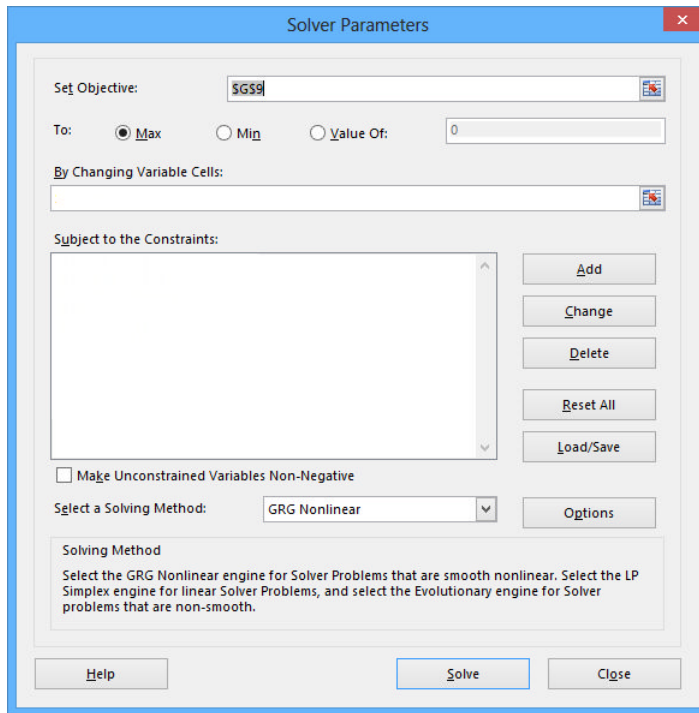After the installation is complete, Solver appears on the Data tab, in the Analysis group. Clicking Solver displays the Solver Parameters dialog box.

The first step of setting up your Solver problem is to identify the cell that contains the summary formula you want to establish as your objective. To identify that cell, click in the Set Objective box, click the target cell in the worksheet, and then select the option that represents whether you want to minimize the cell's value, maximize the cell's value, or make the cell take on a specific value. Next, you click in the By Changing Variable Cells box and select the cells Solver should vary to change the value in the objective cell.

If you want to require Solver to find solutions that use only integer values (that is, values that are whole numbers and have no decimal component), you can do so by clicking the Options button in the Solver Parameters dialog box to open the Options dialog box.
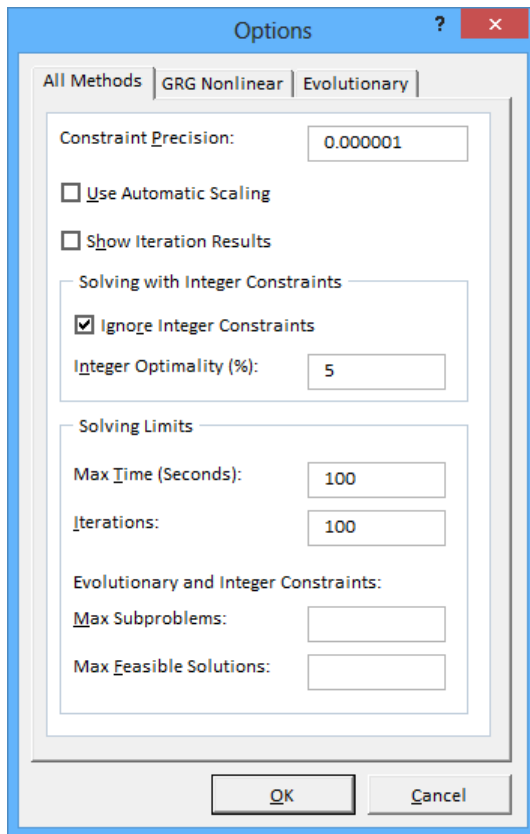
If necessary, clear the Ignore Integer Constraints check box and click OK to save your setting and return to the Solver Parameters dialog box.

Finally, you can create constraints that will set the limits for the values Solver can use. To do so, click Add to open the Add Constraint dialog box. You add constraints to the Solver problem by selecting the cells to which you want to apply the constraint, selecting the comparison operation (such as less than or equal to, greater than or equal to, or must be an integer), and clicking in the Constraint box to select the cell with the value of the constraint. You could also enter a value in the Constraint box, but referring to a cell makes it possible for you to change the constraint later without opening Solver.

TIP After you run Solver, you can use the commands in the Solver Results dialog box to save the results as changes to your worksheet or create a scenario based on the changed data.

In this exercise, you'll use Solver to determine the best mix of ads given the following constraints:

- You want to maximize the number of people who view the ads.
- You must buy at least 8 ads in three magazines and at least 10 in the fourth.
- You can't buy part of an ad (that is, all numbers must be integers).
- You can buy no more than 20 ads in any one magazine.
- You must reach at least 10,000,000 people.
- Your ad budget is $3,000,000.

➡ SET UP **You need the AdBuy workbook located in the Chapter08 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1 If the **Solver** button doesn't appear in the **Analysis** group on the **Data** tab, follow the instructions described earlier to install it.

2 In the **Analysis** group on the **Data** tab, click **Solver** to open the **Solver Parameters** dialog box.

3 In the **Solver Parameters** dialog box, click **Options** to open the **Options** dialog box.

4 On the **All Methods** page of the dialog box, clear the **Ignore Integer Constraints** check box, and then click **OK**.

5 Click in the **Set Objective** box, and then click cell **G9**. **$G$9** appears in the **Set Objective** field.

6 Click **Max**.

7   Click in the **By Changing Variable Cells** field, and select cells **E5:E8**. **$E$5:$E$8** appears in the **By Changing Variable Cells** field.

8   Click **Add** to open the **Add Constraint** dialog box.

9   Select cells **E5:E8**. **$E$5:$E$8** appears in the **Cell Reference** field.

10 In the operator list, click **int**. Then click **Add**. Excel adds the constraint to the Solver problem, and the **Add Constraint** dialog box clears to accept the next constraint.

11 Click cell **F9**. **$F$9** appears in the **Cell Reference** field. Verify that the operator **<=** appears in the operator field.

12 Click in the **Constraint** field, and then click cell **G11**. **=$G$11** appears in the **Constraint** field.
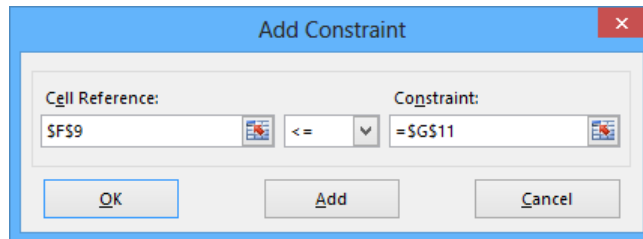
13 Click **Add**. Excel adds the constraint to the Solver problem, and the **Add Constraint** dialog box clears to accept the next constraint.

14 Click cell **G9**. **$G$9** appears in the **Cell Reference** field.

15 In the operator list, click **>=**.

16 Click in the **Constraint** field, and then click cell **G12**. **=$G$12** appears in the **Constraint** field.

17 Click **Add**. Excel adds the constraint to the Solver problem, and the **Add Constraint** dialog box clears to accept the next constraint.

8

18   Select cells **E5:E7**. **$E$5:$E$7** appears in the **Cell Reference** field.

19   In the operator list, click **>=**.

20   Click in the **Constraint** field, and then click cell **G13**. **=$G$13** appears in the
      Constraint field.
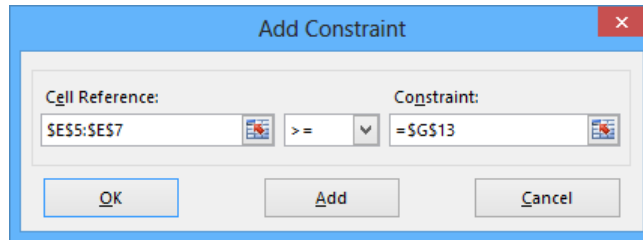
21   Click **Add**. Excel adds the constraint to the Solver problem, and the **Add Constraint**
      dialog box clears to accept the next constraint.

22   Click cell **E8**. **$E$8** appears in the **Cell Reference** field.

23   In the operator list, click **>=**.

24   Click in the **Constraint** field, and then click cell **G14**. **=$G$14** appears in the
      Constraint field.

25   Click **Add**. Excel adds the constraint to the Solver problem, and the **Add Constraint**
      dialog box clears to accept the next constraint.

26   Select cells **E5:E8**. **$E$5:$E$8** appears in the **Cell Reference** field.

27   Verify that the **<=** operator appears in the operator field, click in the **Constraint** field,
      and then click cell **G15**. **=$G$15** appears in the **Constraint** field.

28   Click **OK**. Excel adds the constraint to the Solver problem and closes the **Add
      Constraint** dialog box, and the **Solver Parameters** dialog box opens again.

29   Click **Solve**. The **Solver Results** dialog box opens, indicating that Solver found a solution. The result is displayed in the body of the worksheet.

Magazine	Cost per Ad	Readers	Number of Ads	Total Cost	Audience
Mag1	$ 30,000.00	100,000	20	$ 600,000.00	2,000,000
Mag2	$ 40,000.00	400,000	20	$ 800,000.00	8,000,000
Mag3	$ 27,000.00	350,000	20	$ 540,000.00	7,000,000
Mag4	$ 80,000.00	200,000	13	$ 1,040,000.00	2,600,000
Totals				$ 2,980,000.00	19,600,000

30   Click **OK** to close the **Solver Results** dialog box.

❌ CLEAN UP **Close the AdBuy workbook, saving your changes if you want to.**

Analyzing data by using descriptive statistics

Experienced business people can tell a lot about numbers just by looking at them, such as whether the numbers "feel right." That is, the sales figures are about where they're supposed to be for a particular hour, day, or month; the average seems about right; and sales have increased from year to year. When you need more than an informal assessment, however, you can use the tools in the Analysis ToolPak.

If the Data Analysis item isn't visible in the Analysis group on the Data tab, you can install it. To do so, click the File tab, and then click Options. In the Excel Options dialog box, click Add-Ins to display the Add-Ins page. At the bottom of the dialog box, in the Manage list, click Excel Add-Ins, and then click Go to display the Add-Ins dialog box. Select the Analysis ToolPak check box and click OK.

TIP You might be prompted for the Microsoft Office system installation CD. If so, put the CD in your CD drive, and click OK.

After the installation is complete, the Data Analysis option appears in the Analysis group on the Data tab.
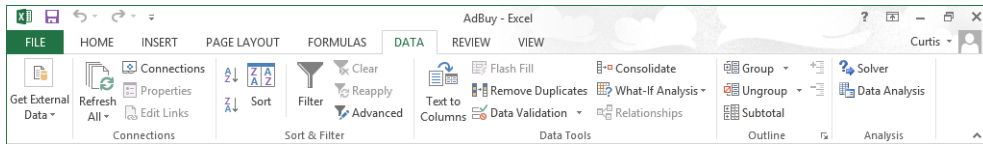

In the list that appears when you click the Data Analysis button, click the item representing the type of data analysis you want to perform, click OK, and use the commands in the resulting dialog box to analyze your data.

In this exercise, you'll use the Analysis ToolPak to generate descriptive statistics of driver sorting time data.

SET UP **You need the DriverSortTimes workbook located in the Chapter08 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1   On the **Data** tab, in the **Analysis** group, click **Data Analysis** to open the **Data Analysis** dialog box.

2   Click **Descriptive Statistics**, and then click **OK** to open the **Descriptive Statistics** dialog box.
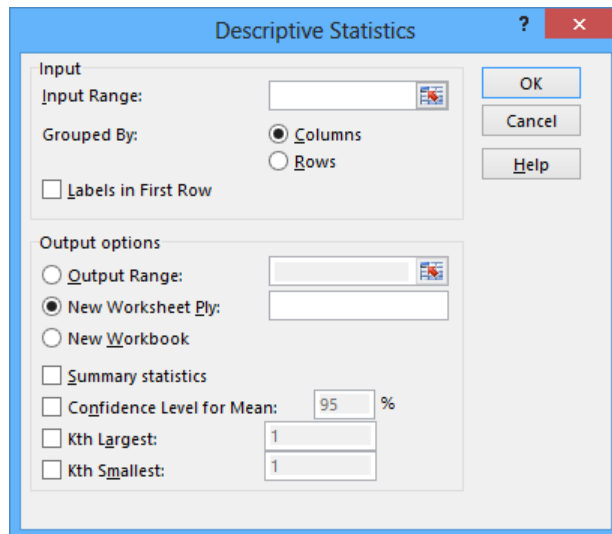
3　Click in the **Input Range** field, and then select cells **C3:C17**. **$C$3:$C$17** appears in the **Input Range** field.

4　Select the **Summary statistics** check box.

5　Click **OK**. A new worksheet that contains summary statistics about the selected data appears.

	A	B	C
1	Column1		
2			
3	Mean	120.7333	
4	Standard Error	7.036955	
5	Median	109	
6	Mode	102	
7	Standard Deviation	27.25401	
8	Sample Variance	742.781	
9	Kurtosis	-1.17215	
10	Skewness	0.642027	
11	Range	74	
12	Minimum	91	
13	Maximum	165	
14	Sum	1811	
15	Count	15	
16			

❌ CLEAN UP **Close the DriverSortTimes workbook, saving your changes if you want to.**

Key points

- The Quick Analysis Lens puts the most popular summary analysis tools at your fingertips.

- By using scenarios, you can describe many potential business cases within a single workbook.

- It's usually a good idea to create a "normal" scenario that you can use to reset your worksheet.

- Remember that you can change up to 32 cells in a scenario, but no more.

- You can summarize your scenarios on a new worksheet to compare how each scenario approaches the data.

- You can use data tables to create useful what-if scenarios by changing one or two variables that provide input to a summary formula.

- You can use Goal Seek to determine what value you need in a single cell to generate the result you want from a formula.

- If you want to vary the values in more than one cell to find the optimal mix of inputs for a calculation, use the Solver Add-In.

- Advanced statistical tools are available in the Analysis ToolPak. You can use them to examine your data thoroughly.
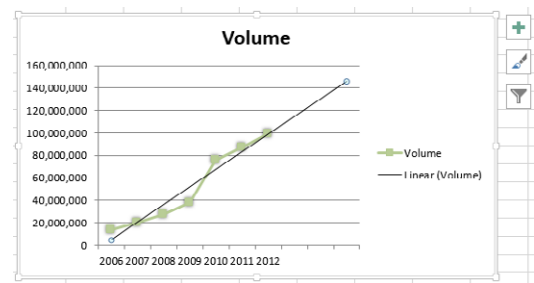
8

Chapter at a glance

Charts

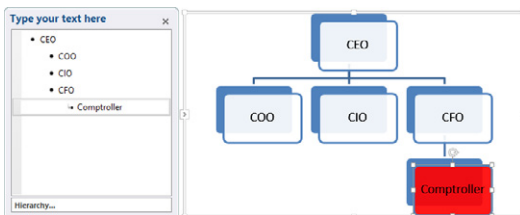Customize the appearance of charts,
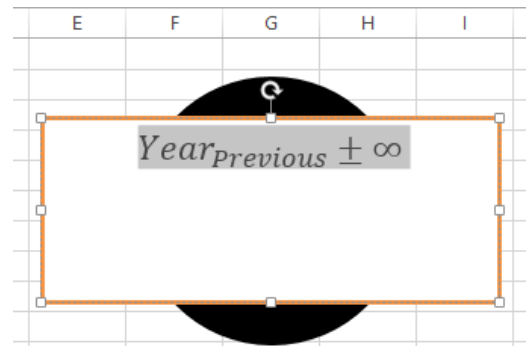page 254
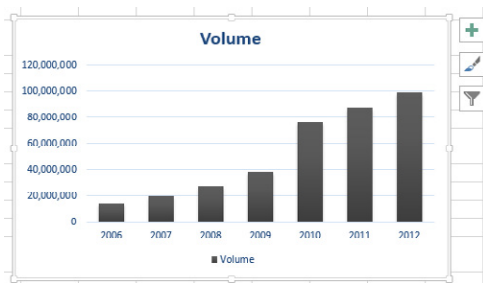
Trendlines

Find trends in your data,
page 262

Diagrams

Create diagrams by using SmartArt,
page 273

Shapes

Create shapes and mathematical equations,
page 278

Creating charts and graphics

IN THIS CHAPTER, YOU WILL LEARN HOW TO

- Create charts.

- Customize the appearance of charts.

- Find trends in your data.

- Create dual-axis charts.

- Summarize your data by using sparklines.

- Create diagrams by using SmartArt.

- Create shapes and mathematical equations.

When you enter data into a Microsoft Excel 2013 worksheet, you create a record of important events, whether they are individual sales, sales for an hour of a day, or the price of a product. However, a list of values in cells can't communicate easily the overall trends in the data. The best way to communicate trends in a large collection of data is by creating a chart, which summarizes data visually. In addition to the standard charts, with Excel 2013, you can create compact charts called sparklines, which summarize a data series by using a graph contained within a single cell.

You have a great deal of control over your charts' appearance—you can change the color of any chart element, choose a different chart type to better summarize the underlying data, and change the display properties of text and numbers in a chart. If the data in the worksheet used to create a chart represents a progression through time, such as sales over several months, you can have Excel extrapolate future sales and add a trendline to the graph that represents that prediction.

In this chapter, you'll create a chart and customize its elements, find trends in your data, create a dual-axis chart, summarize data by using sparklines, create diagrams by using SmartArt, and create shapes that contain mathematical equations.

Creating charts

With Excel 2013, you can create charts quickly by using the Quick Analysis Lens, which displays recommended charts to summarize your data. To display recommended charts, select the entire data range you want to chart, click the Quick Analysis button, and then click Charts to display the types of charts that Excel recommends.
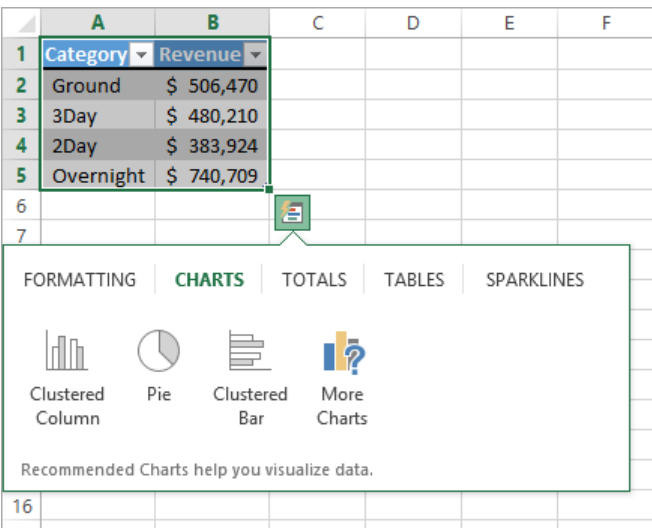
You can display a live preview of each recommended chart by pointing to the icon that represents that chart. Clicking the icon adds the chart to your worksheet.
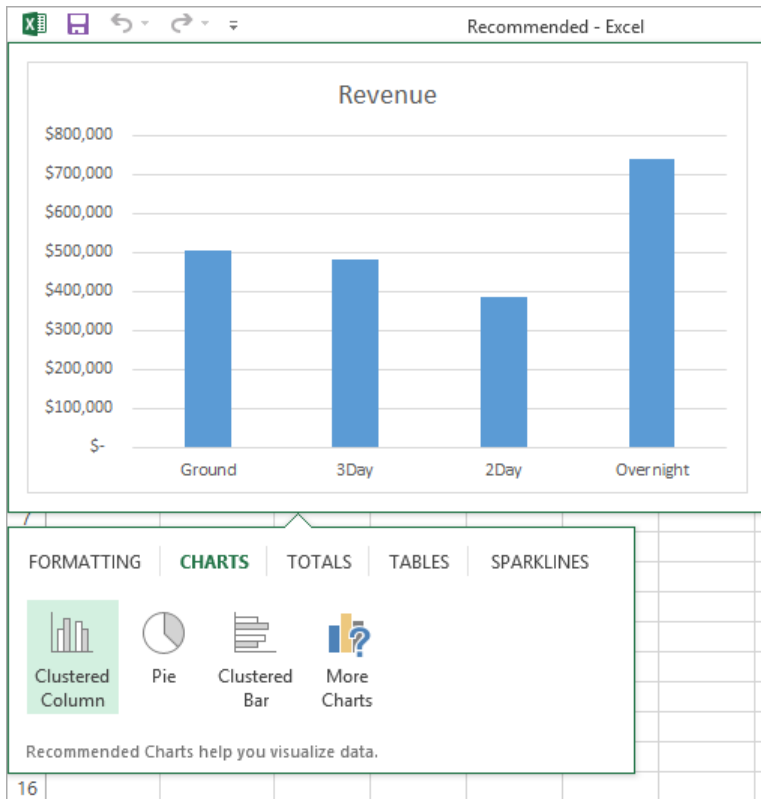
If the chart you want to create doesn't appear in the Recommended Charts gallery, select the data that you want to summarize visually and then, on the Insert tab, in the Charts group, click the type of chart that you want to create to have Excel display the available chart subtypes. When you point to a subtype, Excel displays a live preview of what the chart will look like if you click that subtype.
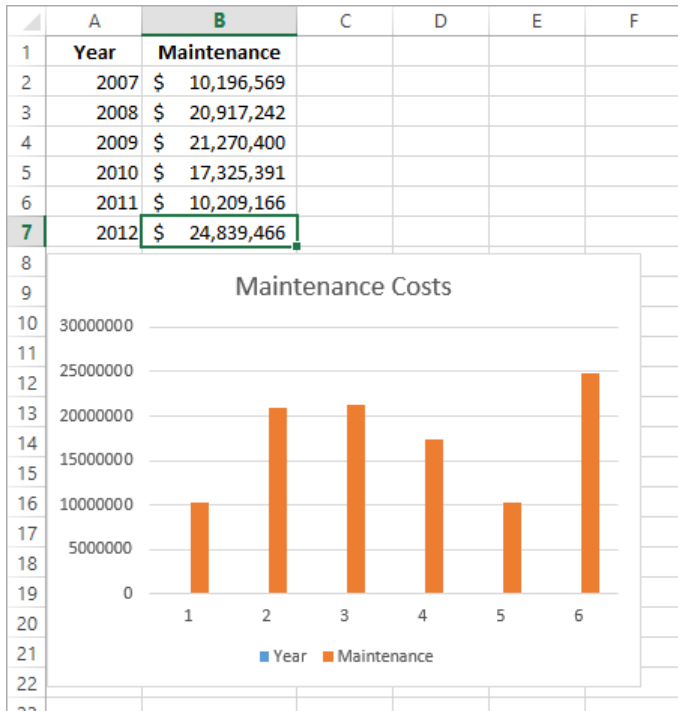
9
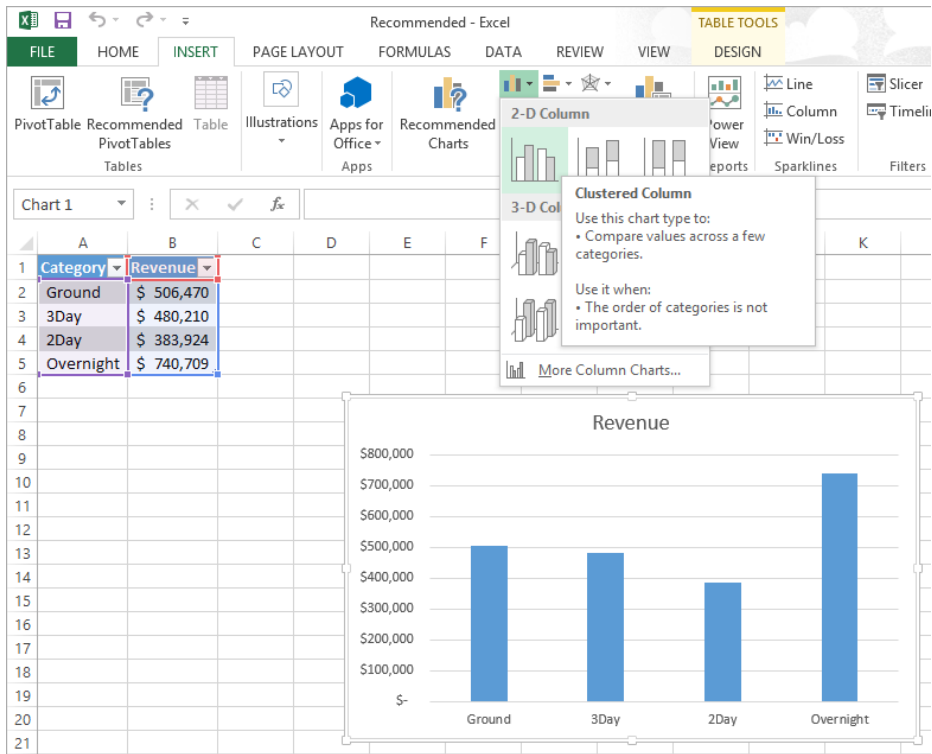
When you click a chart subtype, Excel creates the chart by using the default layout and color scheme defined in your workbook's theme.

KEYBOARD SHORTCUT Press Alt+F11 to create a chart of the default type on the current worksheet or press F11 to create a new chart sheet. Unless you or another user changed the default, Excel creates a column chart. For a complete list of keyboard shortcuts, see "Keyboard shortcuts" at the end of this book.

If Excel doesn't plot your data the way that you want it to appear, you can change the axis on which Excel plots a data column. The most common reason for incorrect data plotting is that the column to be plotted on the horizontal axis contains numerical data instead of textual data. For example, if your data includes a Year column and a Maintenance column, instead of plotting maintenance data for each consecutive year along the horizontal axis, Excel plots both of those columns in the body of the chart and creates a sequential series to provide values for the horizontal axis.

▲	A	B	C	D	E	F
1	**Year**	**Maintenance**				
2	2007	$ 10,196,569				
3	2008	$ 20,917,242				
4	2009	$ 21,270,400				
5	2010	$ 17,325,391				
6	2011	$ 10,209,166				
7	2012	$ 24,839,466				

You can change which data Excel applies to the vertical axis (also known as the *y-axis*) and the horizontal axis (also known as the *x-axis*). To make that change, select the chart and then, on the Design tab, in the Data group, click Select Data to open the Select Data Source dialog box.

9
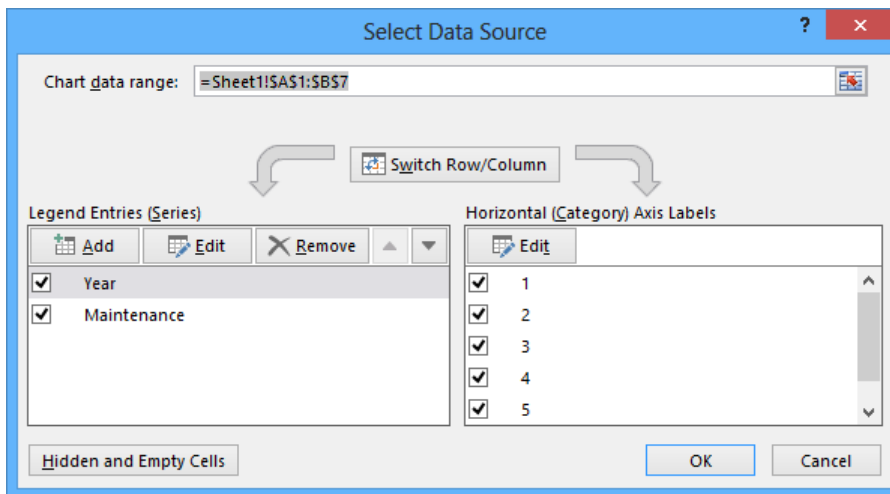
As shown in the preceding graphic, the Year column doesn't belong in the Legend Entries (Series) pane, which corresponds to a column chart's vertical axis. To remove a column from an axis, select the column's name, and then click Remove. To add the column to the Horizontal (Category) Axis Labels pane, click that pane's Edit button to display the Axis Labels dialog box, which you can use to select a range of cells on a worksheet to provide values for an axis.
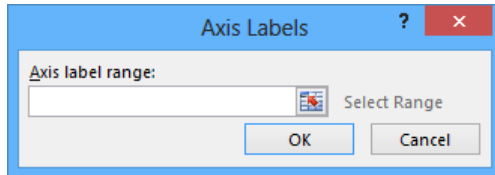
In the Axis Labels dialog box, click the Collapse Dialog button at the right edge of the Axis Label Range field, select the cells to provide the values for the horizontal axis (not including the column header, if any), click the Expand Dialog button, and then click OK. Click OK again to close the Select Data Source dialog box and revise your chart.
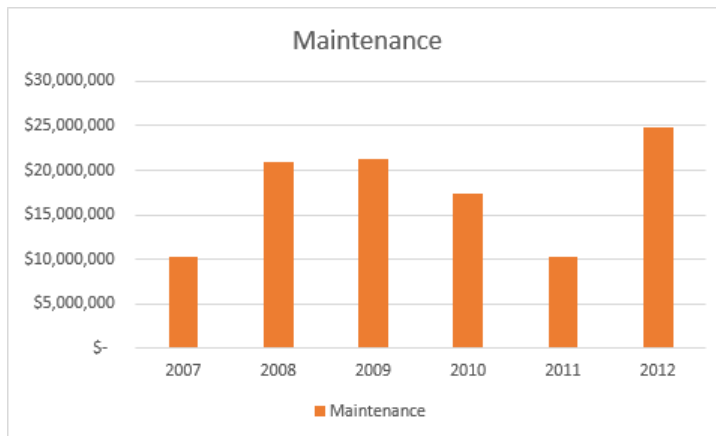

After you create your chart, you can change its size to reflect whether the chart should dominate its worksheet or take on a role as another informative element on the worksheet. For example, Gary Schare, the chief executive officer of Consolidated Messenger, could create a

workbook that summarizes the performance of each of his company's business units. In that case, he would display the chart and data for each business unit on the same worksheet, so he would want to make his charts small.

To resize a chart, select the chart, and then drag one of the handles on the chart's edges. By using the handles in the middle of the edges, you can resize the chart in one direction. When you drag a handle on the left or right edge, the chart gets narrower or wider, whereas when you drag the handles on the chart's top and bottom edges, the chart gets shorter or taller. You can drag a corner handle to change the chart's height and width at the same time; and you can hold down the Shift key as you drag the corner handle to change the chart's size without changing its proportions.

Just as you can control a chart's size, you can also control its location. To move a chart within a worksheet, drag the chart to the desired location. If you want to move the chart to a new worksheet, click the chart and then, on the Design tool tab, in the Location group, click Move Chart to open the Move Chart dialog box.
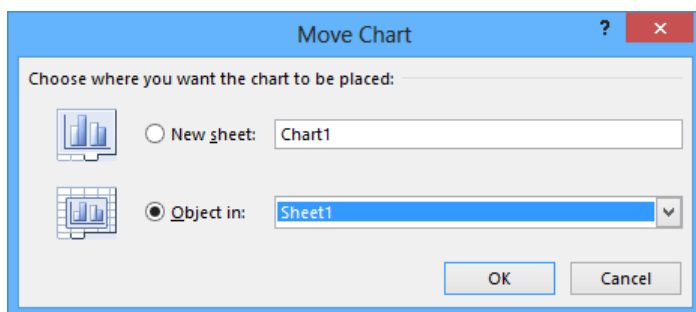
To move the chart to a new chart sheet, click New Sheet and enter the new sheet's name in the accompanying field. Clicking New Sheet creates a chart sheet that contains only your chart. You can still resize the chart on that sheet, but when Excel creates the new chart sheet, the chart takes up the full sheet.

To move the chart to an existing worksheet, click Object In and then, in the Object In list, click the worksheet to which you want to move the chart.

9

In this exercise, you'll create a chart, change how the chart plots your data, move your chart within a worksheet, and move your chart to its own chart sheet.

➡ SET UP **You need the YearlyPackageVolume workbook located in the Chapter09 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1   On the **Data** worksheet, click any cell in the Excel table, and then press **Ctrl+*** to select the entire table.

2   In the lower-right corner of the Excel table, click the **Quick Analysis** button to display tools available in the **Quick Analysis** gallery.

3   Click the **Charts** tab to display the available chart types.

4   Click **Line** to create the recommended line chart.
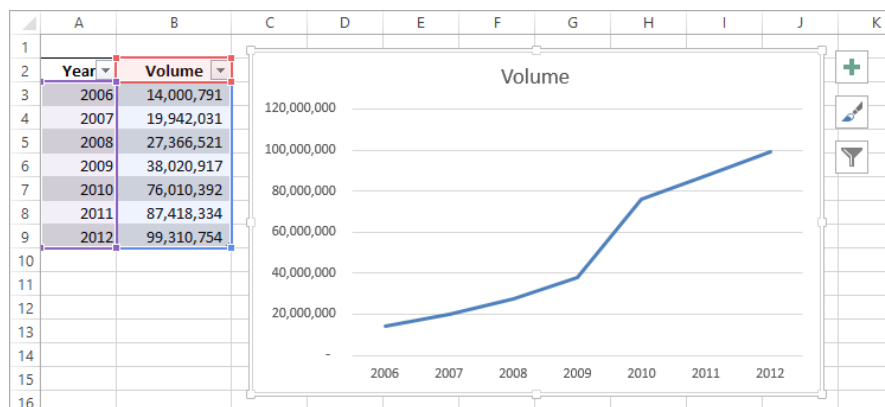
5   Press **Ctrl+Z** to undo the last action and remove the chart from your worksheet.

6   On the **Insert** tab, in the **Charts** group, click **Bar** and then, in the **2D Bar** group, click the first chart subtype, **Clustered Bar**. Excel creates the chart, with both the **Year** and **Volume** data series plotted in the body of the chart.
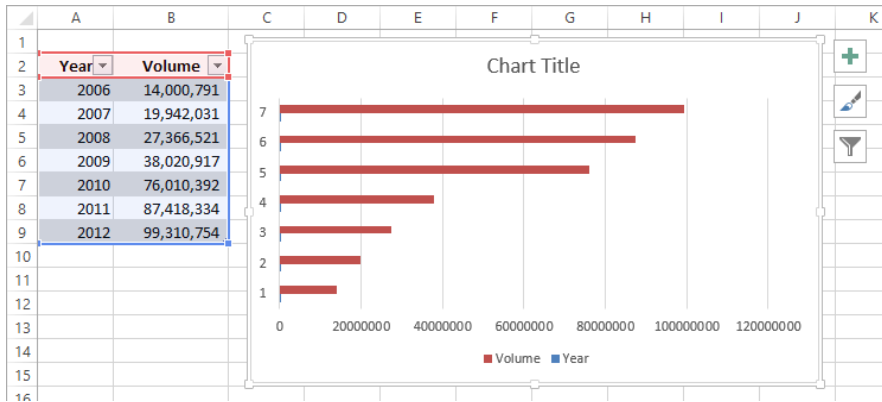
7   On the **Design** tab, in the **Data** group, click **Select Data** to open the **Select Data Source** dialog box.

8   In the **Legend Entries (Series)** area, click **Year**.

9   Click **Remove** to delete the **Year** series.

10   In the **Horizontal (Category) Axis Labels** area, click **Edit** to open the **Axis Labels** dialog box.

11   Select cells **A3:A9**, and then click **OK**. The **Axis Labels** dialog box closes, and the **Select Data Source** dialog box reappears with the years in the **Horizontal (Category) Axis Labels** area.
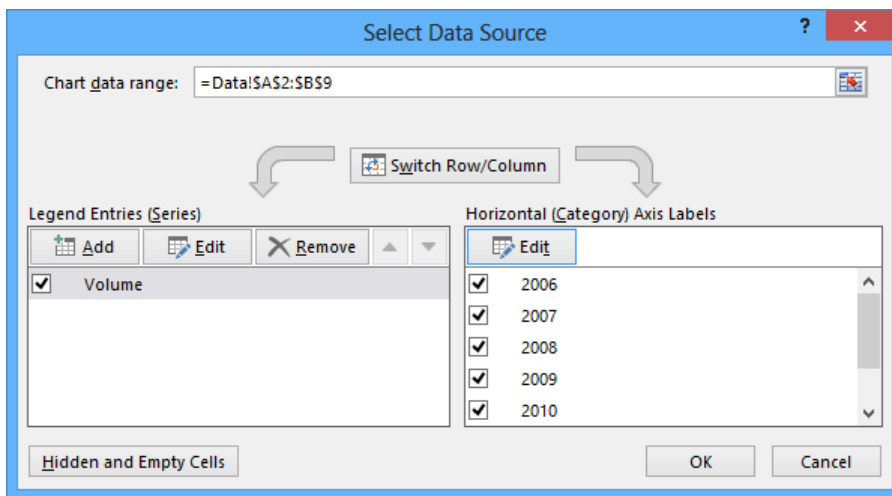
12 Click **OK**. Excel redraws your chart, using the years as the values for the horizontal axis.

13 Point to (don't click) the body of the chart, and when the pointer changes to a four-headed arrow drag the chart up and to the left so that it covers the Excel table.

14 On the **Design** tab, in the **Location** group, click **Move Chart** to open the **Move Chart** dialog box.

15 Click **New sheet**, enter **Volume Chart** in the sheet name box, and then click **OK**. Your chart appears on a chart sheet named *Volume Chart*.
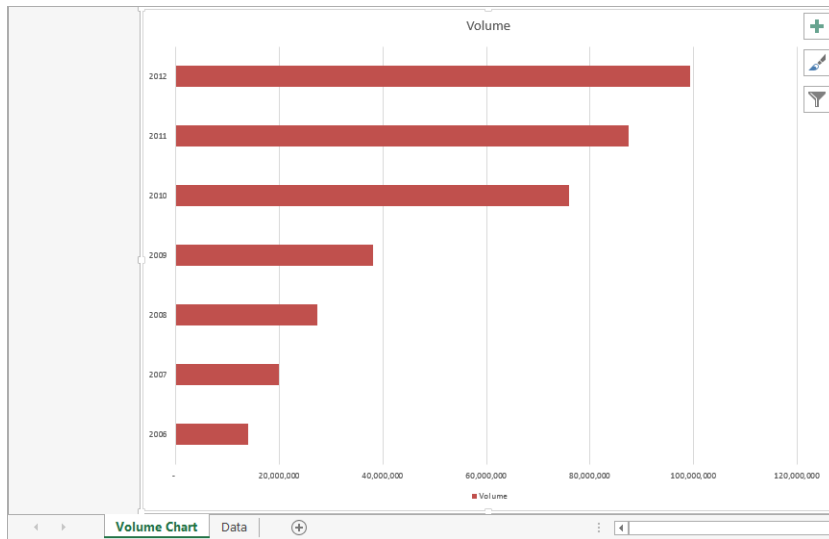
❌ CLEAN UP **Close the YearlyPackageVolume workbook, saving your changes if you want to.**

Customizing the appearance of charts

If you want to change a chart's appearance, select the chart and then click the Chart Styles button, which appears in a group of three buttons. These buttons, which are new in Excel 2013, put chart formatting and data controls within easy reach of your chart.
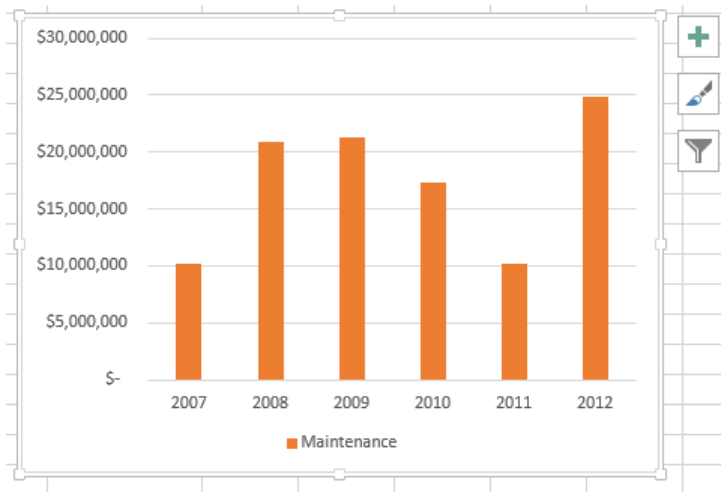
The Chart Styles gallery has two tabs: Style and Color. You can select a new look for you chart by choosing from the many styles on the Style.

TIP If you prefer to work with the ribbon, these same styles appear in the Chart Styles gallery on the Design tab.

Clicking the Color tab in the Chart Styles gallery displays a series of color schemes that you can select to change your chart's appearance.
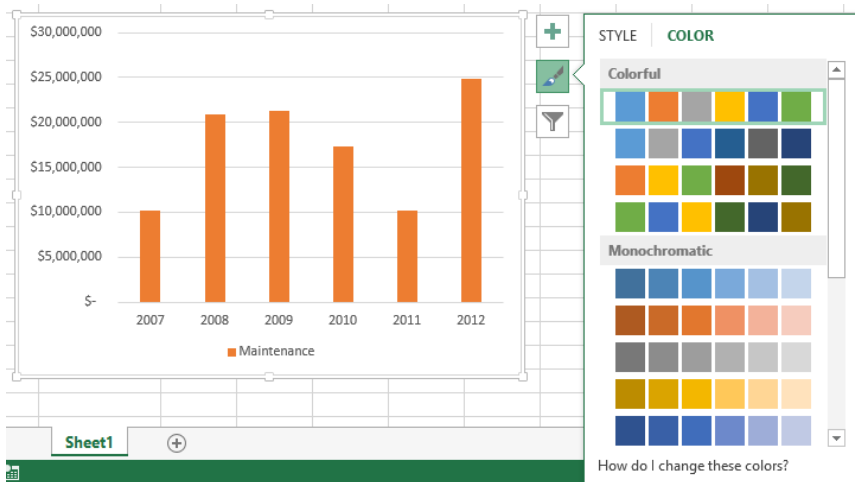
TIP The styles in the Chart Styles gallery are tied to your workbook's theme. If you change your workbook's theme, Excel changes your chart's appearance to reflect the new theme's colors.

When you create a chart by using the tools in the Charts group on the Insert tab, Excel creates an attractive chart that focuses on the data. In most cases, the chart has a title, legend (list of data series displayed in the chart), horizontal lines in the body of the chart to make it easier to discern individual values, and axis labels. If you want to create a chart that has more or different elements, such as additional data labels for each data point plotted on your chart, you can do so by selecting the chart and then, on the Design tab, in the Chart Layouts group, clicking Quick Layouts and then clicking the layout you want.
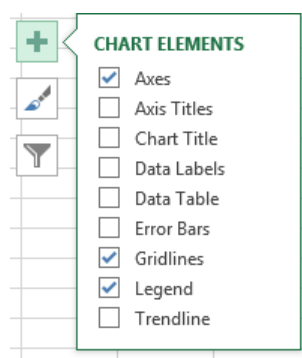
If you don't find the exact chart layout you want, you can select the chart and then click the Chart Elements action button, which appears to the right of the chart, to control each element's appearance and options.

CHART ELEMENTS
- ☑ Axes
- ☐ Axis Titles
- ☐ Chart Title
- ☐ Data Labels
- ☐ Data Table
- ☐ Error Bars
- ☑ Gridlines
- ☑ Legend
- ☐ Trendline

By selecting the Gridlines check box, you can determine whether the chart displays horizontal and vertical gridlines.

In addition to changing your chart's layout, you can control the appearance of each element within the chart. To select a chart element to format, click that element. For example, if you want to change the formatting of the data series named Volume in the column chart you created in the previous exercise, you can click any column in the series to select the entire series. Any formatting changes you make then apply to every point in the entire series. If you want to change a single data point, select the entire series, and then click the chart element (for example, a column) that represents the data point that you want to change. For example, you can highlight the column that represents the year 2011 in the chart you created in the previous exercise.

You can display a list of the selectable chart elements by selecting the chart and then, on the Format tab, in the Current Selection group, clicking the Chart Elements arrow. Then click the desired chart element to select it.
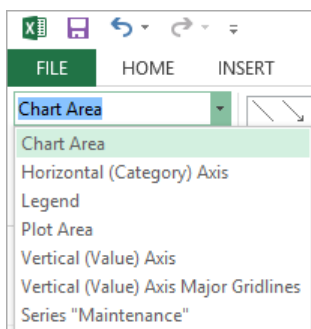
After you select the chart element, you can drag one of the element's handles to resize the element or drag the element to another location within the chart. To change the chart element's format, use the tools and dialog box launchers in the Shape Styles, Word Art Styles, Arrange, and Size groups on the Format tab to change the element's appearance. You can also select the chart element and then, on the Format tab, in the Current Selection group, click Format Selection to display a Format pane that you can use to change the chart element's appearance.
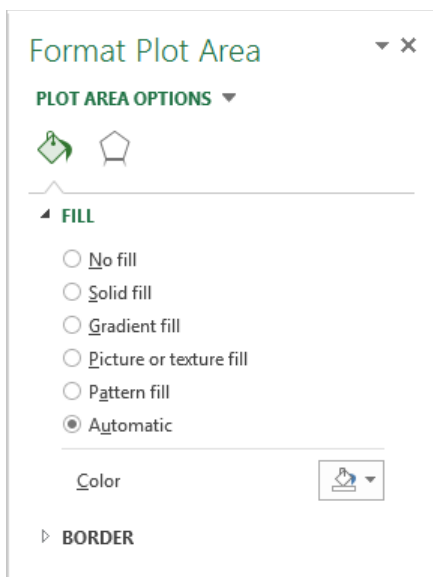
You can also display a similar set of formatting controls for a chart element by clicking the Chart Elements action button, pointing to the name of the element you want to change, clicking the right-pointing triangle that appears, and then clicking More Options. Doing so displays the pane related to that element.

With the third action button, Chart Filters, you can focus on specific data in your chart. Clicking the Chart Filters action button displays a filter interface that is very similar to that used to limit the data displayed in an Excel table.
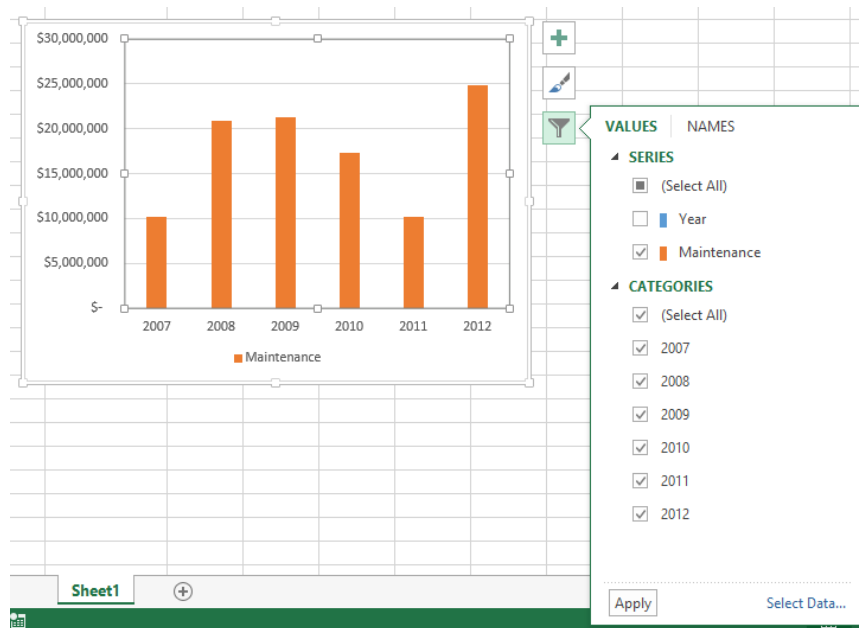
Selecting or clearing a check box displays or hides data related to a specific value within a series, which you can select as well.

If you think you want to apply the same set of changes to charts you'll create in the future, you can save your chart as a chart template. When you select the data that you want to summarize visually and apply the chart template, you'll create consistently formatted charts in a minimum of steps. To save a chart as a chart template, right-click the chart and then click Save As Template. Use the controls in the dialog box that opens to name and save your template. Then, to create a chart based on that template, select the data that you want to summarize and on the Insert tab, in the Charts group, click the dialog box launcher in the lower-right corner of the group to open the Insert Chart dialog box. On the All Charts tab, click Templates, click the template you want to use, and then click OK.

TIP You can apply a template to an existing chart by selecting the chart and then, on the Design tab, in the Type group, clicking Change Chart Type to open the Change Chart Type dialog box. Click Templates, click the template you want to use, and then click OK.

In this exercise, you'll change a chart's layout, apply a new Chart Style, change the number format of the values on the vertical axis, save the chart as a chart template, and apply the template to another chart.

➡️ SET UP **You need the VolumeByCenter workbook located in the Chapter09 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1   On the **Presentation** worksheet, select the chart.

2   On the **Design** tab, in the **Chart Layouts** group, click **Quick Layouts**, and then click the first chart layout **Layout 1**.
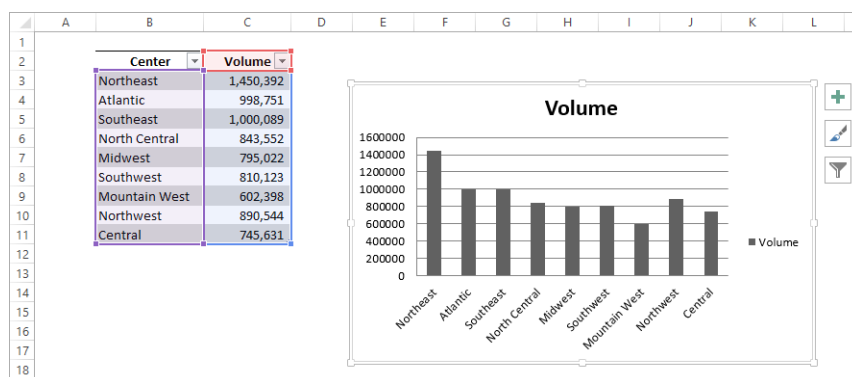
3   To the right of the chart, click the **Chart Styles** action button to display the **Chart Styles** gallery.

4   Click **Style 7** to change the chart's style.

5   Click the **Chart Styles** action button to hide the **Chart Styles** gallery.

6   Click the **Chart Elements** action button, point to the **Axes** entry, click the right-pointing triangle that appears, and then click **More Options** to display the **Format Axis** pane.

7   In the pane, click **Axis Options**, and then click **Vertical (Value) Axis**.

8   Click **Number** to display the **Number** options in the **Format Axis** pane.

9   In the **Category** list, click **Number** to display the **Number** category's style options.

10 In the **Decimal places** field, enter **0**.

11 If necessary, select the **Use 1000 Separator (,)** check box.

12 Click the pane's **Close button**. Excel closes the pane and updates the chart's appearance.
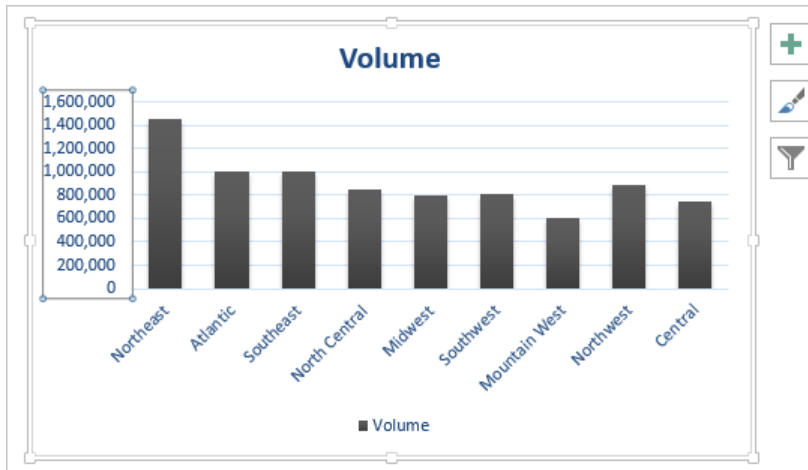
13   Right-click the chart and then click **Save As Template** to open the **Save Chart Template** dialog box.

14   In the **File name** field, enter Cool Blue.

15   Click **Save** to save your template.

16   On the tab bar, click the **Yearly Summary** sheet tab to display the **Yearly Summary** worksheet.

17   Select the chart and then, on the **Design** tab, in the **Type** group, click **Change Chart Type** to open the **Change Chart Type** dialog box.

18   Click **Templates** to display the **My Templates** list.

19   Click the **Cool Blue** custom template, and then click **OK** to apply the template to your chart.

9
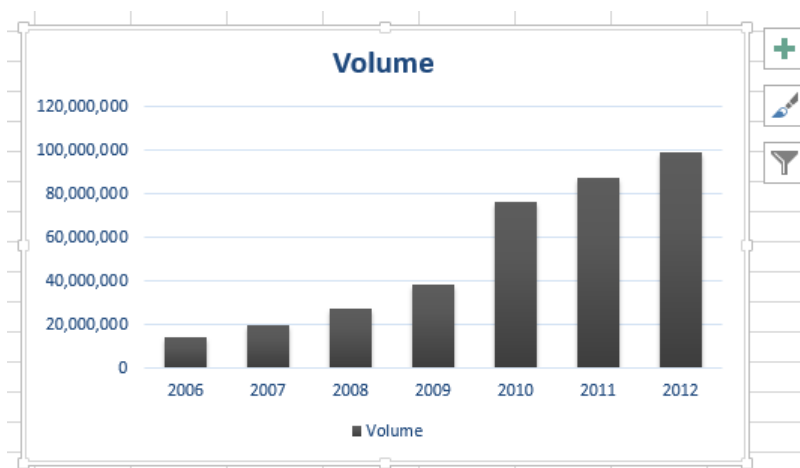
❌ CLEAN UP **Close the VolumeByCenter workbook, saving your changes if you want to.**

Finding trends in your data

You can use the data in Excel workbooks to discover how your business has performed in the past, but you can also have Excel make its best guess—for example, as to future shipping revenues if the current trend continues. Consider a graph that shows the fleet maintenance costs for the years 2006 through 2012 for Consolidated Messenger.
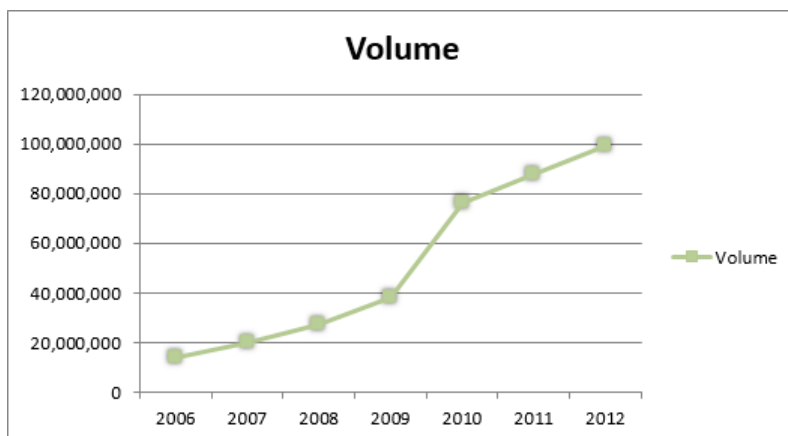
The total has increased from 2006 to 2012, but the growth hasn't been uniform, so guessing how much maintenance costs would increase if the overall trend continued would require difficult mathematical computations. Fortunately, Excel can perform that

math. To have Excel project future values in the maintenance costs data series, click the chart, click the Chart Elements action button, point to Trendline, click the right-pointing triangle that appears, and then click More Options to display the Format Trendline pane.

On the Trendline Options page of the Format Trendline pane, you can choose the data distribution that Excel should expect when it makes its projection.

TIP If you don't know which distribution to choose, use Linear, which applies to most business data. The other distributions are used for scientific and engineering applications and you will most likely know, or be told by a colleague, when to use them.

After you choose the distribution type, you can tell Excel how far ahead to project the data trend. The horizontal axis of the chart used in this example shows revenues by year from 2006 to 2012. To tell Excel how far in the future to look, enter a number in the Forecast area's Forward box. In this case, to look ahead one year, enter *1* in the Forward box, and then click OK to add the trendline to the chart.

Finding trends in your data   **263**

TIP When you click the Trendline button in the Analysis group, one of the options Excel displays is Linear Forecast Trendline, which adds a trendline with a two-period forecast.

As with other chart elements, you can double-click the trendline to open a formatting dialog box and change the line's appearance.

In this exercise, you'll add a trendline to a chart.

➡ SET UP **You need the FutureVolumes workbook located in the Chapter09 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1 Select the chart.

2 Click the **Chart Elements** action button, point to **Trendline**, click the right-pointing triangle that appears, and then click **More Options**. The **Format Trendline** pane appears.

3 If necessary, in the **Trend/Regression Type** area, click **Linear**.

4 In the **Forecast** area, in the **Forward** field, enter **3**.

5 Click the pane's **Close button** to add the trendline to the chart.
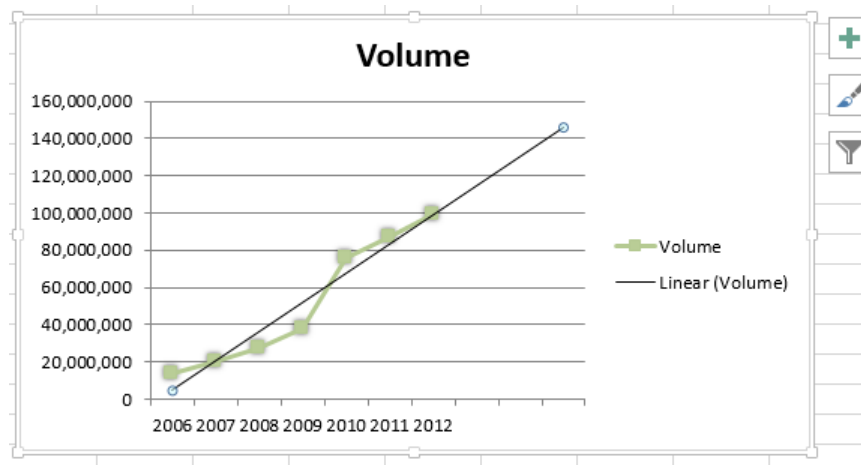
✖ CLEAN UP **Close the FutureVolumes workbook, saving your changes if you want to.**

Creating dual-axis charts

The Excel 2013 charting engine provides you with the flexibility to plot more than one data series, even if the series use two different scales. For example, Consolidated Messenger might track seasonal package volumes for each regional distribution center by category and, as part of the same data collection, track the number of improperly routed packages.

	A	B	C
1	Month	Volume	Exceptions
2	January	191,442	45
3	February	155,371	31
4	March	207,614	41
5	April	111,977	31
6	May	283,284	29
7	June	109,175	39
8	July	298,858	37
9	August	170,936	47
10	Septembe	195,520	39
11	October	134,432	34
12	Novembe	150,993	23
13	December	195,378	21
14			

When you have two differing but related data series in a table, you can summarize the data by using a dual-axis chart. To create a dual-axis chart, click any cell in the data you want to chart and then, on the Insert tab, click the type of chart you want to create. When you do, Excel plots both data series by using that chart type.

9
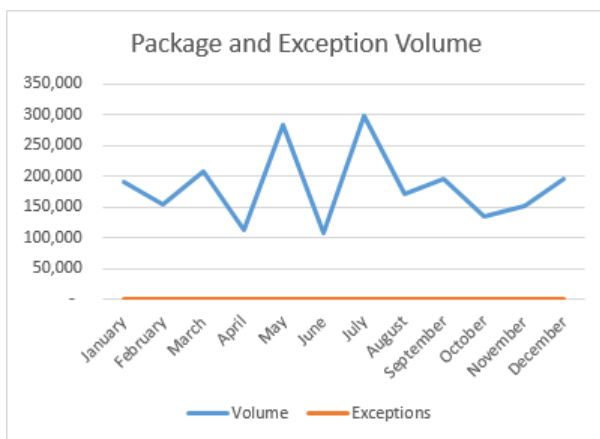
You can plot these two data series using separate axes by creating a combo chart. To do that, click the chart and then, on the Design tool tab, click Change Chart Type to display the dialog box of the same name. In the Change Chart Type dialog box, click the All Charts tab, and then click Combo to display the Combo charts page.
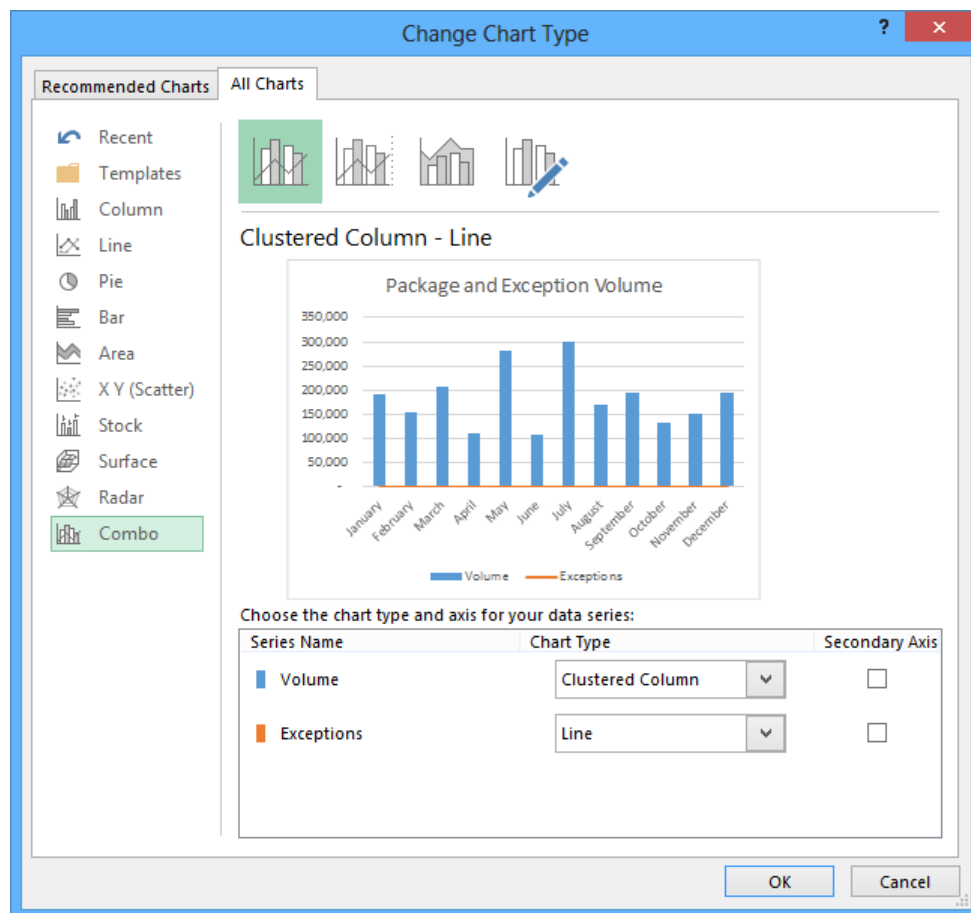
You can now use the controls in the Choose The Chart Type And Axis For Your Data Series area of the dialog box to select how to plot each series. To choose how to format a series, click the Chart Type arrow for that series and select its chart type. If you want the series to be plotted in relation to the values on the left vertical axis, leave the Secondary Axis check box cleared. To have the series plotted in relation to the values on the right vertical axis, select the Secondary Axis check box.

When you click OK, Excel creates your chart.

Package and Exception Volume
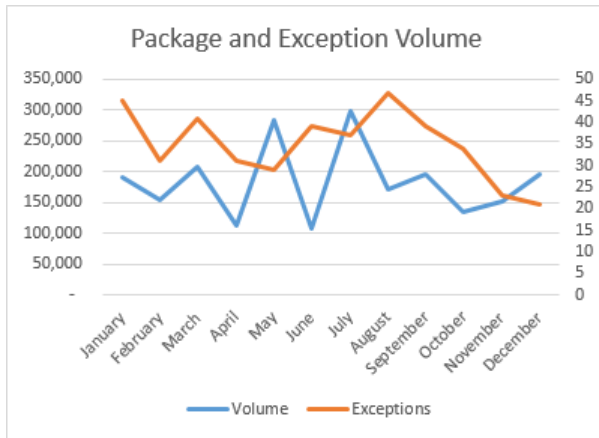
IMPORTANT Dual-axis charts that plot series with widely separated values can be visually deceiving. Be sure to read them carefully.

In this exercise, you'll create a dual-axis chart.

➡ SET UP **You need the DualAnalysis workbook located in the Chapter09 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1 Click any cell in the Excel table.

2 Click the **Insert** tab and then, in the **Charts** group, click the **Insert Column Chart** button and click the first **2D Column** chart subtype, **Clustered Column**. When you do, Excel creates a chart with the two data series.

3 Right-click the **Chart Title** text box and click **Edit Text**. Enter **Comparison** for the chart title.

4 On the **Design** tool tab, click the **Change Chart Type** button to open the **Change Chart Type** dialog box.

5 If necessary, click the **All Charts** tab to display that page of the dialog box. Then, in the list of chart types, click **Combo** to display the **Combo Chart** interface.

6 Verify that the **Volume** series will be plotted by using a **Clustered Column** chart and that the **Exceptions** series will be plotted by using a **Line** chart.

7 Select the **Secondary Axis** check box next to the **Exceptions** series. Doing so adds a second vertical axis to the right edge of the chart. The values on this axis reflect the values in the **Exceptions** series.

9
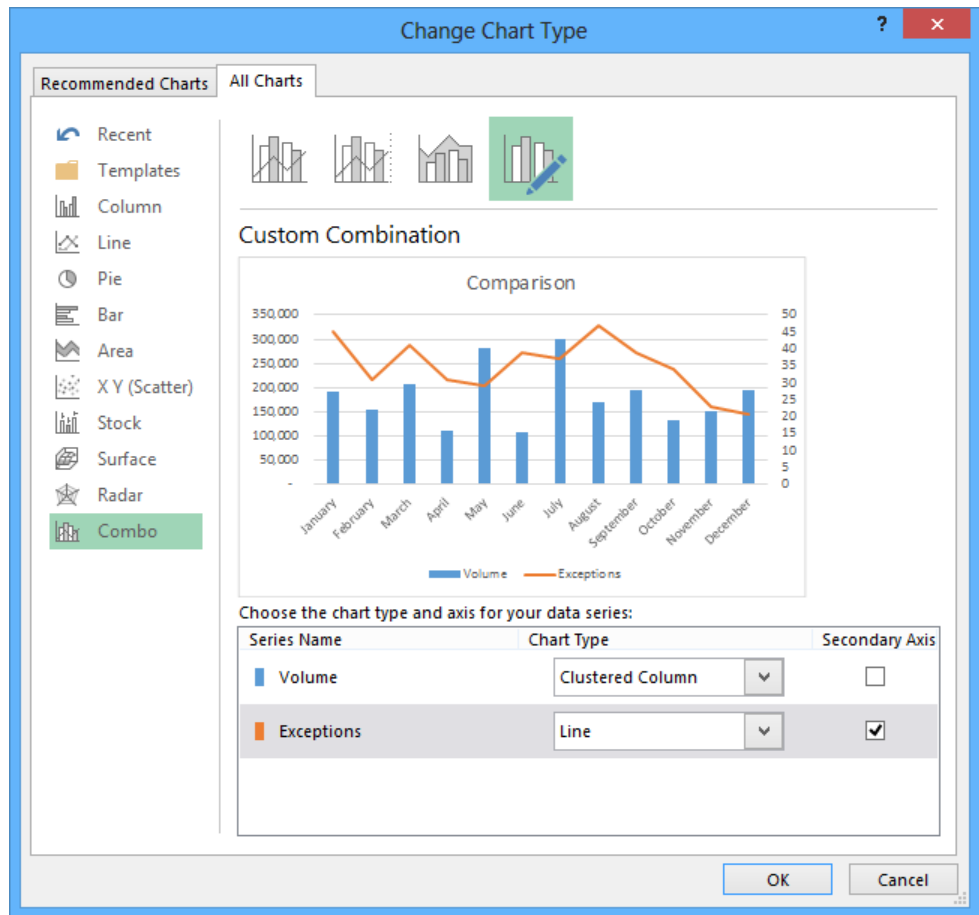
8   Click **OK** to create the chart.
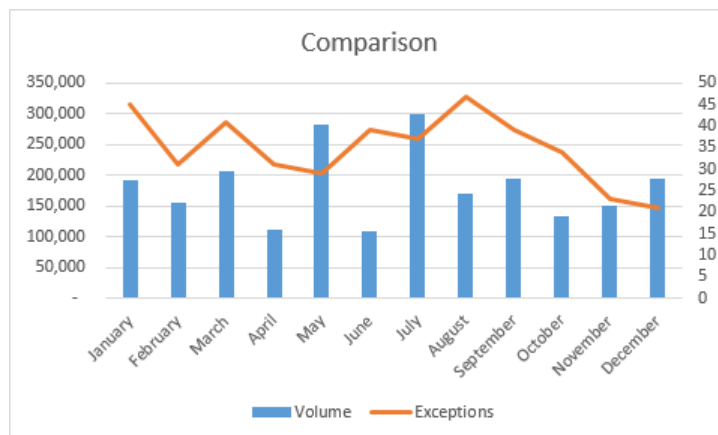
CLEAN UP Close the DualAnalysis workbook, saving your changes if you want to.

Summarizing your data by using sparklines

You can create charts in Excel workbooks to summarize your data visually by using legends, labels, and colors to highlight aspects of your data. It is possible to create very small charts to summarize your data in an overview worksheet, but you can also use *sparklines* to create compact, informative charts that provide valuable context for your data.

Edward Tufte introduced sparklines in his book *Beautiful Evidence* (Graphics Press, 2006), with the goal of creating charts that imparted their information in approximately the same space as a word of printed text. In Excel, a sparkline occupies a single cell, which makes it ideal for use in summary worksheets. As an example, suppose Lori Penor wanted to summarize the monthly revenue data for one of Consolidated Messenger's local branches.

	A	B	C	D	E	F
1						
2		**Month**	**Revenue**	**Target**	**Difference**	
3		January	$1,538,468	$1,600,000	$ (61,532)	
4		February	$1,474,289	$1,600,000	$ (125,711)	
5		March	$1,416,242	$1,600,000	$ (183,758)	
6		April	$1,685,377	$1,600,000	$ 85,377	
7		May	$1,573,046	$1,600,000	$ (26,954)	
8		June	$1,979,077	$1,600,000	$ 379,077	
9		July	$1,600,000	$1,600,000	$ -	
10		August	$2,417,226	$1,600,000	$ 817,226	
11		September	$1,872,026	$1,600,000	$ 272,026	
12		October	$2,097,478	$1,600,000	$ 497,478	
13		November	$2,876,025	$2,750,000	$ 126,025	
14		December	$3,825,430	$4,000,000	$ (174,570)	
15						

9

Lori can create three types of sparklines: line, column, and win/loss. The line and column sparklines are compact versions of the standard line and column charts. The win/loss sparkline indicates whether a cell value is positive (a win), negative (a loss), or zero (a tie). To create a line sparkline, you select the data you want to summarize and then, on the Insert tab, in the Sparklines group, click the Line button. When you do, Excel displays the Create Sparklines dialog box.
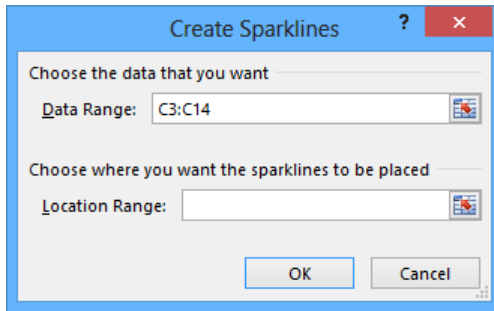
The data range you selected appears in the Data Range box. If the data range is not correct, you can click the Collapse Dialog button to the right of the Data Range box, select the correct cells, and then click the Expand Dialog button. Then, in the Location Range box, enter the address of the cell into which you want to place your sparkline. When you click OK, Excel creates a line sparkline in the cell you specified.

	B	C	D	E	F	G	H
	Month	Revenue	Target	Difference		Trend	By Month
	January	$1,538,468	$1,600,000	$ (61,532)			
	February	$1,474,289	$1,600,000	$ (125,711)			
	March	$1,416,242	$1,600,000	$ (183,758)			
	April	$1,685,377	$1,600,000	$ 85,377			
	May	$1,573,046	$1,600,000	$ (26,954)			
	June	$1,979,077	$1,600,000	$ 379,077			
	July	$1,600,000	$1,600,000	$ -			
	August	$2,417,226	$1,600,000	$ 817,226			
	September	$1,872,026	$1,600,000	$ 272,026			
	October	$2,097,478	$1,600,000	$ 497,478			
	November	$2,876,025	$2,750,000	$ 126,025			
	December	$3,825,430	$4,000,000	$ (174,570)			

You follow the same basic procedure to create a column sparkline, except that instead of clicking the Line button in the Sparklines group on the Insert tab, you click the Column button. To create a win/loss sparkline, you need to ensure that your data contains, or could contain, both positive and negative values. If you measured monthly revenue for

Consolidated Messenger, every value would be positive and the win/loss sparkline would impart no meaningful information. Comparing revenue to revenue targets, however, could result in positive, negative, or tie values, which can be meaningfully summarized by using a win/loss sparkline.

To create a win/loss sparkline, follow the same data selection process and click the Win/Loss button.

Months in which Consolidated Messenger's branch exceeded its revenue target appear in the top half of the cell in blue, months in which the branch fell short of its target appear in the bottom half of the cell in red, and the month in which the revenue was exactly the same as the target is blank.

After you create a sparkline, you can change its appearance. Because a sparkline takes up the entire interior of a single cell, resizing that cell's row or column resizes the sparkline. You can also change a sparkline's formatting. When you click a sparkline, Excel displays the Design tool tab.
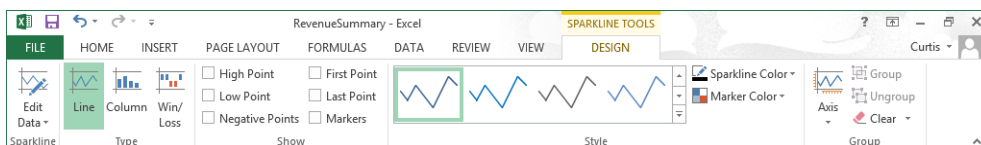
You can use the tools on the Design tool tab to select a new style; show or hide value markers; change the color of your sparkline or the markers; edit the data used to create the sparkline; modify the labels on the sparkline's axes; or group, ungroup, or clear sparklines. You can't delete a sparkline by clicking its cell and then pressing the Delete or Backspace key—you must click the cell and then, on the Design tool tab, click the Clear button.

TIP Remember that sparklines work best when displayed in compact form. If you find yourself adding markers and labels to a sparkline, you might consider using a regular chart to take advantage of its wider range of formatting and customization options.

In this exercise, you'll create a line, column, and win/loss sparkline, change the sparkline's formatting, and clear a sparkline from a cell.

SET UP **You need the RevenueSummary workbook located in the Chapter09 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1   Select the cell range **C3:C14**.

2   On the **Insert** tab, in the **Sparklines** group, click **Line** to open the **Create Sparklines** dialog box.

3   Verify that **C3:C14** appears in the **Data Range** box. Then, in the **Location Range** box, enter **G3** and click **OK**. Excel creates a line sparkline in cell **G3**.

4   Select the cell range **C3:C14**.

5   On the **Insert** tab, in the **Sparklines** group, click **Column**. The **Create Sparklines** dialog box opens again.

6   Verify that **C3:C14** appears in the **Data Range** box. Then, in the **Location Range** box, enter **H3** and click **OK**. Excel creates a column sparkline in cell **H3**.

7   Drag the right edge of the column **H** header to the right until the cell's width is approximately doubled. Excel displays more details in the sparkline.
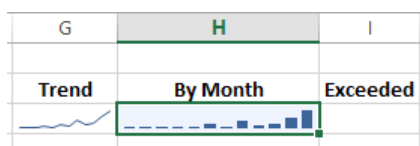
8   Select the cell range **E3:E14**.

9   On the **Insert** tab, in the **Sparklines** group, click **Win/Loss**. The **Create Sparklines** dialog box opens again.

10   Verify that **E3:E14** appears in the **Data Range** box. Then, in the **Location Range** box, enter **I3** and click **OK**. Excel creates a win/loss sparkline in cell **I3**.

11   With cell **I3** still selected, on the **Design** tool tab, in the **Style** gallery, click the right-most sparkline style. Excel changes the win/loss sparkline's appearance.

12 Click cell **G3** and then, on the **Design** tool tab, in the **Group** group, click the **Clear** button and then click **Clear Selected Sparkline**. The sparkline disappears.

❌ CLEAN UP **Close the RevenueSummary workbook, saving your changes if you want to.**

Creating diagrams by using SmartArt

As an international delivery company, Consolidated Messenger's business processes are quite complex. Many times, chief operating officer Lori Penor summarizes the company's processes for the board of directors by creating diagrams. Excel has just the tool she needs to create those diagrams: SmartArt. To create a SmartArt graphic, on the Insert tab, in the Illustrations group, click SmartArt to display the Choose A SmartArt Graphic dialog box.
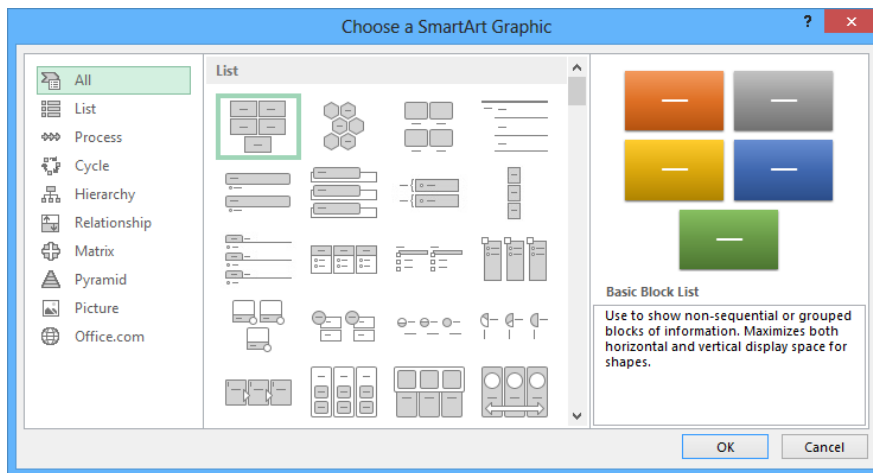
When you click one of the thumbnails in the center pane of the Choose A SmartArt Graphic dialog box, Excel displays a description of the diagram type you selected in the rightmost pane of the dialog box. Clicking All displays every available SmartArt graphic type. The following table lists the types of diagrams you can create by using the Choose A SmartArt Graphic dialog box.

TIP The Office.com category contains SmartArt diagrams available online through Office.com.

| Diagram	Description
List	Shows a series of items that typically require a large amount of text to explain
Process	Shows a progression of sequential steps through a task, process, or workflow
Cycle	Shows a process with a continuous cycle or relationships of core elements
Hierarchy	Shows hierarchical relationships, such as those within a company
Relationship	Shows the relationships between two or more items
Matrix	Shows the relationship of components to a whole by using quadrants
Pyramid	Shows proportional, foundation-based, or hierarchical relationships such as a series of skills
Picture	Shows one or more images with captions

TIP Some of the diagram types can be used to illustrate several types of relationships. Be sure to examine all your options before you decide on the type of diagram to use to illustrate your point.

After you click the button that represents the type of diagram you want to create, click OK to add the diagram to your worksheet.
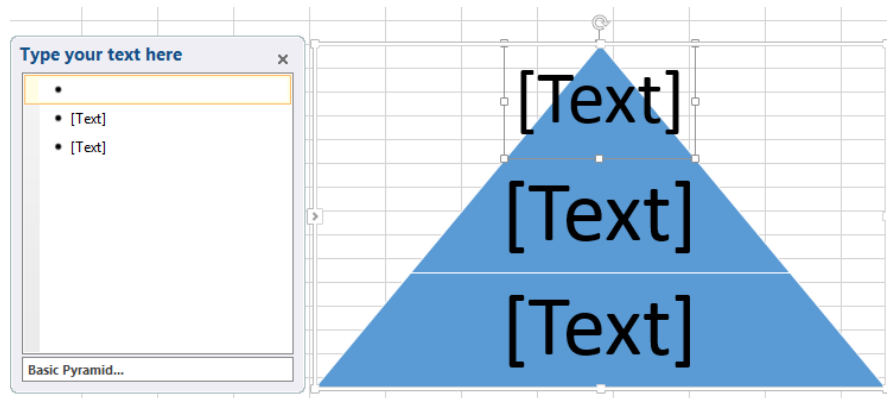
While the diagram is selected, Excel displays the Design and Format tool tabs. You can use the tools on the Design tool tab to change the graphic's layout, style, or color scheme. The Design tool tab also contains the Create Graphic group, which is home to tools you can use to add a shape to the SmartArt graphic, add text to the graphic, and promote or demote shapes within the graphic.

As an example, consider a process diagram that describes how Consolidated Messenger handles a package within one of the company's regional distribution centers.
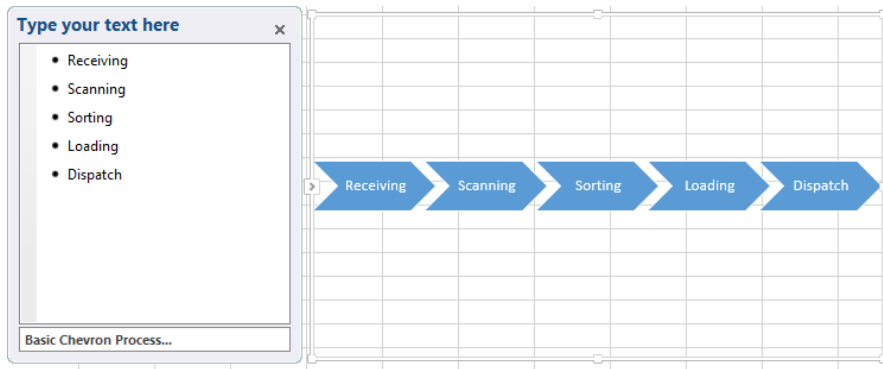
In the text pane, located to the left of the SmartArt graphic, you can add text to a shape without having to click and type within the shape. If you enter the process steps in the wrong order, you can move a shape by right-clicking the shape you want to move and then clicking Cut on the shortcut menu that appears. To paste the shape back into the graphic, right-click the shape to the left of where you want the pasted shape to appear, and then click Paste. For example, if you have a five-step process and accidentally switch the second and third steps, you can move the third step to the second position by right-clicking the third step, clicking Cut, right-clicking the first shape, and then clicking Paste.

If you want to add a shape to a SmartArt graphic, to add a step to a process, for instance, click a shape next to the position you want the new shape to occupy and then, on the Design tool tab, in the Create Graphic group, click Add Shape, and then click the option that represents where you want the new shape to appear in relation to the selected shape.

TIP The options that appear when you click Add Shape depend on the type of SmartArt graphic you created and which graphic element is selected. For instance, the options for an organizational chart are Add Shape After, Add Shape Before, Add Shape Above, Add Shape Below, and Add Assistant.

You can edit the graphic's elements by using the buttons on the Format tool tab or by right-clicking the shape and then clicking Format Shape to display the Format Shape pane. If you have selected the text in a shape, you can use the tools in the Font group on the Home tab to change the text's appearance.

TIP You can use the controls in the Format Shape dialog box to change the shape's fill color, borders, shadow, three-dimensional appearance, and text box properties.

In this exercise, you'll create an organization chart, fill in the shapes, delete a shape, add a shape, change the layout of the diagram without changing the information it embodies, and change the formatting of one of the diagram elements.

➡ SET UP **You need the OrgChart workbook located in the Chapter09 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1 On the **Insert** tab, in the **Illustrations** group, click **SmartArt** to open the **Choose a SmartArt Graphic** dialog box.

2 Click **Hierarchy** to display the **Hierarchy** graphic subtypes.
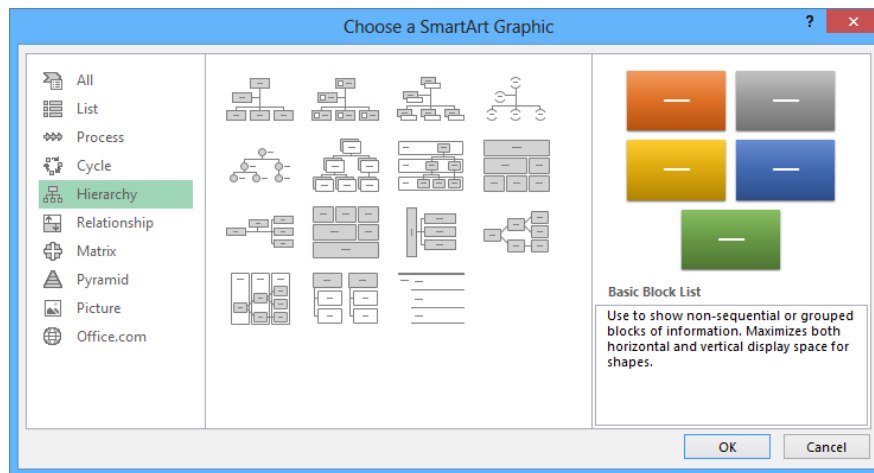
3 Click the first subtype (**Organization Chart**), and then click **OK**. Excel creates the organization chart graphic.

4 In the **Type your text here** pane, in the first text box, enter **CEO**, and then press the **Down Arrow** key. The value *CEO* appears in the shape at the top level of the organization chart.

5 In the SmartArt diagram, right-click the assistant box, located below and to the left of the **CEO** shape, and then click **Cut**. Excel removes the shape and moves the shapes on the third level of the organization chart to the second level.
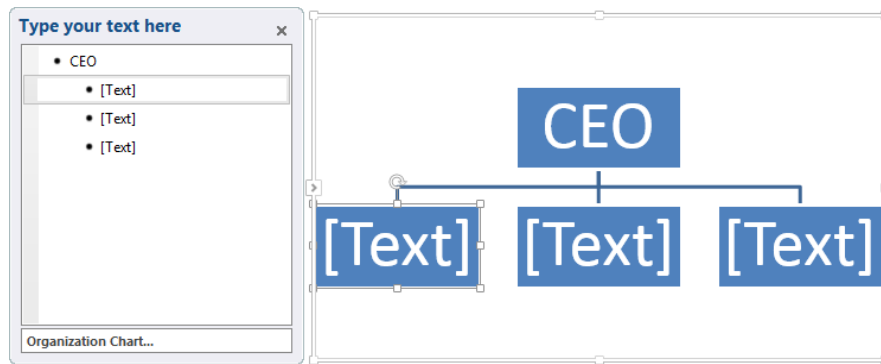
6 Click the leftmost shape on the second level of the organization chart, and then enter **COO**.

7 Click the middle shape on the second level of the organization chart, and then enter **CIO**.

8 Click the rightmost shape on the second level of the organization chart, and then enter **CFO**.

9 Click the **CFO** shape. On the **Design** tool tab, in the **Create Graphic** group, in the **Add Shape** list, click **Add Shape Below**. A new shape appears below the **CFO** shape.

10 In the new shape, type **Comptroller**.

11 On the **Design** tool tab, in the **Layouts** group, click the second layout from the left on the second line of layouts. Excel applies the new layout to your organization chart.
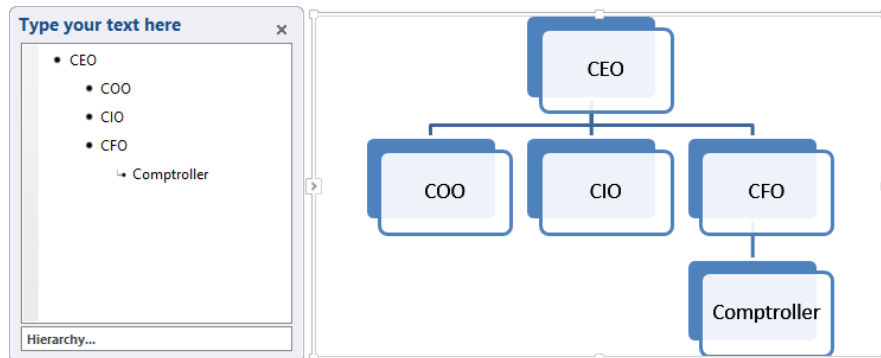
12   Right-click the **Comptroller** shape, and then click **Format Shape** to display the **Format Shape** pane.

13   If necessary, click the **Fill** category to display the fill options.

14   Verify that the **Solid fill** option is selected, click the **Color** button and then, in the **Standard Colors** area of the color picker, click the red swatch.

15   Click **Close**. Excel changes the shape's fill to red.
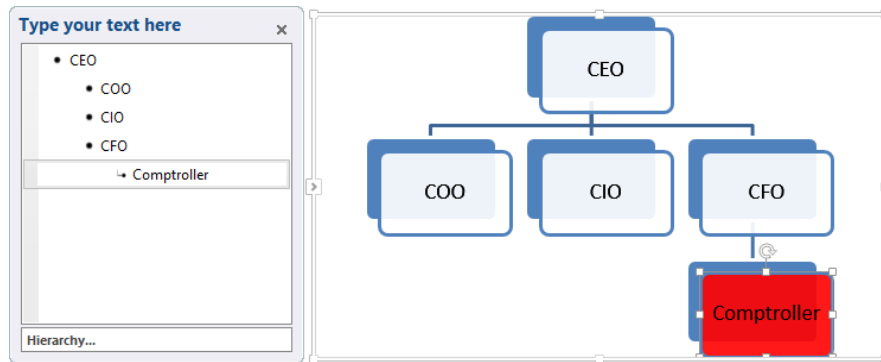
❌ CLEAN UP **Close the OrgChart workbook, saving your changes if you want to.**

Creating shapes and mathematical equations

With Excel, you can analyze your worksheet data in many ways, including summarizing your data and business processes visually by using charts and SmartArt. You can also augment your worksheets by adding objects such as geometric shapes, lines, flowchart symbols, and banners.

To add a shape to your worksheet, click the Insert tab and then, in the Illustrations group, click the Shapes button to display the shapes available. When you click a shape in the gallery, the pointer changes from a white arrow to a thin black crosshair. To draw your shape, click anywhere in the worksheet and drag the pointer until your shape is the size you want. When you release the mouse button, your shape appears and Excel displays the Format tool tab on the ribbon.
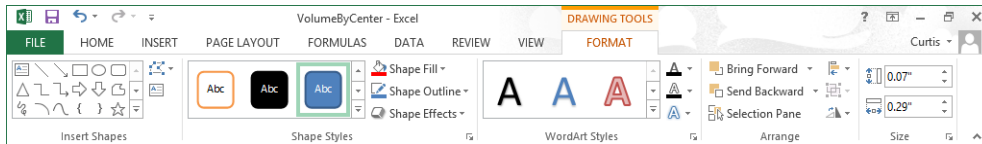
TIP Holding down the Shift key while you draw a shape keeps the shape's proportions constant. For example, clicking the Rectangle tool and then holding down the Shift key while you draw the shape causes you to draw a square.

You can resize a shape by clicking the shape and then dragging one of the resizing handles around the edge of the shape. You can drag a handle on a side of the shape to drag that side to a new position; when you drag a handle on the corner of the shape, you affect height and width simultaneously. If you hold down the Shift key while you drag a shape's corner, Excel keeps the shape's height and width in proportion. To rotate a shape, select the shape and then drag the white rotation handle at the top of the selection outline in a circle until the shape is in the orientation you want.

TIP You can assign your shape a specific height and width by clicking the shape and then, on the Format tool tab, in the Size group, entering the values you want in the height and width boxes.

After you create a shape, you can use the controls on the Format tool tab to change its formatting. To apply a predefined style, click the More button in the lower-right corner of the Shape Styles group's gallery and then click the style you want to apply. If none of the predefined styles are exactly what you want, you can use the Shape Fill, Shape Outline, and Shape Effects options to change those aspects of the shape's appearance.

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TIP When you point to a formatting option, such as a style or option displayed in the Shape Fill, Shape Outline, or Shape Effects lists, Excel displays a live preview of how your shape would appear if you applied that formatting option. You can preview as many options as you like before committing to a change. If a live preview doesn't appear, click the File tab to display the Backstage view and then click Options to open the Excel Options dialog box. On the General page, select the Enable Live Preview check box and click OK.

If you want to use a shape as a label or header in a worksheet, you can add text to the shape's interior. To do so, select the shape and begin typing; when you're done adding text, click outside the shape to deselect it. You can edit a shape's text by moving the pointer over the text. When the pointer is in position for you to edit the text, it will change from a white pointer with a four-pointed arrow to a black I-bar. You can then click the text to start editing it. If you want to change the text's appearance, you can use the commands on the Home tab or on the Mini Toolbar that appears when you select the text.
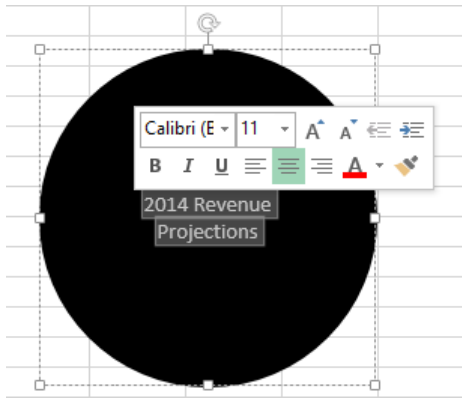
You can move a shape within your worksheet by dragging it to a new position. If your worksheet contains multiple shapes, you can align and distribute them within the worksheet. Horizontal shape alignment means that the shapes are lined up by their top edge, bottom edge, or center. Vertical shape alignment means that they have the same right edge, left edge, or center. To align a series of shapes, hold down the Ctrl key and click the shapes you want to align. Then, on the Format tool tab, in the Arrange group, click Align, and then click the alignment option you want.

Distributing shapes moves the shapes so they have a consistent horizontal or vertical distance between them. To do so, select three or more shapes on a worksheet, click the Format tool tab and then, in the Arrange group, click Align and then click either Distribute Horizontally or Distribute Vertically.

If you have multiple shapes on a worksheet, you will find that Excel arranges them from front to back, placing newer shapes in front of older shapes.
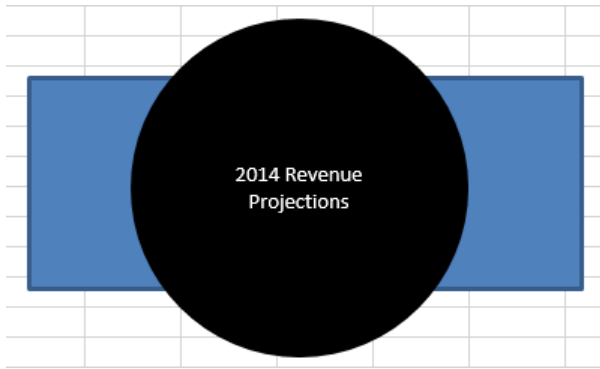
To change the order of the shapes, select the shape in the back, click the Format tool tab, and then, in the Arrange group, click Bring Forward. When you do, Excel moves the back shape in front of the front shape. Clicking Send Backward has the opposite effect, moving the selected shape one layer back in the order. If you click the Bring Forward arrow, you can choose to bring a shape all the way to the front of the order; similarly, when you click the Send Backward arrow, you can choose to send a shape to the back of the order.

One other way to work with shapes in Excel is to add mathematical equations to their interior. As an example, a business analyst might evaluate Consolidated Messenger's financial performance by using a ratio that can be expressed with an equation. To add an equation to a shape, click the shape and then, on the Insert tab, in the Symbols group, click Equation, and then click the Design tool tab to display the interface for editing equations.
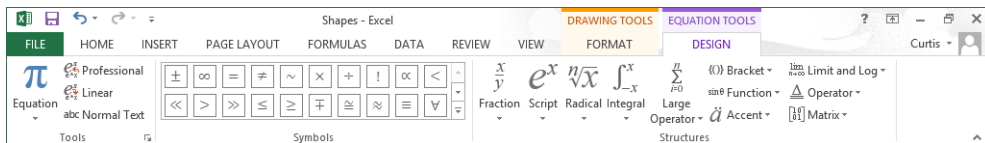

TIP Clicking the Equation arrow displays a list of common equations, such as the Pythagorean Theorem, that you can add with a single click.

Click any of the controls in the Structures group to begin creating an equation of that type. You can fill in the details of a structure by adding text normally or by adding symbols from the gallery in the Symbols group.

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In this exercise, you'll create a circle and a rectangle, change the shapes' formatting, reorder the shapes, align the shapes, add text to the circle, and then add an equation to the rectangle.

➡️ SET UP **You need the Shapes workbook located in the Chapter09 practice file folder to complete this exercise. Open the workbook, and then follow the steps.**

1   On the **Insert** tab, in the **Illustrations** group, click the **Shapes** button, and then click the oval. The pointer changes to a thin black crosshair.

2   Starting near cell **C3**, hold down the **Shift** key and drag the pointer to approximately cell **E9**. Excel draws a circle.

3   On the **Format** tool tab, in the **Shapes Styles** group's gallery, click the second style. Excel formats the shape with white text and a black background.

4   On the **Insert** tab, in the **Illustrations** group, click the **Shapes** button, and then click the rectangle shape. The pointer changes to a thin black crosshair.

5   Starting near cell **G3**, drag the pointer to cell **K9**. Excel draws a rectangle.

6   On the **Format** tool tab, in the **Shapes Styles** group's gallery, click the first style. Excel formats the shape with black text, an orange border, and a white background.
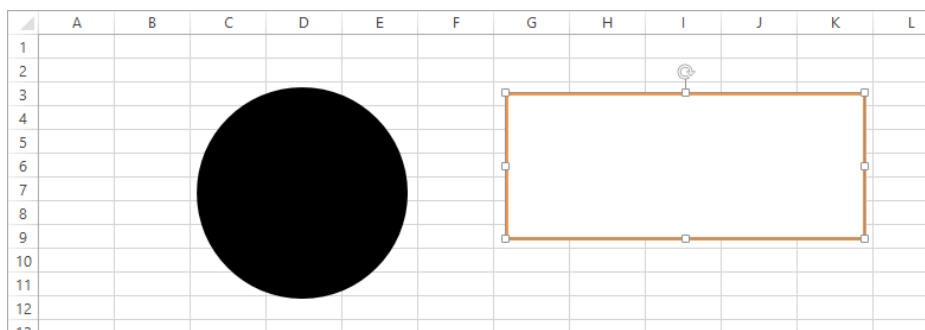
7   Click the circle and enter **2014 Revenue Projections**. Then, on the **Home** tab, in the **Alignment** group, click the **Middle Align** button. Excel centers the text vertically within the circle.

8   On the **Home** tab, in the **Alignment** group, click the **Center** button. Excel centers the text horizontally within the circle.

9   Hold down **Ctrl** and click the circle and the rectangle. Then, on the **Format** tool tab, in the **Arrange** group, click the **Align Objects** button, and then click **Align Center**. Excel centers the shapes horizontally.

10   Without releasing the selection, on the **Format** tool tab, in the **Arrange** group, click the **Align Objects** button, and then click **Align Middle**. Excel centers the shapes vertically.
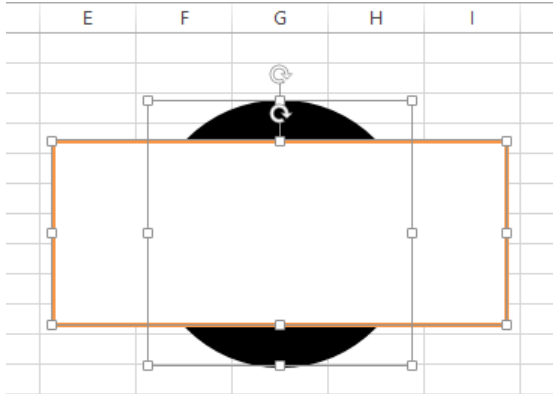
11   Click any spot on the worksheet outside of the circle and rectangle to release the selection, and then click the rectangle.

12   On the **Format** tool tab, in the **Arrange** group, click **Send Backward**. Excel moves the rectangle behind the circle.

13   Press **Ctrl+Z** to undo the last action. Excel moves the rectangle in front of the circle.

14   Click anywhere on the worksheet except on the circle or the rectangle. Click the rectangle and then, on the **Insert** tab, in the **Symbols** group, click **Equation**. The text **Type Equation Here** appears in the rectangle.

15   On the **Design** tool tab, in the **Structures** group, click the **Script** button, and then click the **Subscript** structure (the second from the left in the top row). The **Subscript** structure's outline appears in the rectangle.

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