

# 8 Calculations

Numbers has several tools for adding and editing formulas and functions.

## 8.1 Formula Editor

The Formula Editor is used to create and modify formulas. To open it select a Cell and press the equals (=) key.

The Formula Editor can also be accessed from the Tool Bar.

The formula bar is underneath the Format bar and is always accessible. Formula can be entered here manually or Functions can be applied.

When using the Formula Editor, Numbers adds colour to the cell reference in a formula and to the respective cells, making formulas easier to read.

In the illustration Cell D2 was selected. And a Formula added ( $=B2+C2$ ) by clicking Cells B1 and C2.

	A	B	C	D
1	<b>Item</b>	<b>Unit Price</b>	<b>Tax</b>	<b>Price Including Tax</b>
2	Widget 1	£1.00	20%	£1.20
3	Widget 2	£1.20	20%	£1.40
4	Widget 3	£1.10	20%	£1.30
5	Widget 4	£1.30	20%	£1.50
6	Widget 5	£1.00	20%	£1.20
7	Widget 6	£1.50	20%	£1.70
8	Widget 7	£1.20	20%	£1.40

The formula for calculating tax at 20% is Price x 20%.

In the example column B = Price, C = Tax at 20% and column D is the total of Column B and C to give the Price including Tax.

Cell references can be dragged to swap the order of a formula. Clicking the insertion point between cell references allows Operators to be added or changed. In the illustration the plus sign could be replaced with a minus sign or other Operator.

Holding down the Alt key while in the Formula Editor allows the arrow keys to be used to reference Cells.

## 8.2 Operators

To enter formulae, Numbers uses the standard mathematical operators. They are, +, -, \*, /, ^, %.

Here are examples of the operators in use. Using Columns E and F, where Column E contains 20 and Column F contains 2:

	A	B	C	D	E	F	G
1	To add two values	+ (plus sign)	E1 + F1 Returns 22	is	20	2	22
2	To subtract	- (minus sign)	E1 - F1 Returns 18	is	20	2	18
3	To multiply	* (asterisk)	E1 * F1 Returns 40	is	20	2	40
4	To divide	/ (forward slash)	E1 / F1 Returns 10	is	20	2	10
5	To raise one value to the power of another value	^ (carat)	E1 ^ F1 Returns 400	is	20	2	400
6	To format as a percentage	% (percent sign)	E1 % Returns 0.2 which formats as 20%	is	20	-	20%

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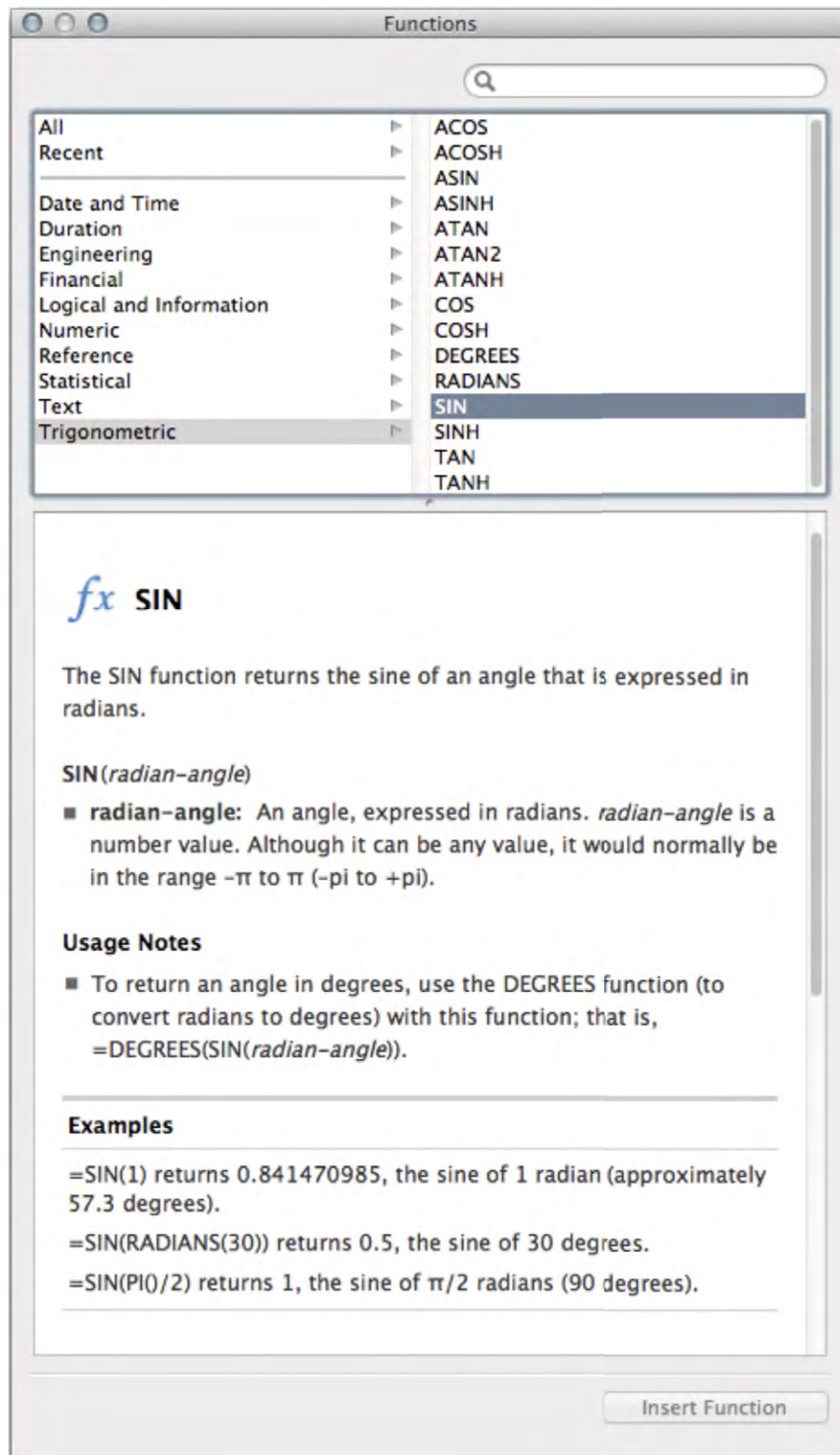
### 8.3 Functions

Numbers supports over 250 maths functions for performing statistical, financial, engineering, and other computations. The built-in Function Browser provides a quick way to learn about functions and add them to a formula.

The Function browser icon sits in the Tool Bar. A Cell has to be selected before it can be invoked. There are eight options in the Function Browser:

Sum	Average	Minimum	Maximum	Count	Product
0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9
10	10	10	10	10	10
<b>55</b>	<b>5</b>	<b>0</b>	<b>10</b>	<b>11</b>	<b>0</b>

- **Sum** – Calculates the sum of numeric values in the selected cells
- **Average** – Calculates the average of numeric values in selected cells
- **Minimum** – Determines the smallest numeric value in selected cells
- **Maximum** – Determines the largest numeric value in selected cells
- **Count** – Determines the number of numeric values and date/time values in selected cells
- **Product** – Multiplies all the numeric values in selected cells
- **Show Function Browser** – The fastest way to add a predefined, named operation. In the illustration the Trigonometric function SIN has been highlighted.



- **Formula Editor** – Is a menu options that invokes the Formula Editor. The menu can also be invoked by selecting a Cell and pressing equals (=).

To view all the formulas in a spreadsheet, choose View > Show Formula List or click Formula List icon in the toolbar. All the formulas are then displayed in list form with the following column headings.

- **Location** – Lists the cells, by sheet and table, that contain formula.
- **Results** – Shows the value returned by the formula.

## 8.4 Performing Calculations With Variables

The following time sheet example was introduced in Section 6.6 Using Checkboxes, Steppers, and Sliders. Column D contains the Variable.

	A	B	C	D	E
1	<b>Date</b>	<b>Task</b>	<b>Time</b>	<b>Billable</b>	<b>Billable Time</b>
2	▼ March 2012				
3	28 March 2012	Phone Call	0h 30m	<input type="checkbox"/>	0h 0m
4	28 March 2012	Correspondence	1h 0m	<input type="checkbox"/>	0h 0m
5	29 March 2012	Meeting	1h 30m	<input type="checkbox"/>	0h 0m
6	30 March 2012	Correspondence	1h 0m	<input type="checkbox"/>	0h 0m
7	▼ April 2012				
8	4 April 2012	Phone Call	0h 20m	<input type="checkbox"/>	0h 0m
9	4 April 2012	Artwork	4h 0m	<input checked="" type="checkbox"/>	4h 0m
10	4 April 2012	Correspondence	0h 20m	<input type="checkbox"/>	0h 0m
11	4 April 2012	Artwork	3h 0m	<input checked="" type="checkbox"/>	3h 0m
12	5 April 2012	Phone Call	0h 5m	<input type="checkbox"/>	0h 0m
13	5 April 2012	Artwork	3h 0m	<input checked="" type="checkbox"/>	3h 0m
14	5 April 2012	Correspondence	0h 20m	<input type="checkbox"/>	0h 0m
15	▼ May 2012				
16	5 May 2012	Phone Call	0h 10m	<input type="checkbox"/>	0h 0m
17	5 May 2012	Artwork	1h 0m	<input checked="" type="checkbox"/>	1h 0m
18	6 May 2012	Artwork	1h 0m	<input checked="" type="checkbox"/>	1h 0m
19	6 May 2012	Meeting	1h 0m	<input checked="" type="checkbox"/>	1h 0m
20	6 May 2012	Artwork	2h 0m	<input checked="" type="checkbox"/>	2h 0m
21	6 May 2012	Correspondence	0h 30m	<input type="checkbox"/>	0h 0m
22	6 May 2012	Proofing	1h 0m	<input checked="" type="checkbox"/>	1h 0m
23	6 May 2012	Correspondence	0h 10m	<input type="checkbox"/>	0h 0m
24	10 May 2012	Invoice	0h 15m	<input type="checkbox"/>	0h 0m
25	<b>22h 10m</b>				<b>16h</b>

Column E contains the formula  $C2 \times D2$ . If Column D is ticked it takes the value 1, returning a value in Column E equal to Column C. This timesheet can be used to track all work undertaken for audit purposes but only the SUM of Column E is billed to the client.

## 8.5 Referencing Multiple Sheets And Tables

Previously it has been stated that multiple sheets can be used; one being used as a working sheet and another for presentation. To reference the results of a calculation from one sheet or table to another, target a cell, press Equals (=) then navigate to the reference cell and select it.

## 8.6 Referencing Data; Relative and Absolute References

Relative Reference is the default when formulas are created. In the illustration of household accounts the formulae are relatively referenced. The formula for total expenses is the SUM of Cells C5 to C10; Cell C12 was selected and equals (=) pressed to invoke the Formula Editor, then Cell C5 was selected and the Shift key held down and Cell C10 was selected. With the formula in place Cell C12 was selected and the formula dragged across the entire Row 12. The automatically added formulas reference their respective columns, maintaining a relative relationship. The formula in Cell D12 references Column D, in Cell E12 the formula references Column E and so on. All the formulas in the household accounts illustration are Relative.



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	A	B	C	D	E	F	G	H
1			January	February	March	April	May	June
2	▼ Income							
3		Salary	£2,300	£2,300	£2,300	£2,300	£2,300	£2,300
4	▼ Expenditure							
5		Mortgage	£1,000	£1,000	£1,000	£1,000	£1,000	£1,000
6		Car	£500	£500	£500	£500	£500	£500
7		Heating			£200			£150
8		Food	£500	£500	£500	£500	£500	£500
9		Telecoms	£40	£40	£40	£40	£40	£40
10		Holiday				£500		
11	▼ Total Expenses							
12		Total Expenses	£2,040	£2,040	£2,240	£2,540	£2,040	£2,190
13	▼ Net Flow							
14		Net Flow	£260	£260	£60	-£240	£260	£110
15	▼ Balance							
16		Balance	£260	£520	£580	£340	£600	£710

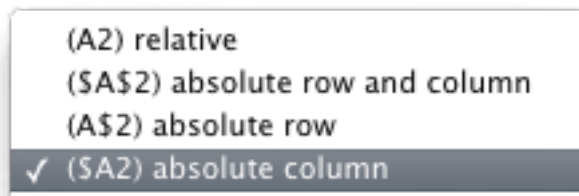
Absolute Reference is best explained using the times table.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	1	2	3	4	5	6	7	8	9	10	11	12	
2	1	2	3	4	5	6	7	8	9	10	11	12	
3	2	4	6	8	10	12	14	16	18	20	22	24	
4	3	6	9	12	15	18	21	24	27	30	33	36	
5	4	8	12	16	20	24	28	32	36	40	44	48	
6	5	10	15	20	25	30	35	40	45	50	55	60	
7	6	12	18	24	30	36	42	48	54	60	66	72	
8	7	14	21	28	35	42	49	56	63	70	77	84	
9	8	16	24	32	40	48	56	64	72	80	88	96	
10	9	18	27	36	45	54	63	72	81	90	99	108	
11	10	20	30	40	50	60	70	80	90	100	110	120	
12	11	22	33	44	55	66	77	88	99	110	121	132	
13	12	24	36	48	60	72	84	96	108	120	132	144	

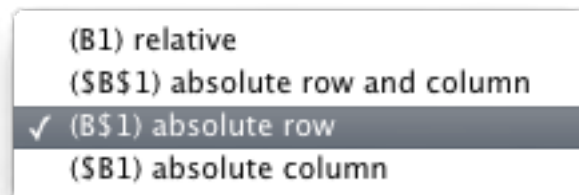
In the illustration the Header Columns and Rows contain numbers from one to twelve. The formula in Cell B2 is = B1\*A2, which is one times one, equalling one. If that formula were to be dragged across the whole of Row 2, Numbers would automatically Relatively Reference so the formula in Cell C2 would be =C1\*B2, or two times one, the correct answer, but in Cell D2 the formula would be =D1\*C2, or three times two. As six is not the result required for a times table the formula reference has to be changed to absolute cell reference. To do this invoke the Formula Editor:



Click on A2 in the Formula Editor and from the menu select Absolute Column:



Then click on B1 in the Formula Editor and from the menu select Absolute Row:



The Formula References now contain dollar (\$) signs:

Now the formula always references the absolute cell reference in the header columns and rows. Try creating a times table as illustrated to test this process.