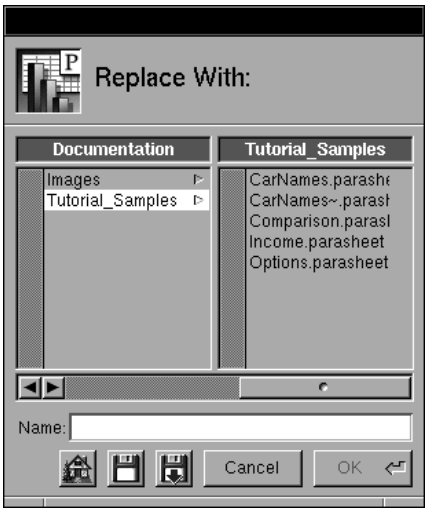
don’t exist in the substitute sheet, !NAME will appear in the appropriate cells in the master spreadsheet.

To substitute a new supporting spreadsheet, choose *Open Links* from the Document menu. Click *Replace* and choose the new spreadsheet from the Replace With panel.



Select the new supporting spreadsheet and click *OK*. If you’re sure you want to change all references in the master spreadsheet to this new spreadsheet, click *OK* in the Replace Link alert panel.

Recalculating Links

A linking formula may not retrieve the correct data if:

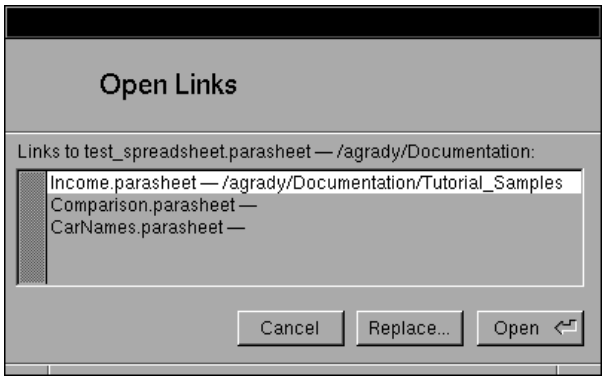
- Someone else with access to the supporting spreadsheet changes it while you have the master spreadsheet open and the supporting spreadsheet closed.
- Either the master or supporting spreadsheet is set for manual recalculation.

In either one of these cases, open every spreadsheet linked to the master or to any of its supporting spreadsheets. Then choose *Recalc All* from the Sheet menu. The *Recalc All* command recalculates all open spreadsheets. It also retrieves changed data from unopened supporting spreadsheets.

Note *Changed data from spreadsheets that, in turn, support unopened supporting spreadsheets is not retrieved.*

Opening Supporting Spreadsheets

ParaSheet maintains a list of all spreadsheets that support the current one. To open one or more of them, or substitute a different spreadsheet for any one of them, choose *Open Links* from the Document menu. This raises the Open Links panel:



Select the name of the spreadsheet you want to open from the list, then click *Open*.

You can also substitute a new spreadsheet for one of those already linked. All references from the master spreadsheet to the previous supporting spreadsheet will refer instead to the new spreadsheet. If named ranges

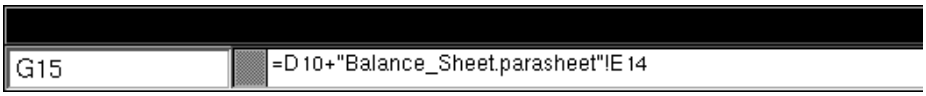
Creating the Link

To enter a formula that refers to another spreadsheet, either point to a cell, or type the cell reference.

To enter a linking formula by pointing:

- Select the cell where you want to store the formula.
- Type "=" to start entering the formula.
- Enter the formula to the point when you want to refer to the supporting spreadsheet.
- Make sure the supporting spreadsheet is open and active. If it isn't active, select it from the Windows menu, or click the spreadsheet window's title bar (rather than clicking in a cell).
- In the supporting spreadsheet, click in the cell or click and drag the range to which you want to refer.

The name of the supporting spreadsheet appears in quotes followed by an exclamation point and the named range or cell reference:

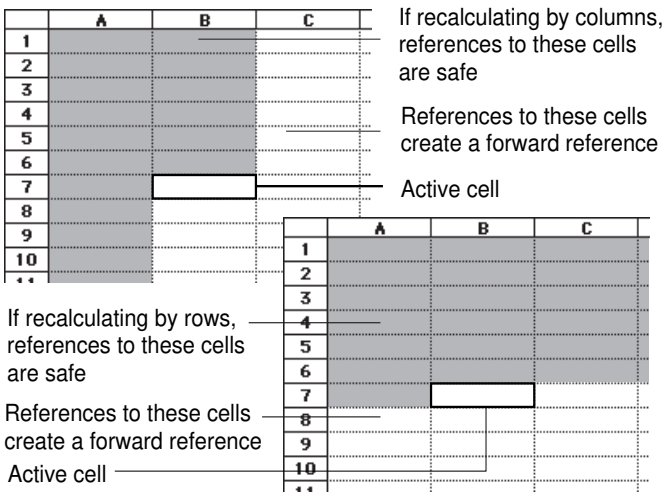


If the supporting spreadsheet is in a different folder than the master spreadsheet, the supporting spreadsheet's path name is included inside the quotes.

In that case, the formula would look like this:

When you finish entering the formula, press Enter, Return, Tab, or an arrow key to enter the formula.

You may prefer to enter the links by typing instead of pointing if the supporting spreadsheet isn't open or if it isn't created yet. If you type the formula, be sure to follow the pattern described in the steps above. (Keep in mind that path names are case sensitive.) Until you create the supporting spreadsheet, !REF will appear in the cell in the master spreadsheet containing the formula.



How ParaSheet Calculates

ParaSheet stores numbers and performs all calculations with 15 digits of precision, but rounds the number to 14 digits before displaying.

Therefore, the number displayed in a cell may not always be the same number that ParaSheet stores — the cell's format determines only how the value is displayed. When you reference a cell's value in a formula, the stored value is always used, regardless of its displayed appearance. For more information on cell formats, refer to the "Displaying Numbers in Different Formats" section on page 116 of Chapter 9.

Note *If you enter a number that isn't in the range between the negative number 2.3E-308 to the positive number 1.7E308, ParaSheet stores the number as text.*

Linking Spreadsheets

When you reference another spreadsheet in a formula, the spreadsheets are *linked*. The spreadsheet that contains the formula is called the *master* spreadsheet, and the referenced one is the *supporting* spreadsheet. When a value changes in a supporting spreadsheet, the result in the master spreadsheet is updated automatically if both spreadsheets are open.

the active cell are not recalculated. Don't forget to choose *Recalc* or *Recalc All* before you draw conclusions about your data, print the spreadsheet, or show it to someone else.

To interrupt a lengthy automatic recalculation, press Command-period (.). Although it's difficult to tell which cells have already been recalculated, this gives you the opportunity to set recalculation to manual.

Changing Recalculation Order

Whenever you enter a number or a formula, ParaSheet automatically recalculates the spreadsheet. It updates cells in the order in which they depend on the new entry. This is called *natural* recalculation.

For example, suppose a formula in cell A1 adds 10 to the value in cell C20, and the formula in cell C20 adds the values in cells C18 and C19. If the value in cell C18 changes, cell C20 is recalculated *before* cell A1.

Natural recalculation is appropriate for most spreadsheets, so change it only for an explicit reason. For example, you may want to construct a spreadsheet that has circular references. A *circular reference* is any formula that refers to itself (such as 1+A1 in cell A1), or ties a series of references back in a circle (such as 1+B1 in cell A1, and 1+A1 in cell B1). To use circular references, you must change recalculation to row or column order.

To change the way ParaSheet recalculates, click either *By Rows* or *By Columns* from the Recalc Options panel and click *Set*. When you choose *By Rows*, ParaSheet recalculates across each row from left to right starting with row 1. When you choose *By Columns,* ParaSheet recalculates down each column from top to bottom starting with column A.

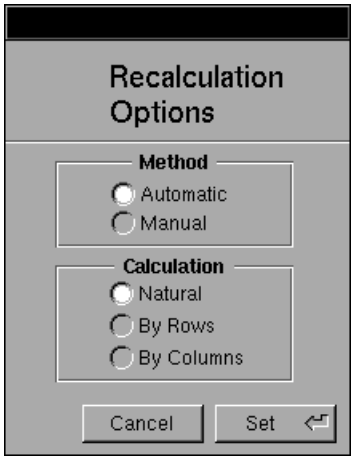
When you recalculate by rows or by columns, avoid creating *forward references*. A forward reference is a formula that refers to a cell that will be calculated *after* it, as shown below.

Recalculating the Spreadsheet

So that each spreadsheet always displays the correct results, ParaSheet is initially set to recalculate the necessary parts of the spreadsheet every time you change a cell entry.

There may be times when you don't want ParaSheet to recalculate automatically. When you're working with a very large spreadsheet, for example, having the spreadsheet recalculate every time you make an entry can be time-consuming.

To control how and when to recalculate the spreadsheet, choose *Recalc Options* from the Sheet menu to raise the Recalc Options panel.



Manual Recalculation

To control when recalculation occurs, choose *Manual* from the Recalc Options panel and click *Set*. ParaSheet will then wait to recalculate until you choose *Recalc* or *Recalc All* from the Sheet menu. The *Recalc* command recalculates the active spreadsheet; *Recalc All* recalculates all spreadsheets open in the Workspace and retrieves changed data from any closed supporting spreadsheets.

Note *Changed data from spreadsheets that, in turn, support closed supporting spreadsheets is not retrieved.*

With manual recalculation, the result of any formula you enter in the active cell is evaluated and displayed in the cell, but cells dependent on

Click in the *Name* field and type a name. Click *Add* to save it and add it to the list of all the named ranges in the spreadsheet.

Later, if you forget the range to which the name refers, just select the name from this list. The cell coordinates will appear in the *Range* field. Conversely, if you forget the name you've given a range, select the cells on the spreadsheet. The name appears in the selection box.

To refer to the named range in formulas, either type the name or select the range with the mouse.

Changing or Removing a Named Range

ParaSheet conveniently handles changes to named ranges:

- If you fill the cells in a named range with new values, the range name stays the same.
- If you change the name of a range, ParaSheet automatically converts to the new name in formulas that used the previous name. Even formulas that link to the named range from other open spreadsheets are updated.
- If you reassign a name to a different range of cells, the new range is used in formulas.
- If you remove the name you've given a range, ParaSheet simply returns to using cell addresses when you point to the range in new formulas. In formulas that already refer to the removed range, !NAME appears in the cell.

To change or remove a named range, choose the *Named Ranges* command from the Sheet menu. Select the named range you want to change or remove from the list.

If you want to change a range name or the cell coordinates to which it refers, type the new entries in the *Name* or *Range* fields. Click *Modify* or *Delete*, whichever is appropriate.

If you click *Delete*, ParaSheet clears the name from the list. If you click *Modify*, ParaSheet changes the name or cell references to those you've typed.

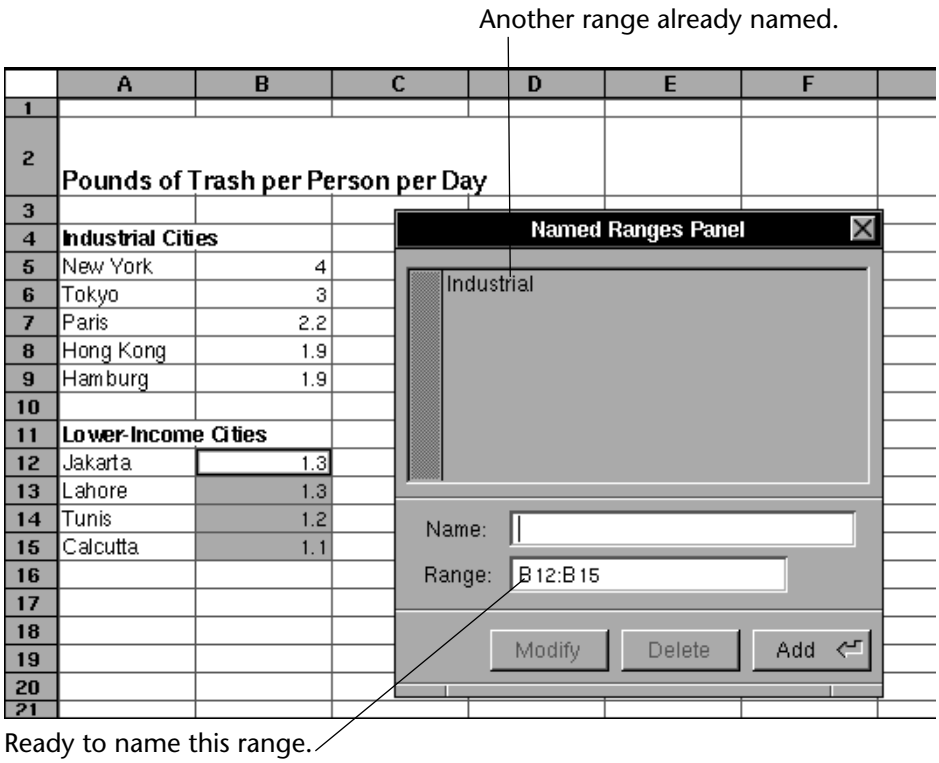
Note *Entering text in a cell is not the same as assigning that cell a range name. Refer to the "Assigning a Name to a Range" section below for instructions.*

Assigning a Name to a Range

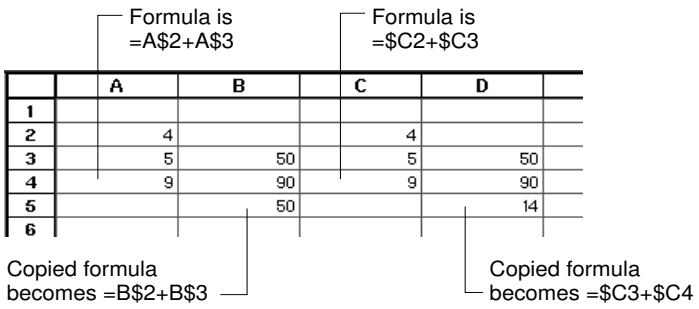
A range name can contain only letters, numbers, and underscores. The name must begin with either a letter or an underscore. ParaSheet doesn't distinguish between uppercase and lowercase letters; you cannot have two different ranges in the same spreadsheet named *Sales* and *sales*, for example. Finally, you cannot name a range with a cell coordinate, such as D10 or A1.

To name a range, select the range, open the Sheet menu and choose *Named Ranges*.

The Named Ranges panel appears. Notice that the cells of the selected range appear in the *Range* field.



The figure below illustrates what would happen if you were to copy these formulas one cell to the right and one cell down, into cells B5 and D5.



The formula copied into cell B5 reads =B$2+B$3. The column reference has changed because it is a relative reference in the original formula. The rows have not changed because they are absolute references in the original formula.

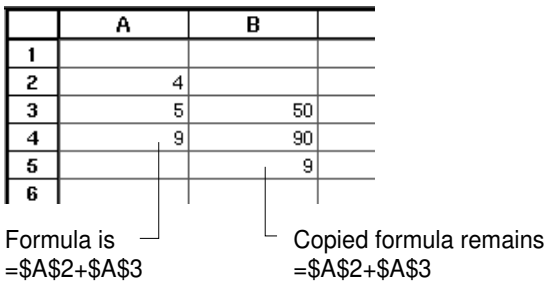
The formula copied into cell D5 reads =$C3+$C4. The column reference remains the same because it is an absolute reference in the original formula. The rows have changed because they are relative references in the formula in the original cell.

Using Named Ranges

A range is referred to by either its cell coordinates, such as A1 or C55:G92, or by a specific name that you define. There are several advantages of named ranges:

- Data can be moved, copied, entered, and referenced in a group of cells instead of cell by cell.
- A name like *JulySales* is easier to remember than a range reference like H12:H24.
- In a large spreadsheet, typing a named range is easier than scrolling and pointing.
- If you move, insert, or delete other cells, or if you copy or move a formula that refers to a named range, references to named ranges will always be accurate. This is especially vital when linking spreadsheets.

you copy this formula to B5, ParaSheet still refers to cells A2 and A3 and adds the values that appear in those two cells, as shown below.



Mixed Cell References

A *mixed* cell reference is part absolute and part relative. You can make either the column or the row absolute. The absolute part of the reference must be preceded by a dollar sign. When you copy a formula containing mixed cell references, relative references change to reflect the new location, but absolute references remain the same.

For example, suppose you have formulas in cells A4 and C4 that calculate the sum of the values in the two cells immediately above them. The formula in A4 is a mixed reference consisting of a relative column reference and absolute row references (=A$2+A$3). Notice that there are no dollar signs in front of the column letters.

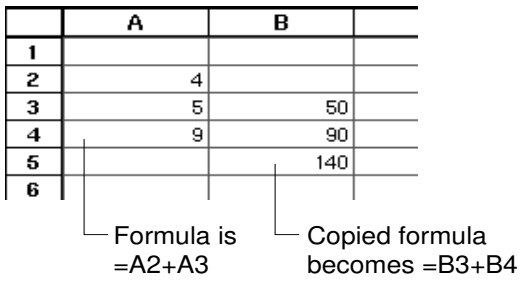
The formula in C4 is a mixed reference consisting of an absolute column reference and relative row references (=$C2+$C3). Notice that this time there are no dollar signs before the row numbers.

Relative Cell References

A *relative* cell reference tells ParaSheet how to find a cell with respect to the active cell. Creating a relative reference is like directing ParaSheet to, for example, "start from this cell, go over three columns to the right, go up one cell, and get that cell's value." The values used are *relative* to the location of the current cell. In most formulas, relative references are best.

When you copy a formula with relative references, the formula in the new cells has new row and column references reflecting the new location.

For example, suppose you entered the formula =A2+A3 in cell A4. ParaSheet reads this formula as "add the values that appear in the same column one row and two rows above this cell." When you copy this formula to cell B5, ParaSheet adds the values in cells B3 and B4 (cells in the same column one and two rows above). When you select cell B5 after copying the formula =A2+A3 there, it reads =B3+B4, as shown below.



Absolute Cell References

An *absolute* cell reference always refers to the same cell, no matter where you copy the formula on the spreadsheet. Absolute cell references must have a dollar sign before the column and row you want to reference.

For example, suppose you enter =$A$2+$A$3 in cell A4. ParaSheet reads this formula as "add the values that appear in cells A2 and A3." When

- Type “=” to begin entering a formula.
- Click cell A2. (The input window shows =A2.)
- Click cell B6. (The input window shows =A2+B6.)
- Click cell D10. (The input window shows =A2+B6+D10.)

If you don’t want to use the plus operator, type the operator you prefer before you click the next cell to be referenced. In that case, the plus sign will be omitted.

You can also include references to cells from other spreadsheets. See the “Linking Spreadsheets” section on page 89 for information.

Copying Formulas

Formulas may be copied from one cell to another within the same spreadsheet, or to a different spreadsheet. Just as you copy the contents of any cell, select the cell that contains the formula, choose *Copy* from the Edit menu, select the new location, and then choose *Paste*.

ParaSheet uses two types of cell references: *relative* and *absolute*. (A reference that combines the two is called a *mixed reference*.)

Relative references are simply the cell coordinates, while *absolute* references are a set of row or column coordinates preceded by dollar signs. This distinction between reference types is only important when you’re copying formulas. Refer to the following sections in this chapter for definitions and a detailed discussion of relative and absolute references. The table below shows how types of cell references look in your formulas.

Table 6-1: Cell reference types

Reference Type	Appearance in the Formula
Relative	B1
Absolute	$B$1
Mixed: absolute column, relative row	$B1
Mixed: relative column, absolute row	B$1

A range reference is two cell coordinates separated by a colon, as in A2:B6 above. The coordinates are the two cells at the diagonal limits of the rectangular area that forms the range.

You can enter the coordinates in any order. For example, A2:B6, B6:A2, A6:B2, and B2:A6 all refer to the same range. If you edit the formula later, however, you will notice that ParaSheet stores the range reference in upper-left to lower-right order: A2:B6.

If you want to refer to entire columns, omit the row numbers from the range reference. For example, A:C refers to all cells in columns A, B, and C. You can refer to entire rows the same way; for instance, 4:4 refers to all cells in row 4.

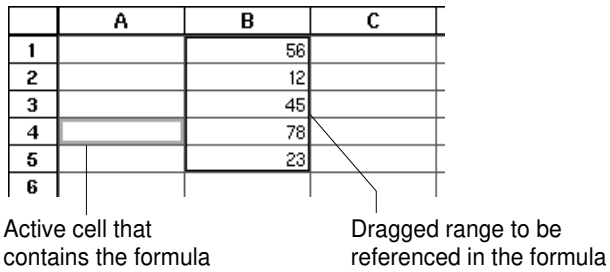
Typing Cell References

There are several ways to include a cell reference in a formula. You can type the cell or range coordinates from the keyboard. If the range you want to reference is named, type the name. (See “Using Named Ranges” on page 84 for information on defining and naming ranges.)

Pointing to Cells

If you prefer to use the mouse, click a cell or click and drag through a range to reference cells in a formula. The cell coordinates appear in the formula or, if it is a named range, the name appears. If the reference is the first entry in the formula, type “=” first.

When you reference cells with the mouse, an outline appears around the cell or range but the cell into which you’re putting the formula is still the active and selected cell, as shown below.



If you continue pointing to cells, the plus operator is automatically entered between cell references. Follow these steps to see this time-saving process:

multiplying by 2 (to return 22). This occurs because the multiplication operator (*) has a higher precedence than the addition operator (+).

The mathematical operators have the following precedence, in descending order:

- ^ (exponentiation)
- * (multiplication) and / (division)
- + (addition) and – (subtraction)

Other types of operators perform comparisons (such as < and >), concatenation (#cat#), and other tasks. For information on additional operators and their precedence, refer to the "Precedence of Operators" section on page 24 in ParaSheet's Macro and Function Reference manual.

If your formula contains several operators with the same precedence, ParaSheet performs the calculations from left to right within the formula.

To override any precedence order, enclose parts of the formula in parentheses. All the calculations in parentheses are performed first; within the parentheses, operations are performed according to precedence levels. If you use more than one set of parentheses, the inner operation is calculated first. If you are ever uncertain about which operation will be performed first, just create your own precedence by enclosing part of the formula in parentheses.

For example, in the formula =B1*B2–B4/10, ParaSheet first multiplies, then divides, and then subtracts, according to the standard order of precedence. However, if you add parentheses and enter the formula as =B1*(B2–B4)/10, ParaSheet performs the subtraction first, then multiplies, and then divides. If you add another set of parentheses, changing the formula to =B1*((B2–B4)/10), ParaSheet performs the subtraction first, then divides, and then multiplies.

Including Cell References in Formulas

To reference other cells in a formula, just enter the cell range coordinates. The following example references a *single* cell and a *range* of cells. The references are separated by a comma:

- =Sum(A10,A2:B6)

In calculating the results of this formula, ParaSheet adds the value in cell A10 to the total of the values in cells A2 through B6.

Formulas may contain *functions*, which are built-in instructions that perform calculations. For example, instead of entering the formula =*A1+A2+A3*, you could enter the formula as =*Sum(A1:A3)*. The Sum function takes the place of the + operator and totals the values in cells A1 through A3. For more information about functions, refer to the next chapter.

To learn how to enter formulas, refer to the next section, "Entering a Formula."

To learn how to create formulas that perform more complex tasks, refer to Chapter 1 in ParaSheet's Macro and Function Reference manual.

Entering a Formula

When you type a formula, the formula appears in the input window. After you press Enter, Return, Tab, or an arrow key, the result of the formula appears in the cell.

To begin a formula, type an equal sign (=), a plus sign (+), or a minus sign (–), followed by the formula.

Remember you must type one of these signs to begin entering a formula. Otherwise, the cell reference A1 or the Sum function, for example, would be treated as text.

You can either type all cell and range references in a formula, or enter them by clicking the cell or range. For more information, refer to the "Including Cell References in Formulas" section on page 79.

You can also speed the entry of functions by using the Functions panel. Refer to the next chapter for more information.

Using Operators

In a formula, ParaSheet performs the mathematical calculations represented by the operators in a certain order. This order of calculation is determined by the operator's *level of precedence*. The operator with the highest level of precedence is performed first.

For example, if you enter the formula =5+6*2, ParaSheet multiplies 6 times 2 and then adds 5 (to return 17), instead of adding 5 and 6 and

Chapter 6

Using Formulas

Formulas are added to spreadsheets to perform simple or complex calculations. This chapter describes how to create formulas, how to apply formulas to cells, the difference between an absolute and a relative cell reference, and how to link formulas to cells in other spreadsheets.

What are Formulas?

Formulas perform calculations in the spreadsheet. The formula =4*5, for example, displays 20 in the cell that contains it. The * sign is the multiplication *operator*. The most common operators are +, –, *, /, and ^ (exponent). The formula =*A1+A2–4* adds the values in cells A1 and A2, subtracts 4, and displays the result in the cell containing the formula.

A1 and A2 are *cell references*. Using cell references instead of retyping the cell contents saves typing time and prevents errors. It also means formulas will always be accurate, even if you change the value in a referenced cell.