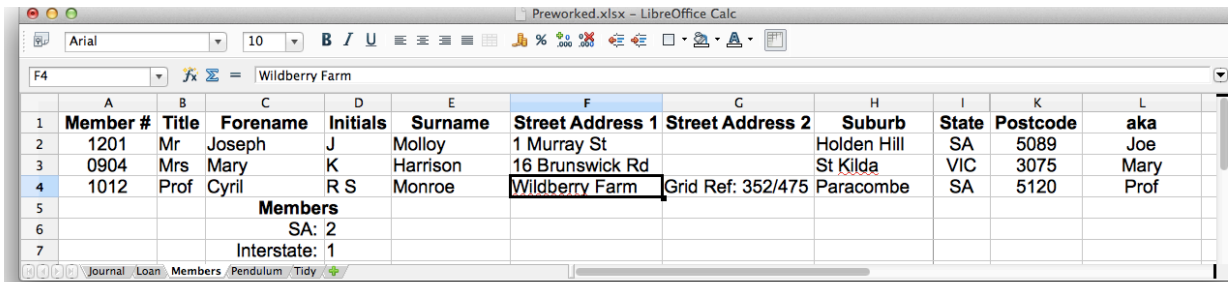


Introduction to Spreadsheets

Spreadsheets consist of tables of **cells** arranged in horizontal **rows** and vertical **columns**. *Rows* are numbered 1, 2, 3, and so on, and *columns* are numbered A, B, C, ... Z, AA, AB, AC, and so on. A *cell* is identified by its column and row, e.g., C7. One spreadsheet document can contain several **worksheets**, selectable by named tabs. (New worksheets are added by clicking the + tab, and named by double-clicking the default name.)

Spreadsheets are supported by *Calc* in *LibreOffice* and *OpenOffice*, both of which can import and export **.xlsx** files that are compatible with *MS Excel* and several other programs, such as Apple's *Numbers*. Spreadsheets can also be imported and exported as comma (or **Tab**) separated text, making them compatible with word processors, etc. *LibreOffice* and *OpenOffice* can also embed *Calc* tables within their own *Writer* documents.

One of the simplest uses of a worksheet would be to maintain a list of names and addresses, say, a membership list. Each row would contain the details for one member, with columns representing *Surname*, *Suburb*, *Postcode*, etc. Compared with a word-processing document, it is easier to **sort** the rows into order by *Member No*, *Surname*, *Postcode*, etc., whenever desired. The *first* row of a worksheet often contains headings naming the columns. These headings are helpful when sorting, using the *Data/Sort ...* menu item. They also come in handy if you want to use the worksheet to create a *mail-merge* form letter.



The screenshot shows a spreadsheet titled 'Wildberry Farm' with columns for Member #, Title, Forename, Initials, Surname, Street Address 1, Street Address 2, Suburb, State, Postcode, and aka. The data is as follows:

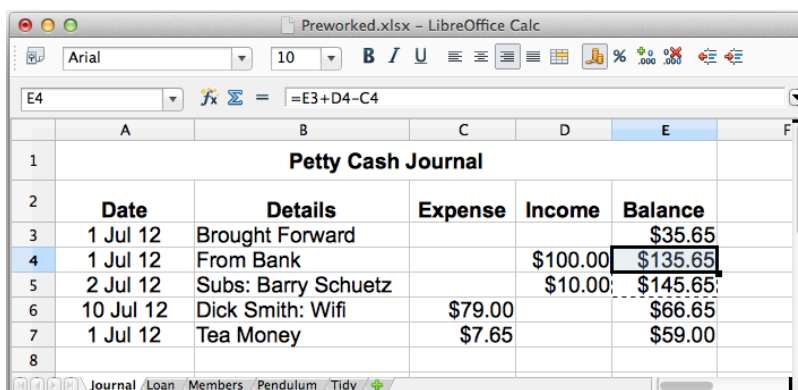
Member #	Title	Forename	Initials	Surname	Street Address 1	Street Address 2	Suburb	State	Postcode	aka
1201	Mr	Joseph	J	Molloy	1 Murray St		Holden Hill	SA	5089	Joe
0904	Mrs	Mary	K	Harrison	16 Brunswick Rd		St Kilda	VIC	3075	Mary
1012	Prof	Cyril	R S	Monroe	Wildberry Farm	Grid Ref: 352/475	Paracombe	SA	5120	Prof

Below the data, there are labels for 'Members', 'SA: 2', and 'Interstate: 1'.

To enter a datum in a cell, you first select the cell, then type the datum, typically a number, a date, or a text string, followed by **Return** or **Enter**. The new datum *replaces* the contents of a cell. To *edit* a datum, one must double-click the cell or, select it, then edit the formula bar (normally displayed at the top of the window). Again, you must type **Enter** to complete the entry. **Enter** selects a cell in the following row, not necessarily the one below, but 'intelligently'. Alternatives to **Enter** are **Tab** (which selects the cell to the right) and the arrow keys.

Cells can be **formatted**, by first selecting a cell or range of cells, using the *Format/Cells ...* menu item (shortcut CTRL-1), and selecting from the extensive range of options. It is also possible to use the usual text-editing shortcuts for **bold** (CTRL-B), *italic* (CTRL-I), left (CTRL-L), centred (CTRL-E), and so on. To select a whole row or column, click on its row or column number. The **widths** of columns and the **heights** of rows can be adjusted by dragging the edges of their number cells, or double clicking them. If a large cell is needed (e.g. for a heading), several cells can *merged*. (Select the cells, then use *Format/Merge Cells/...* .)

A core feature of a spreadsheet program is its ability to evaluate **formulae**. You enter a formula into a cell by selecting the cell, typing an = sign, then typing the formula. Most often, formulae just involve arithmetic operators (+, -, *, /), but it is possible to use a whole list of mathematical functions. Here is a simple example:



The screenshot shows a spreadsheet titled 'Petty Cash Journal' with columns for Date, Details, Expense, Income, and Balance. The data is as follows:

Date	Details	Expense	Income	Balance
1 Jul 12	Brought Forward			\$35.65
1 Jul 12	From Bank		\$100.00	\$135.65
2 Jul 12	Subs: Barry Schuetz		\$10.00	\$145.65
10 Jul 12	Dick Smith: Wifi	\$79.00		\$66.65
1 Jul 12	Tea Money	\$7.65		\$59.00

The formula bar shows the formula '=E3-C4+D4' for cell E4.

The highlighted cell at E4 contains the formula '=E3-C4+D4', i.e., the previous balance, minus any expense, plus any income. (Note that the *empty* cell at C4 counts as zero; the same cannot be said for a *blank* cell, which is *text*.)

The cell E5 contains a similar formula, '=E4-C5+D5'. This was not achieved by typing it, but by copying the cell at E4 and pasting it into E5 through E7. **All spreadsheet programs automatically adjust formulae when they are copied.**

In fact, '=E3-C4+D4' was never typed in full. The formula was entered by selecting cell E4, by typing '=', clicking cell E3, typing '-', clicking cell C4, typing '+', clicking D4, then pressing **Enter** (or another navigation key, such as **Tab**). This last step is *vital*, because navigating to a new cell by clicking on it would simply add its name to the formula in E4.

Introduction to Spreadsheets

The following shows a ‘what-if’ calculation: What if I borrow \$1,000 at 10% interest, and pay \$120 a year? How long will it take me to pay off the loan? I have highlighted the entry in C2 to show that spreadsheets understand the ‘%’ sign: 10% is equivalent to 0.1. To find the balance, we add the interest and subtract the payment. The balance in row 2 is carried forward to row 3 by typing ‘=E2’ into cell A3.

	A	B	C	D	E
1	Premium	Interest Rate	Interest	Payment	Balance
2	\$1,000.00	10.00%	\$100.00	\$120.00	\$980.00
3	\$980.00	10.00%	\$98.00	\$120.00	\$958.00
4	\$958.00	10.00%	\$95.80	\$120.00	\$933.80
5	\$933.80	10.00%	\$93.38	\$120.00	\$907.18
6	\$907.18	10.00%	\$90.72	\$120.00	\$877.90
7	\$877.90	10.00%	\$87.79	\$120.00	\$845.69
8	\$845.69	10.00%	\$84.57	\$120.00	\$810.26
9	\$810.26	10.00%	\$81.03	\$120.00	\$771.28
10	\$771.28	10.00%	\$77.13	\$120.00	\$728.41
11	\$728.41	10.00%	\$72.84	\$120.00	\$681.25
12	\$681.25	10.00%	\$68.13	\$120.00	\$629.38
13	\$629.38	10.00%	\$62.94	\$120.00	\$572.31
14	\$572.31	10.00%	\$57.23	\$120.00	\$509.55
15	\$509.55	10.00%	\$50.95	\$120.00	\$440.50
16	\$440.50	10.00%	\$44.05	\$120.00	\$364.55
17	\$364.55	10.00%	\$36.46	\$120.00	\$281.01
18	\$281.01	10.00%	\$28.10	\$120.00	\$189.11
19	\$189.11	10.00%	\$18.91	\$120.00	\$88.02
20	\$88.02	10.00%	\$8.80	\$120.00	-\$23.18
21					
22					

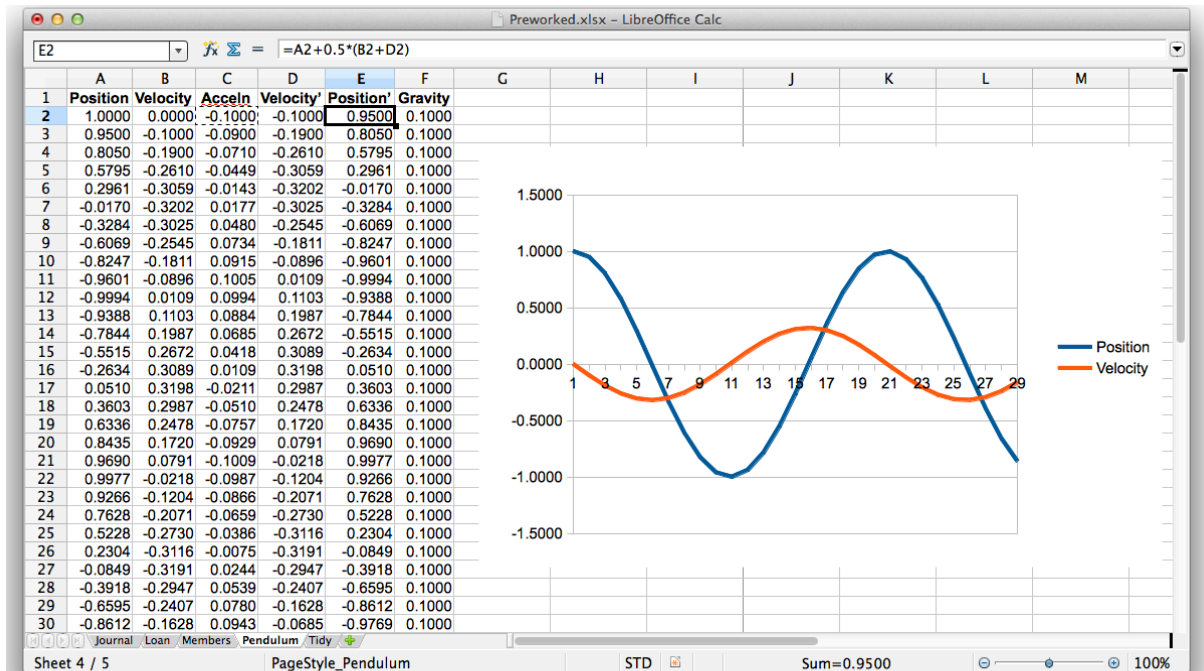
This particular spreadsheet is bulky and repetitious. Pay attention to the formula bar in the *Tidy* sheet below:

	A	B	C	D	E	F
1	Loan Calculator					
2			Period	Balance Owed		
3	Premium	\$1,000.00		\$1,000.00		
4	Interest Rate	10.00%	1	\$980.00		
5	Repayment	\$120.00	2	\$958.00		
6			3	\$933.80		
7			4	\$907.18		
8			5	\$877.90		
9			6	\$845.69		
10			7	\$810.26		
11			8	\$771.28		
12			9	\$728.41		
13			10	\$681.25		
14			11	\$629.38		
15			12	\$572.31		
16			13	\$509.55		
17			14	\$440.50		
18			15	\$364.55		
19			16	\$281.01		
20			17	\$189.11		
21			18	\$88.02		
22			19	-\$23.18		
23						

The *Interest Rate* and *Repayment* appear on this sheet only once. They are referred to using \$ signs. The \$ signs prevent references being modified when formulae are copied, over-riding the normal behaviour. The formulae copied down column D therefore refer to D3, D4, D5, and so on, but they all refer to the *same* B4 and B5. \$B\$4 and \$B\$5 are called **absolute** references. (Read them as, ‘Definitely B, definitely 4.’) D3, D4 and so on are called **relative** references. Mixtures are possible, such as B\$4 or \$B4.

Introduction to Spreadsheets

A common use of spreadsheets is to simulate some physical or business system. The one below simulates the motion of a pendulum:



The idea is that gravity causes the pendulum to seek the vertical, with a force (and therefore an acceleration) proportional to its displacement from the vertical, an approximation which is accurate for small displacements. The acceleration changes the velocity, and the velocity changes the position.

The formulae, which (apart from A2 and B2) are copied down the columns, are:

A2 = 1.0	The initial position.
B2 = 0.0	The initial velocity.
C2 = -F2*(A2+B2/2)	Acceleration = the effect of gravity times the estimated <i>average</i> position for the interval.
D2 = B2+C2	New velocity = the existing velocity plus the estimated acceleration.
E2 = A2+0.5*(B2+D2)	New position = the existing position plus the estimated <i>average</i> velocity for the interval.
F2 = 0.1	A mystic number that depends on the length of the pendulum and the force of gravity.
A3 = E2	The new position becomes the existing position.
B3 = D2	The new velocity becomes the existing velocity.

Rather than using the initial position and velocity, it would have been more accurate to be able to calculate the acceleration C2 using the average of the old and new positions, as $C2=(A2+E2)/2$. But this would create an illegal **circular reference**: C2 depends on E2, E2 depends on D2, D2 depends on C2.)

The **chart** was created by first selecting all the cells we wanted to plot, which were A1 through B30, then selecting *Insert/Chart ...* and choosing *Line Chart* from the many options. A1 and B1 supplied the chart labels. Updating the cells updates the chart.

Here are some other important things you need to know:

You can **insert** n rows anywhere by selecting the n rows below the point where you want to add the new ones, then selecting *Insert/Rows*. (Similarly for columns.) Formulae are automatically adjusted just as you would hope. Even absolute references are adjusted correctly. In a similar way, formulae are updated when cells are moved using *Cut* and *Paste*. For example, if we decided to relocate A3 through B5 on our *Loan* sheet to A5 through B7, everything would still work. However, if cells are moved using **Copy** and *Paste*, the references are *not* updated. (There are now two different copies to refer to, so the original is chosen.) Both *Cut* and *Copy* are useful at various times. Make sure you choose the right one!

Rows, columns and cells can be **deleted** by selecting them, then selecting *Edit/Delete Cells ...*. Also, it is sometimes useful to **hide** rows or columns that are used to calculate intermediate results, leaving only the important ones visible. You hide a column by selecting it, then selecting *Format/Column/Hide*. To display it again, (because you can't see it) you need to select the columns either side of it, then select *Format/Column/Show*. (Similarly for rows.)

Introduction to Spreadsheets

	A	B	C	D	E	F	G	H	I	J	K	L
1	Member #	Title	Forename	Initials	Surname	Street Address 1	Street Address 2	Suburb	State	Postcode	aka	
2	1201	Mr	Joseph	J	Molloy	1 Murray St		Holden Hill	SA	1	5089	Joe
3	0904	Mrs	Mary	K	Harrison	16 Brunswick Rd		St Kilda	VIC	0	3075	Mary
4	1012	Prof	Cyril	R S	Monroe	Wildberry Farm	Grid Ref: 352/475	Paracombe	SA	1	5120	Prof
5	Members											
6	SA: 2											
7	Interstate: 1											

Showing column J in the *Members* sheet shows how the number of SA members is kept up-to-date. (Did you notice it was hidden?) Look at the formula bar: The **if** function returns its 2nd argument (1) if its 1st argument (I2="SA") is **true**, otherwise it returns its 3rd argument (0). After building column J, **sum**(J2:J4) was then used to find the number of SA members. ('J2:J4' indicates the whole **range** from J2 to J4.) You can also easily sum a column by selecting the cell below it, then clicking the Σ shortcut on the formula bar.

The number of interstate members was found by subtracting the number of SA members from the number of rows, **count**(J2:J4). (The **count** function might seem useless, because the answer is totally obvious. However, '=count(J2:J4)' will update when new member rows are inserted or deleted.) In fact, the membership numbers *could* have been calculated in one hit using *Calc's* **countif** function. But the *hidden columns technique* used here is still well worth knowing; it is very flexible.

There are many other mathematical (statistical, trigonometric, business, time-and-date, look-up, boolean, etc.) functions available: The list is accessible through the *Help* menu, or through the function wizard (f_x) on the formula bar.

Pages can have **headings** and **footings** like a word-processing document. (These are edited via *Format/Page ...*) *View/Page Break Preview* lets you see where page breaks will fall, and adjust them. You can also choose to repeat column or row headings from page to page.

It is possible to refer to cells on other worksheets, just by clicking them. References have the form *Sheet!Cell*.

Worksheets can be **protected** by password, so that they cannot be inadvertently or maliciously updated. (Individual cells can be flagged to remain unprotected.) For example, the *Loan* sheet might allow only B3 to B5 to be changed.

A final word: Go home and try it!