

Math Minion

Conversion Units
&
Automatic Dimensional Analysis

SI defines 7 fundamental physical properties from which all others are derived.

Property	Unit
Length	Metre (m)
Mass	Kilogram (kg)
Time	Second (s)
Electric Current	Ampere (A)
Temperature	Kelvin (K)
Time	Second (s)
Amount of Substance	Mole (mol)
Luminous Intensity	Candela (cd)

For every calculation Math Minion tracks the power of each of the fundamental properties.

Thus:

$$10 \text{ m/s}^2$$

Would have a **length** dimension (power) of **1** and a **time** dimension of **-2**, with all others being **0**.

Math Minion has a defined unit type of **acceleration** for this unit dimension set, but it is only used for labelling.

The screenshot shows a software interface for unit conversion. At the top, there is a text input field containing "10 m/s^2". Below this, the text "Acceleration: m/s^2" is displayed, followed by two radio buttons labeled "Input" and "Output", both of which are currently unselected. A play button icon is located to the right of the "Output" label. At the bottom, there is a table with two rows and two columns. The first row has a yellow background and contains the number "1" in the right column. The second row has a blue background in the left column and contains the number "10.00000" in the right column.

	1
1	10.00000

All arithmetic operations and functions also calculate the unit dimensions of the result.

Thus if

$$\mathbf{a = 10 \text{ m/s}^2}$$

and

$$\mathbf{t = 1 \text{ h}}$$

then $\mathbf{a * t}$ would have a length dimension of 1 and a time dimension of -1 and will be labelled as a velocity.

$\text{C} =$

Velocity: m/s ▶

Input Output

	1
1	36000.00000

The formula

$$2 \text{ m} + 3 \text{ kg}$$

would result in an **error** message as addition and subtraction of values with different unit dimensions is not valid.

However

$$2 \text{ m} + 3 \text{ ft}$$

is **valid** since both **m** and **ft** have the same dimension set (length **1** and all others **0**).

The screenshot shows a software interface for unit conversion. At the top, there is a text input field containing the formula "2 m + 3 ft". Below this, the unit "Length: m" is displayed. There are two checkboxes: "Input" and "Output", both of which are currently unchecked. A play button icon is located to the right of the "Length: m" label. Below the checkboxes, there is a table with two rows and two columns. The first row has a yellow cell containing the number "1" and an empty cell. The second row has a light blue cell containing the number "1" and a white cell containing the number "2.91440".

	1	
1		2.91440

Compound units can be constructed by separating the numerator and denominator with a slash / and separating components within each by dashes -.

Thus:

The screenshot shows a software interface for unit conversion. At the top, there is a text input field containing the unit expression "1 ft^3-atm/s". Below this, the target unit is specified as "Power: W". There are two radio buttons labeled "Input" and "Output", both of which are currently unselected. A play button icon is located to the right of the "Output" label. Below the input field, a table displays the conversion result:

	1
1	2869.20448

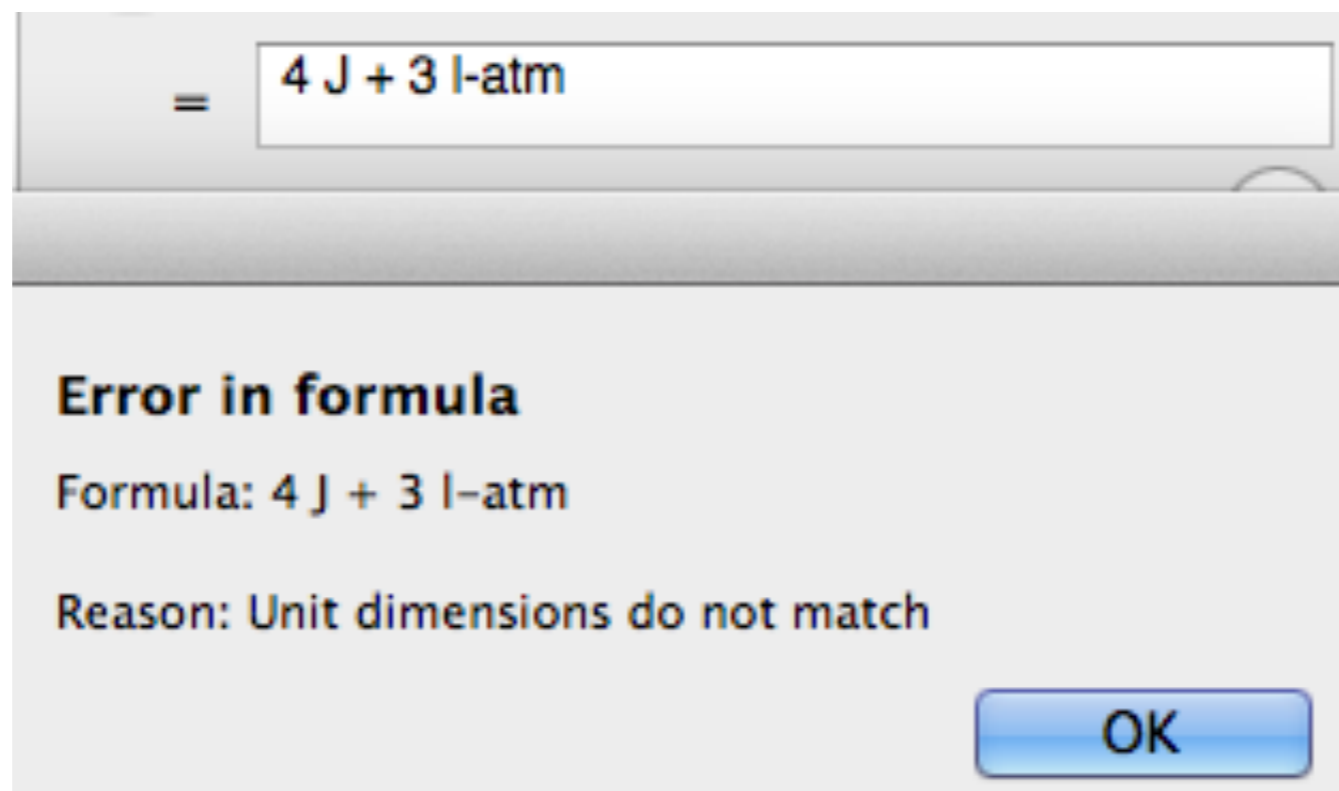
Pressure times volume is energy and that divided by time gives us power.

It is always permissible to enclose units in quotes, but it is necessary when using compound units in formulae that contain math operators.

Thus

$$4 \text{ J} + 3 \text{ l-atm}$$

would result in an error as MM sees this as 4 J + 3 l minus a value named atm.



But:

$$4 \text{ J} + 3 \text{ "l-atm"}$$

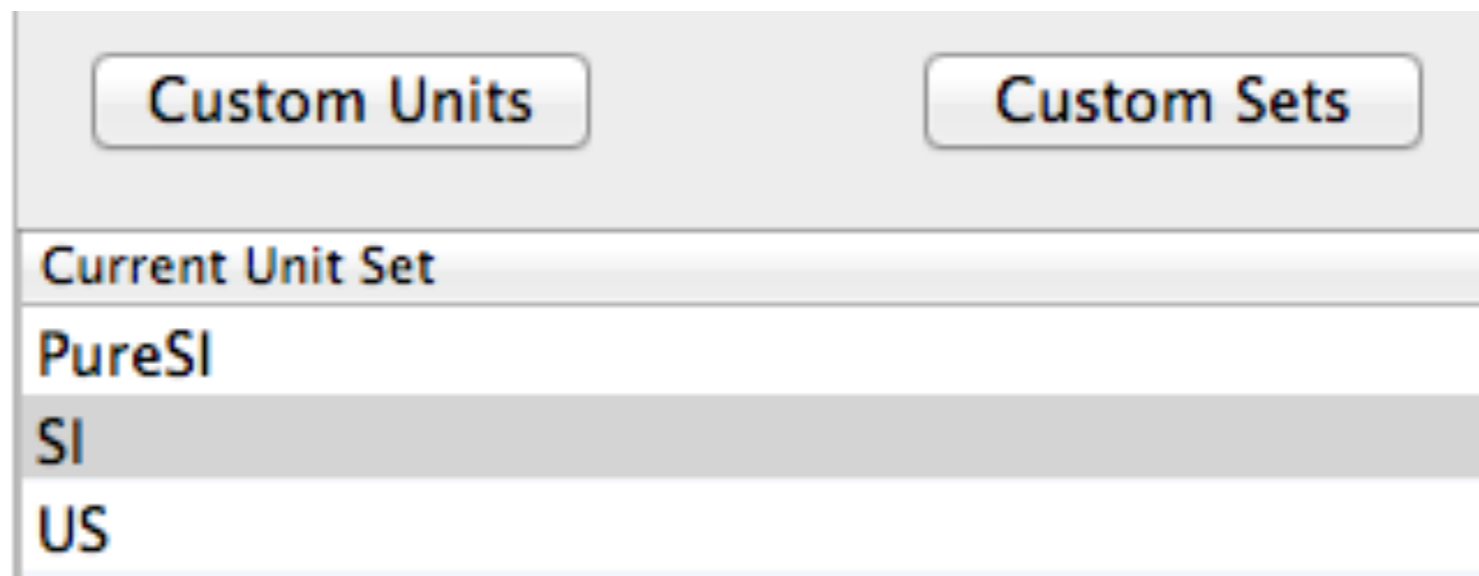
is correct

The screenshot shows the Math Minion interface. At the top, a text input field contains the expression "4 J + 3 'l-atm'". Below this, the unit "Energy: kJ" is displayed. There are two checkboxes labeled "Input" and "Output", both of which are currently unchecked. A play button is visible on the right side. Below the input field, a table displays the calculation results:

	1
1	0.30797

since the quotes allow Math Minion to distinguish the dashes and slashes in the unit from normal arithmetic operators.

You can switch the default set of units used for display and define your own custom units, unit sets and unit types.



This is the Mac unit set selection view with the 3 default sets. The buttons can be used to create custom units or sets. Custom unit types are created when creating custom sets.

Custom units are created by a simple formula definition in terms of existing units.

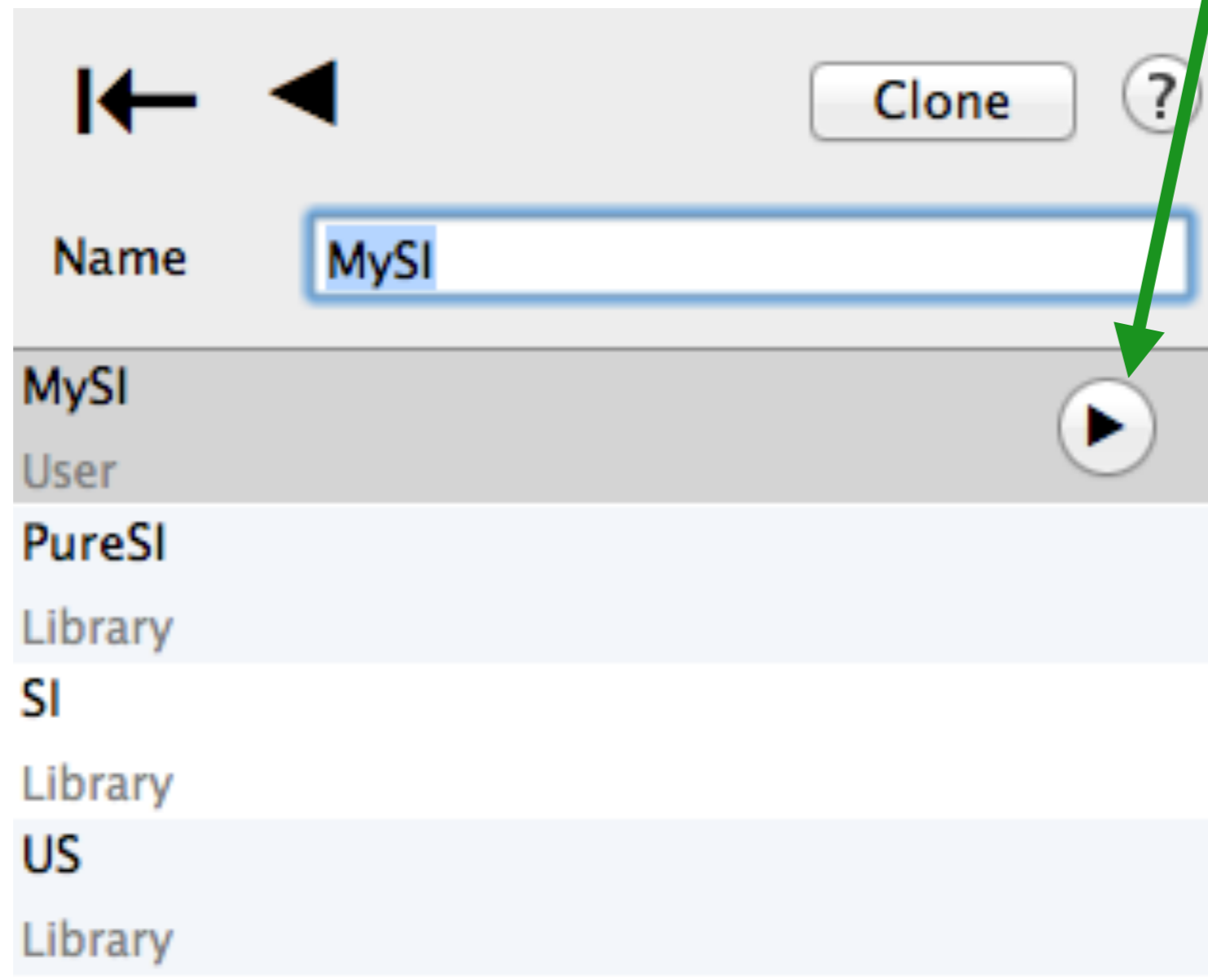
Definition

Example: myUnit = 2 kg-m/s^2

sqyard = 1 yard^2 Delete

Area

Custom sets are created by cloning an existing set and then tapping the edit icon to the right.



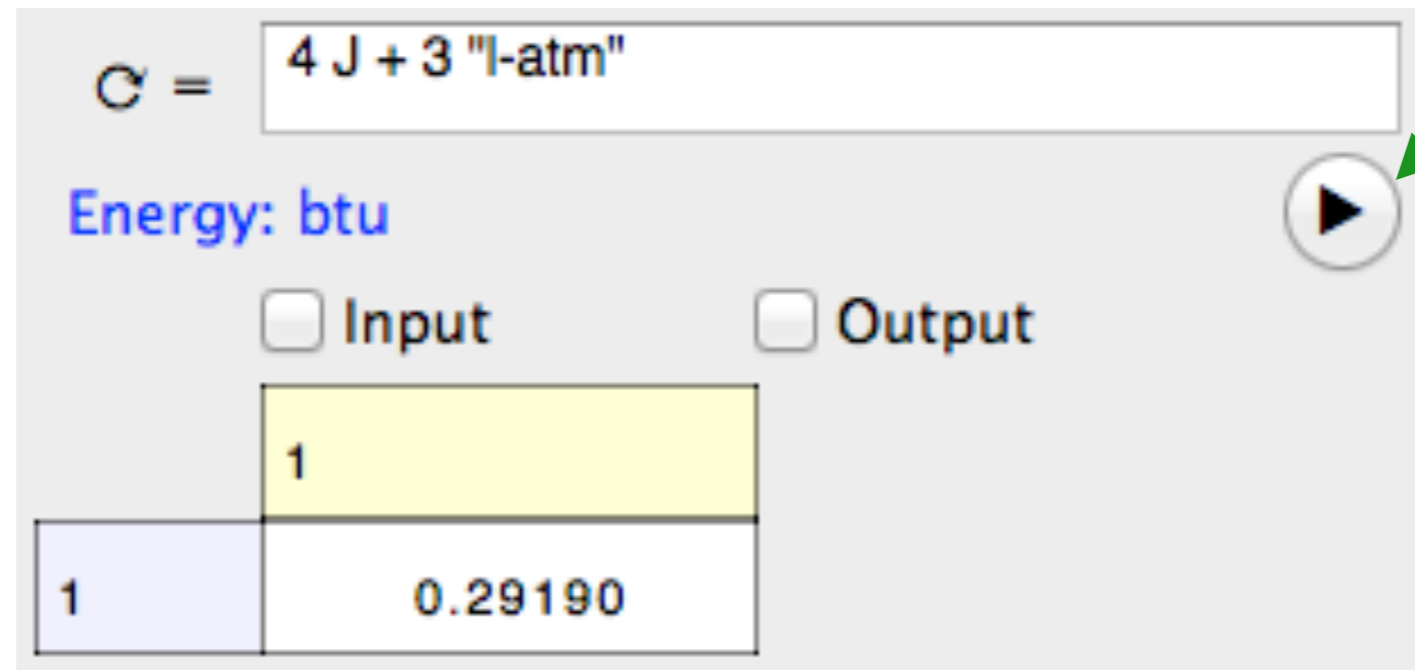
A unit set consists of a series of unit types and associated with the default display units. A unit type is simply a name given to a unique set of fundamental property powers.

A new type is created by associating a name with a default unit.

The screenshot shows a software interface for managing unit types. At the top, there are navigation arrows, a "Delete Set" button, an "Add Type" button, and a help icon (?). Below this is a form with two input fields: "Name" containing "Area" and "Unit" containing "m^2". Below the form is a list of existing unit types, each with a "Delete" button. The "Area" entry is highlighted in blue.

Unit Type	Unit	Action
Acceleration	m/s ²	Delete
Area	m ²	Delete
Capacitance	uF	Delete
Density		

Regardless of the current unit set, an expression can be instructed to display in any appropriate unit. Below the energy is displayed in Btu, even though the current display set is SI. The icon to the right of the unit accesses the unit browser.



The unit browser can also be accessed when entering a formula by tapping on the “u” keyboard key (iOS) or the “U” toolbar button (Mac).

That's All Folks.