart

In Figure 29 the legend has a gray background and it uses too much space on the right-hand side of the figure. We can change the background of the legend by **Format > Legend > Area** and choosing a color. We will pick white.

There are two ways to move the legend. When we inserted the legend we were offered a choice of four different positions for the legend, Top, Bottom, Left, Right.

It is also possible to move various elements of a chart or graph; the main chart area, the legend, the main title or the axes labels by clicking on **Edit**, selecting them with the mouse and dragging them. This is what we did inFigure 30, moving the main body of the graph and the x-axis label up and to the right and then moving the legend and the title.

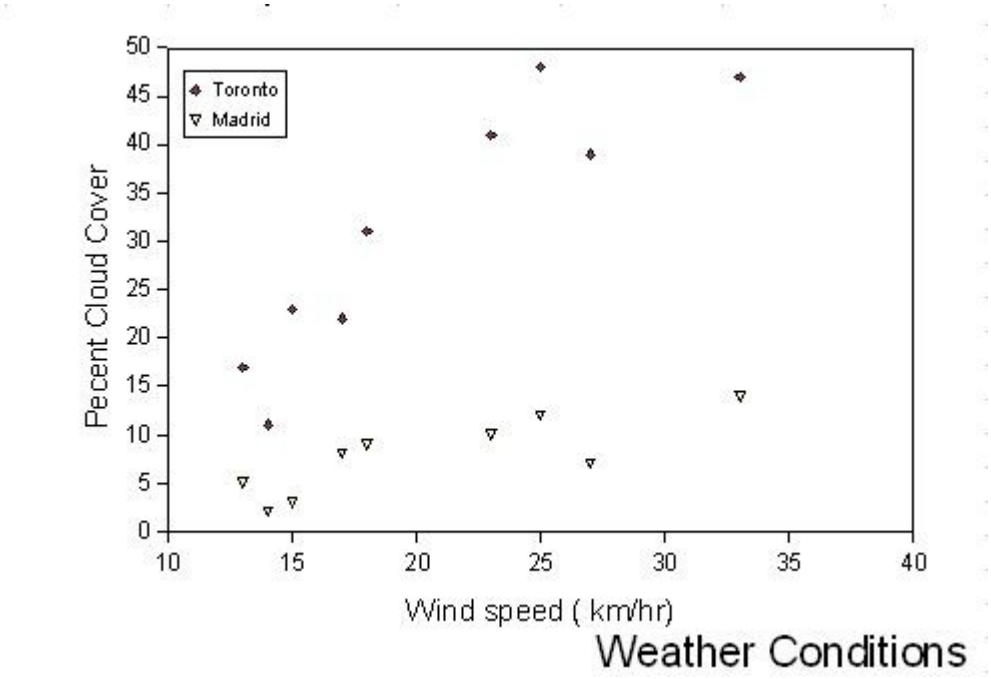

Figure 30: XY scatter plot with moved graph elements

XY – Line graph

As shown in Figure 19 we also can have line graphs. To do this using the data from the table in Figure 28:

1) Select the data and labels to be used as shown in the graph (Figure 31).
2) Create the line graph by clicking on the Chart icon in the main menu bar (see Figure 4), selecting the XY chart and then the Lines with Symbols variant.
3) Add the Title and axes labels as we have done for the scatter plot example above.

Ideally we would have simply changed the Chart Type from Scatter plot to Line with symbol, but Calc currently does not seem to sort a data series that is added to a graph.

	A	B	C
1	Weather Conditions		
2		Percent Cloud Cover	
3	Wind speed (km/hr)	Toronto	Madrid
4	14	11	2
5	13	17	5
6	15	23	3
7	27	39	7
8	17	22	8
9	18	31	9
10	33	47	14
11	25	48	12
12	23	41	10
13			
14			

Figure 31: Data selected to create an XY-Line with symbols graph

This produces the line graph in Figure 32.

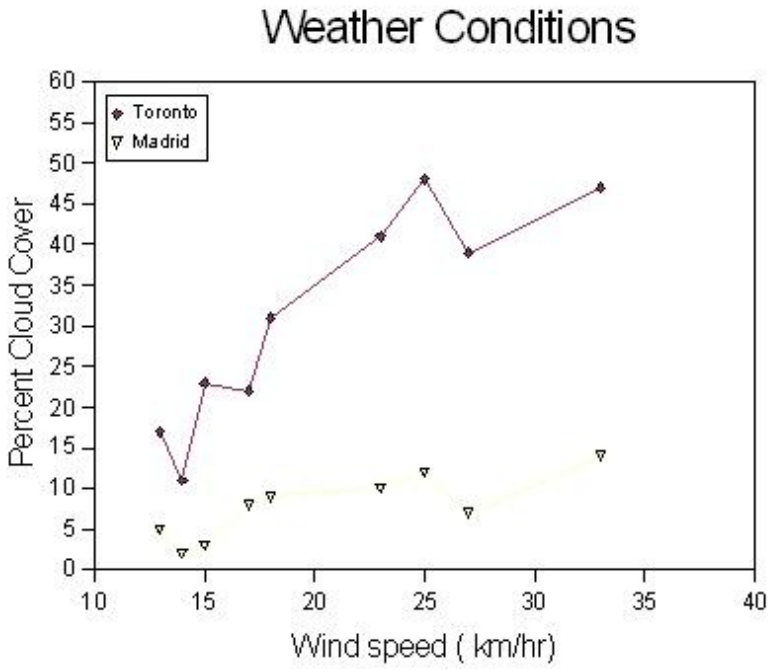

Figure 32: XY-line graph

Secondary y-axes

You may want to have a chart or graph with more than one y-axis. This can be very useful when you wish to compare trends in two or more data series but where the y-axis scales are very different.

We will use a table of made-up data (Figure 33) showing the number of hikers and the average temperature (in Celsius) in a park over a 6-month period to demonstrate this.

33		Park Usage	
34		Temp (C)	Hikers
35	Jan	5	120
36	Feb	7	100
37	Mar	13	158
38	Apr	15	198
39	May	19	211
40	Jun	22	241

Figure 33: Table of data to illustrate the use of a secondary y-axis

Plotting the data in this table produces a chart that gives a view of the trends in temperatures and the number of hikers per month, but the scale is such that we cannot easily see the changes in temperature since the temperature line is rather crushed down in the bottom of the chart.

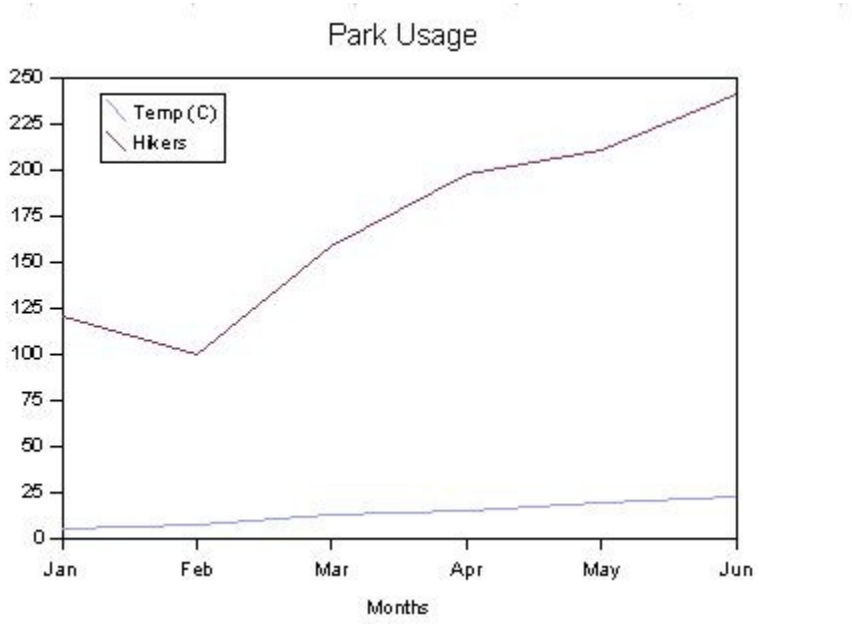

Figure 34: Line chart with a single y-axis

We have done some basic formatting, but we did not add a y-axis label because we have two different data series (Temp and Hikers) with two different kinds of scale, Degrees Celsius, and Number of Hikers.

A better approach is to graph the two data series, Temp and Hikers, against two y-axes. To do this:

1) Right-click on the chart and select **Edit**.
2) Double-click on the data series you wish to plot against a different y-axis, select **Option > Align to second y-axis** and click **OK.**

The result is shown in the chart in Figure 35.

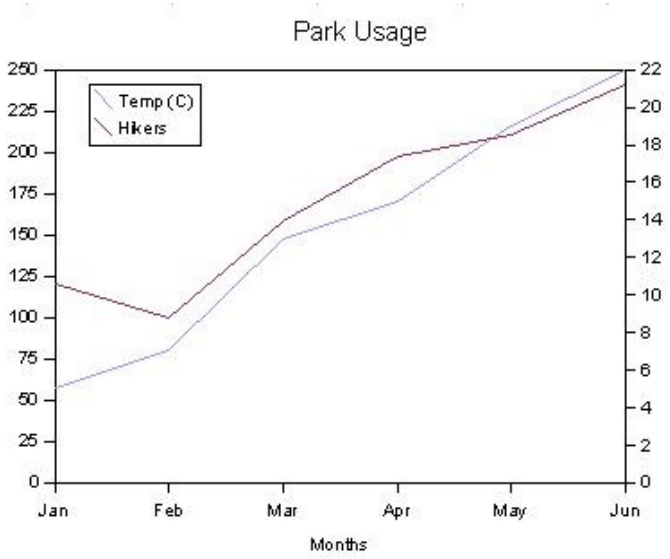

Figure 35: Line chart with primary and secondary y-axes

This change in the plotting scale for the Temp gives a much better idea of the relationship between the temperature and the number of hikers in the park. It seems to suggest that most hikers are wimps and don't hike in cold weather.

Minor formatting

Changing line colors

Double-click on a line to format it. You can also double-click on the data points to format them to some extent.

In Figure 32 notice that the yellow line for Madrid is quite hard to see. To change the color of that line, select **Edit**, hover the cursor over the line until **Data Series Madrid** appears, and then double-click on the line. Then under the **Line** tab, pick a better color. In Figure 36 we have picked *sea blue*.

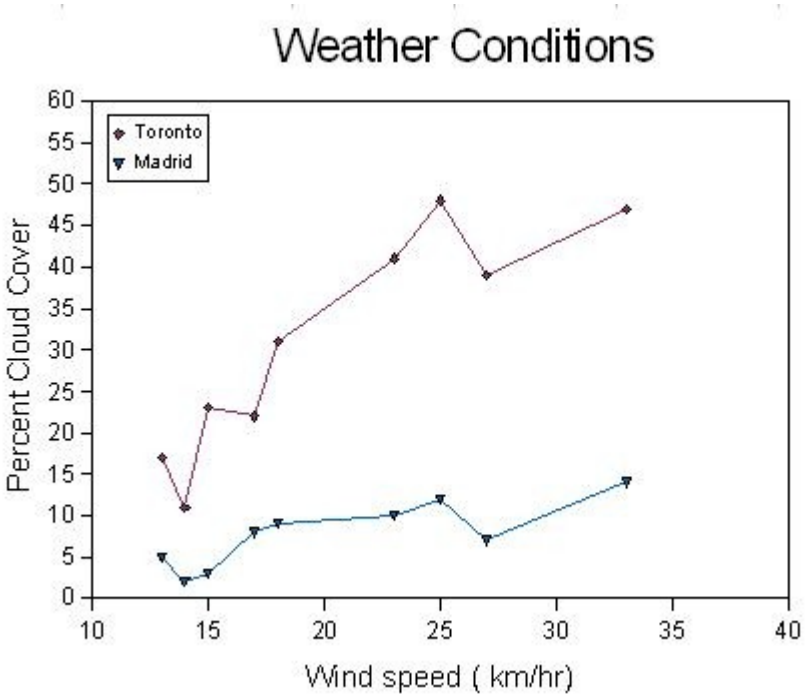

Figure 36: Changing the color of the plotting lines and symbols

We can also use this approach to have one data series as a scatter plot and another as a line We also can change the plotting symbols and lines on the same screen. See Figure 37 for some ideas.

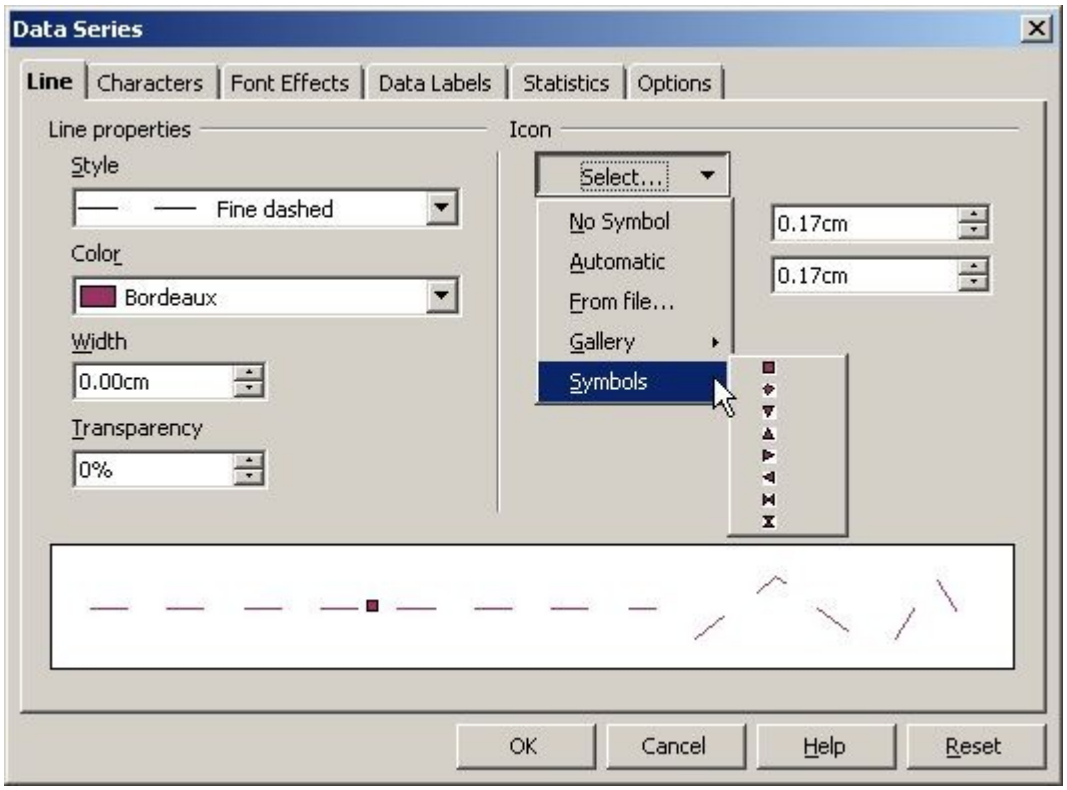

Figure 37: Various line and symbol options

Modifying axes scales

We used the data in Figure 33 and selected it as we did in Figure 2 to plot *Monthly Rentals: Canoes vs Boats* as an XY scatter plot. We have used the standard Calc defaults, except we added a Title to the graph.

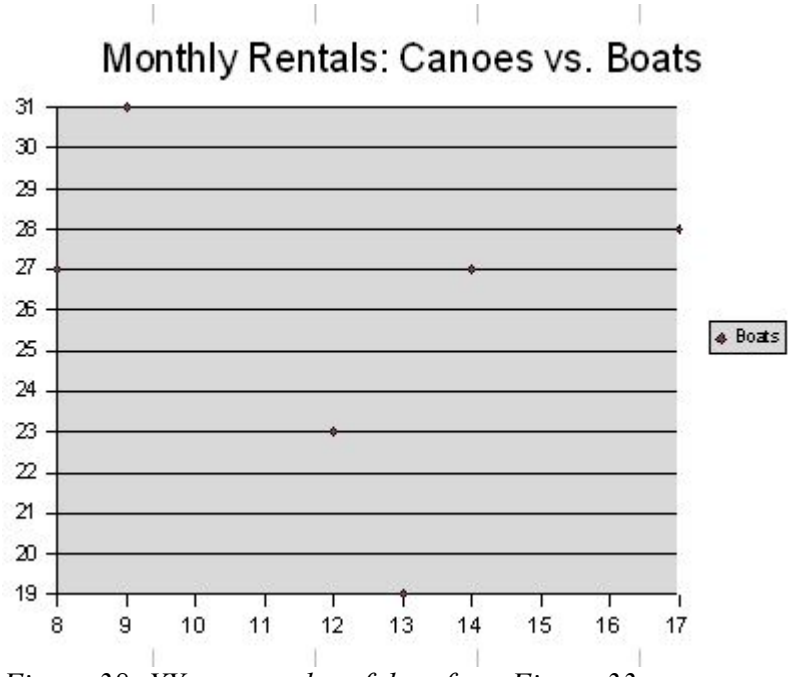

Figure 38: XY scatter plot of data from Figure 33

Figure 38 is not all that good as a graph. We are going to make a number of changes to improve its appearance:

- Change the x-and y-axes so that the data points that now are lying right on the edges of the graph are easier to see.
- Add x- and y- axis labels and a subtitle.
- Get rid of the legend since it is not needed in this situation.

Some of these we have already seen above.

To change the axes scales:

1) Double-click on the graph or **Right Click > Edit**.
2) Select **Format > Axis > X Axis** or **Right Click > Axis > X Axis**.
3) Uncheck the **Automatic** boxes.
4) Input 5 for minimum, 20 for maximum, and 5 for major interval.
5) Repeat steps 1–3 for the y-axis and input 16 for the minimum, 32 for the maximum, and 4 for the major interval.

Adding subtitles, and axis labels

To add a subtitle and add axis labels:

1) Double-click on the graph or **Right Click > Edit**.
2) Select **Insert > Title**.
3) Check the box next to **Subtitle** and enter *Year to Date*.
4) For the axis labels, check the box next to the appropriate axis and enter *Canoe* for the x-axis and *Boat* for the y-axis.

Removing the legend

In this graph, the legend is unnecessary. To remove it:

1) Double-click on the graph or **Right Click > Edit**.
2) Select **Insert > Legend** and uncheck **Display**.

All of this produces the graph in Figure 39 which is a great improvement, but in a graph like this it would be very valuable to know that each data point represented.

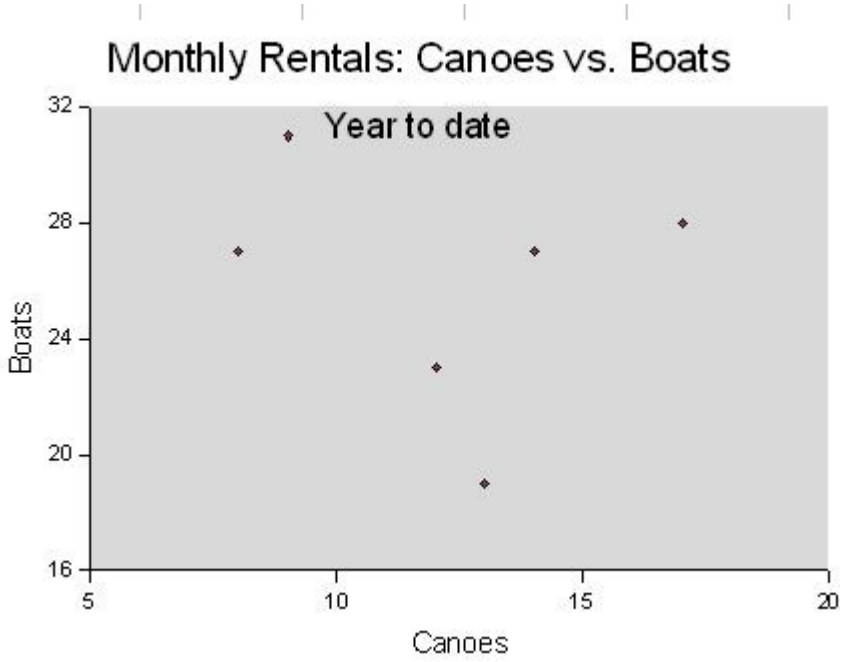

Figure 39: Modified XY chart showing added axes labels, subtitle and modified axes scales

Data labels

While it appears that canoe and boat rentals do not move smoothly together, we do not have the monthly data to make better use of the information in the graph. To see what each point in the graph in Figure 39 represents, we can add labels to the individual points, that is, we will add the names of the months to the individual data points To do this:

1) Double-click on the graph or **Right Click > Edit**.
2) Select **Insert > Data Labels**.

3) Check the **Label Text** box.

This gives the graph in Figure 40.

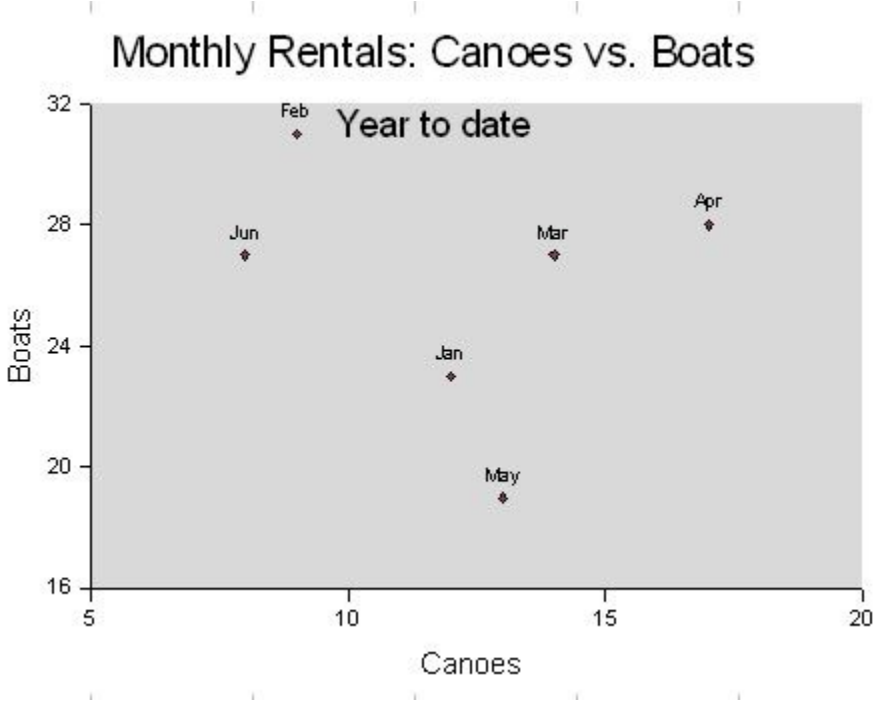

Figure 40: XY graph with data labels

Axis labels

Calc offers several ways to adjust axis labels. Figure 41 has used the data from Figure 33 to create a column chart and rotated the labels roughly 45 degrees by going **Format > X Axis > Label** and rotating the text. Other tabs allow you to modify fonts and other formattin.

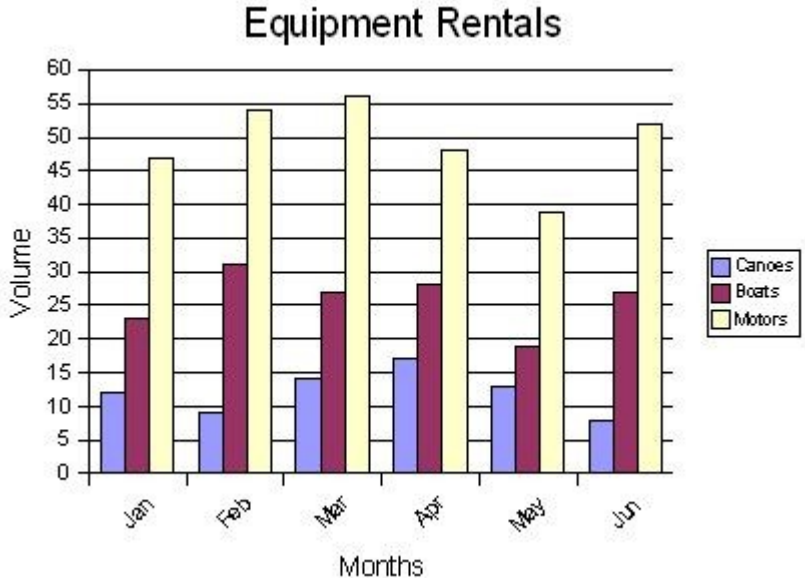

Figure 41: Column chart with rotated axis labels

Error bars

You can fit various types of error bars to a data series in a column/bar chart or an XY graph. To do this:

1) Select a data series by **Edit** and then select one of the data series and double-click as when selecting a line for editing.

2) Then go **Insert > Statistics** and click on the *error type* and *symbol type* desired.

The result is shown in Figure 42.

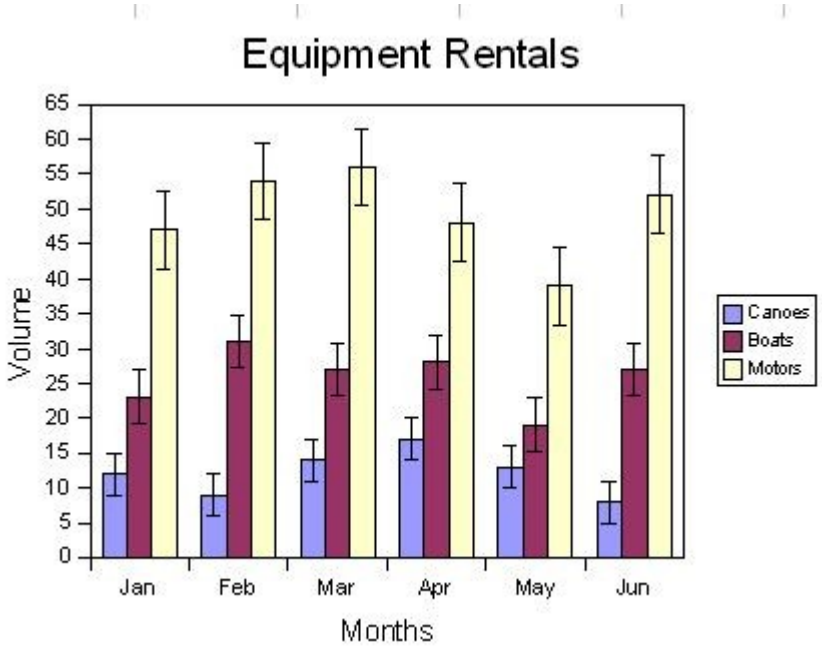

Figure 42: Bar chart with series error bars

Note that these error bars are calculated on the entire data series; that is, the error bars are equal at each point of the chart.