

# TS Calc 1.2

## User Guide



Tension Software - We Make Software for Mac - Pomola.com

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# Welcome to TS Calc

The technical tool to manage and solve mathematical equations

TS Calc is a Mac OS X application offering an ideal platform to solve mathematical models applied to technical problems of various type.

TS Calc is a document based application and its documents can be realized and used as calculation models for a specific mathematical technical problems. These documents can also be distributed as pre-made solutions for various type of technical problems with all the requested equations inside and all the variables pre-inserted with acceptable range already set.

Type	Variable Input	Value	Result	Mesure	Description
•INPUT	M	5.000	✓	Nm	Moment at the neutral axes
•INPUT	b	30	✓	m	Width of section
•INPUT	h	60	✓	m	height of section

Type	Variable Output	Value	Result	Mesure	Description
•OUTPUT	sigma	0,278	✓	Pa	Bending stress, 1Pa = 1N/m^2
•OUTPUT	sigmaKgCm2	283,158	✓	Kg/cm^2	N Bending stress Kg/cm^2

From Wikipedia, the free encyclopedia

### Simple or symmetrical bending

Beam bending is analyzed with the [Euler-Bernoulli beam equation](#). The classic formula for determining the bending stress in a member is:

$$\sigma = \frac{My}{I_x}$$

simplified for a beam of rectangular cross-section to:

$$\sigma = \frac{6M}{bh^2}$$

- $\sigma$  is the bending [stress](#)
- $M$  - the [moment](#) at the [neutral axis](#)
- $y$  - the perpendicular distance to the [neutral axis](#)
- $I_x$  - the [area moment of inertia](#) about the [neutral axis](#)  $x$
- $b$  - the width of the section being analyzed
- $h$  - the depth of the section being analyzed

This equation is valid only when the stress at the extreme fiber (i.e. the portion of the beam furthest from the neutral axis) is below the [yield stress](#) of the material it is constructed from. At higher loadings the stress distribution becomes non-linear, and ductile materials will eventually enter a *plastic hinge* state where the magnitude of the stress is equal to the yield stress everywhere in the beam, with a discontinuity at

A TS Calc document contains a series of equations and a list of variables and constants used by the equations. The user can insert different input and see the output generated by the TS Calc document using the equations solving the problem.

TS Calc includes a calculation engine entirely developed and coded internally by Tension Software in C and Objective-C, able to solve equations with any nested level of parenthesis, variables and a large type of mathematical functions at an impressive speed, almost Instantaneously on modern Mac

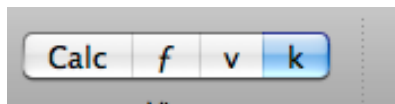
# Getting Started with TS Calc

## A very simple example

We start with a very simple example.  
Nothing special, but it can give you a view on how TS Calc works.  
After that you will be ready to use TS Calc for complex calculations.

So we start with a calculation that is just to show how to manage things in TS Calc  
Suppose we want to calculate how many seconds there are in n days.  
We need to have additional data value, as example how many seconds in 1 hour  
and in one day. We will insert these values as constants

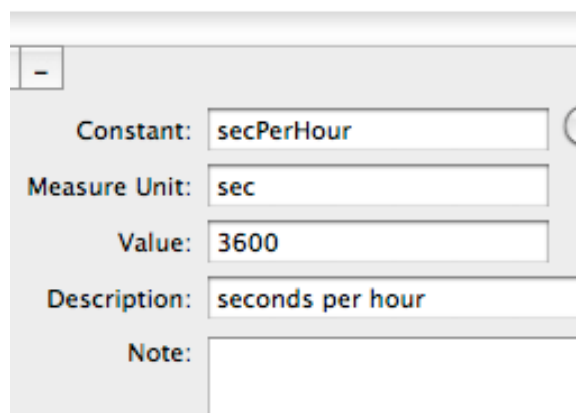
Open TS Calc and switch to the constant view



add a constant



Rename it 'secPerHour' and assign a value of 3600

A dialog box for configuring a constant. It has a title bar with a minus sign on the left. The fields are: 'Constant:' with the text 'secPerHour', 'Measure Unit:' with the text 'sec', 'Value:' with the text '3600', 'Description:' with the text 'seconds per hour', and 'Note:' with an empty text area.

then add another constant  
'hourPerDay' and assign the value 24

You should end with the rows showing the value entered:

type	Constant	Value	Measure	Description
•USED	secPerHour	3600	sec	seconds in 1 hour
•USED	hourPerDay	24	hour	hour in a day

Now we go in the formula view using the tab control in the toolbar



We add a function and modify the default 'x=y' text with with:

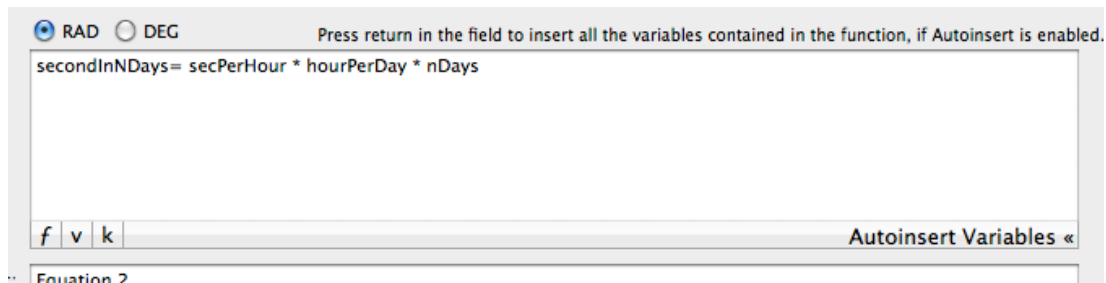
$$\text{secondInNDays} = \text{secPerHour} * \text{hourPerDay} * \text{nDays}$$

It is self explanatory, to calculate the seconds in a week we calculated the seconds in 1 hour multiplied per hours in one day multiplied the nDays value

Note one thing:

We used two constant value we already entered, plus two variables (secondInNDays and nDays) not yet specified.

We can specify it manually in the variable view or have it inserted automatically by TS Calc, if we press enter with the cursor inside the formula field (if Autoinsert Variable is enabled)



TS Calc will do the work for us.

After it we can see in the Variables view both the nDays and the secondsInDays entries:

Type	Variable	Value	Result	measure	Description
•INPUT	nDays	0	✓	undefined	Variable 2
•OUTPUT	secondInNDays	0	✓	undefined	Variable 3

Not only TS Calc realized we inserted two new variables not yet defined but it also recognized one is used as input and the other as output.

So in TS Calc we just have to specify equations, TS Calc understand (and can solve) them

Now double click in the variable field in the table and insert 7 in the nDays row in the Value column and press return.

Type	Variable	Value	Result	measure	Description
INPUT	nDays	7	✓	undefined	Variable 2
OUTPUT	secondInNDays	0	✓	undefined	Variable 3

TS Calc immediately execute the calculation and show the result 604800

Type	Variable	Value	Result	measure	Description
INPUT	nDays	7	✓	undefined	Variable 2
OUTPUT	secondInNDays	604800	✓	undefined	Variable 3

try with another number of days, as example 365 to know how many seconds in one year:

Type	Variable	Value	Result	measure	Description
INPUT	nDays	365	✓	undefined	Variable 2
OUTPUT	secondInNDays	31536000	✓	undefined	Variable 3

you can change formatting to have the number displayed according with your country:

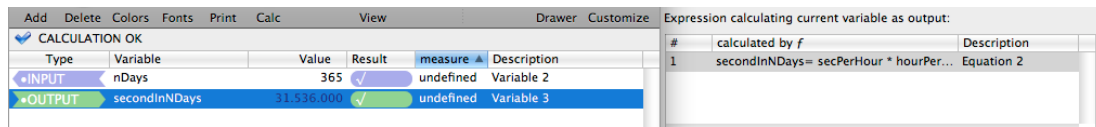
As example USA formatting with comma for thousands separator:

Value	Result	measure
365	✓	undefi
31,536,000	✓	undefi

or some european country with dot for thousands separator:

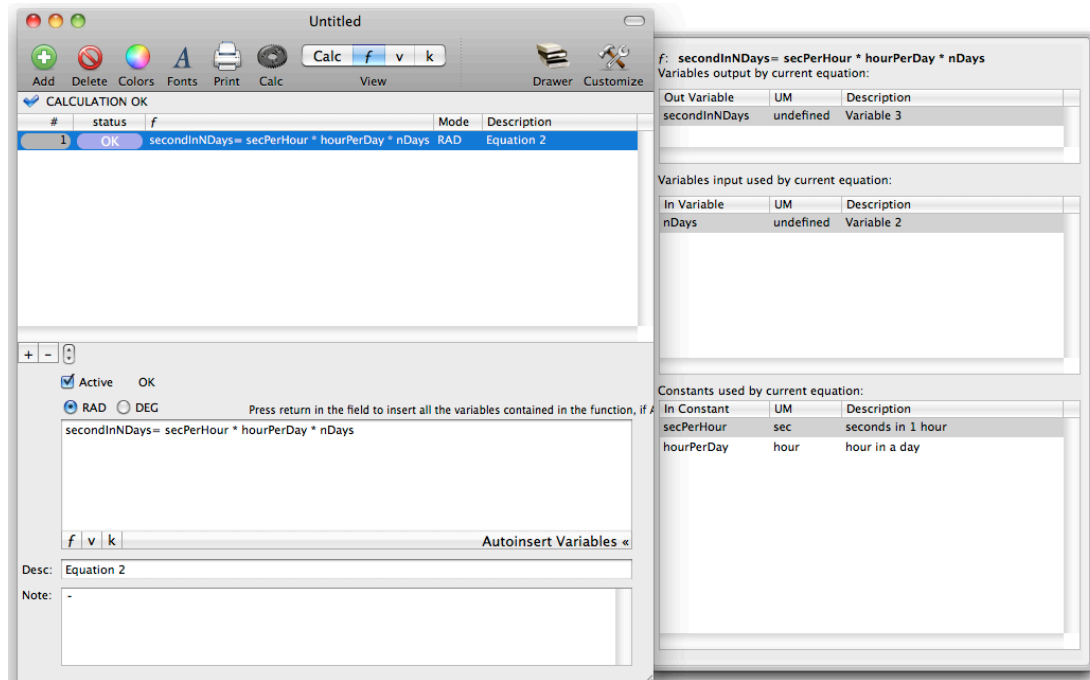
Value	Result	measure	Des
365	✓	undefined	Vari
31.536.000	✓	undefined	Vari

if you select the input variable, in the drawer TS Calc can show you where the variable is used.



This is useful if you have complex model calculation with many variables and equations, things can be a bit confusing in this case.

Is interesting to see what happen selecting the formula in the Equation View:



It can shows for any equation, input variables, output variables and constants used.

The calc view separates Input values and output values in two different panes. This make using a pre made model more easy.

In the 'Calc' view the drawer can show additional info entered wit RTF text and pictures, showing an explanation of what the document does and anything other the document creator thinks is useful.

The calculation used was very simple, it was just to understand how TS Calc works. Now you can try your own calculation models, with many and complex calculations, where the output of one equations is used as input in others and so on.

TS Calc will parse all the content of the document trying to always solve things and showing you what is used and where with which results.

## Using the 'Projectile Trajectory' example

We can now use a more complex pre-made document.

If the Demo Docs are not included with your TS Calc distribution

(As example in the Apple Mac App Store release) you can get the Demo Docs at:

<http://www.pomola.com/download/download.html>

### WARNING!

If you purchased from the Apple Mac App store, DO NOT download the application from our web site.  
Download only the 'Demo Documents for TS Calc'.

If you substitute your copy purchased via the Mac App Store with the one from our web site, you will end in having the trial version.

This is valid for all the Apps you purchased from the Mac App Store also from other vendors!

The rule is:

Update the Apps you purchased via the Mac App Store via the Mac App Store only!

In case, with any application, you substituted the application purchased from the store with a trial, deleting the trial, the App Store should let you re-install the full version.

Included with the demo documents you will find the 'Projectile Trajectory' document, we will use it to have a first view of TS Calc.

It calculates the ballistic trajectory of a projectile launched from a cannon at speed Vkmh (Velocity in Km per hour) with and inclination angle Teta

Type	Variable Input	Value	Result	Mesure	Description
INPUT	x	1,000	✓	m	coordinate x of target to hit (horiz...
INPUT	y	0	✓	m	Coordinate y of target to hit
INPUT	Vkmh	644	✓	Km/h	Projectile lauch speed in Km/h

Type	Variable Output	Value	Result	Mesure	Description
OUTPUT	v	178,889	✓	m/s	Velocity at wich the project...
OUTPUT	Teta1	81,074	✓	°	Angle 1 to use to take target
OUTPUT	Vms	178,889	✓	m/s	Projectile lauch speed in m...
OUTPUT	Teta2	8,926	✓	°	Angle 2 to use to take target

From Wikipedia, the free encyclopedia  
**Trajectory of a projectile (no air friction resistance)**

- $g$ : the [gravitational acceleration](#)—usually taken to be  $9.81 \text{ ms}^{-2}$  near the Earth's surface
- $\theta$ : the angle at which the projectile is launched
- $v$ : the velocity at which the projectile is launched
- $x$ : horizontal coordinate of target to hit
- $y$ : vertical coordinate of target to hit

**Angle  $\theta$  required to hit coordinate  $(x,y)$**

To hit a target at range  $x$  and altitude  $y$  when fired from  $(0,0)$  and with initial velocity  $v$  the required angle(s) of launch  $\theta$  are:

$$\theta = \tan^{-1} \left( \frac{v^2 \pm \sqrt{v^4 - g(gx^2 + 2y(v^2 - gx))}}{gx} \right)$$

The model let you insert the speed of the projectile, exiting from the cannon, and the position of the target to hit.

The position of the target is specified by  $x$  and  $y$  where  $x$  is the horizontal distance from the cannon and  $y$  the elevation from the horizontal line passing from the cannon (difference in altitude from cannon to target)

It calculates the angle from the horizon to assign to the cannon to hit the target

The calculation model consider the launch without air resistance, so it's just a ideal mathematical model, not good if you really want to bomb your neighbors.

To use this formulas in real cases you have to add air resistance elements in the formula.

- Open the document 'Projectile Trajectory' from inside the application or with a double click on it
- Insert the velocity  $V_{kmh} = 400 \text{ Km/h}$
- Insert the distance  $x$  of the target in meters, as example 1000 m (around 300 feet) and elevation  $y$  equal to 0 (cannon and target are at the same altitude)

•INPUT	x	1.000	✓	m	coordinate x of target to hit (horiz...
•INPUT	y	0	✓	m	Coordinate y of target to hit
•INPUT	Vkmh	400	✓	Km/h	Projectile lauch speed in Km/h

When, under the Tools menu, Autocalc is enabled, if you enter and confirm the last input, TS Calc will show in the output area the results:

$v = 111.11 \text{ m/s}$  the projectile velocity expressed in a measure unit used for calculation m/s

Teta1=  $63.69^\circ$  one of the possible inclination angle to assign to the cannon to hit the target at the assigned x,y coordinate

Teta2=  $26.31^\circ$  one of the possible inclination angle to assign to the cannon to hit the target at the assigned x,y coordinate

Type	Variable Output	Value	Result	Mesure	Description
•OUTPUT	v	111,111	✓	m/s	Velocity at wich the project...
•OUTPUT	Teta1	63,691	✓	°	Angle 1 to use to take target
•OUTPUT	Vms	111,111	✓	m/s	Projectile lauch speed in m...
•OUTPUT	Teta2	26,309	✓	°	Angle 2 to use to take target

We can add an additional simply function to indicate the speed in miles per hours and distance in feet

- Go to the Constant view pressing the 'k' in the view switcher inside the toolbar
- Add a new constant
- Call it f2m and assign a value of 0.3048
- Add a description as 'Converts feet to meters'
- Add a second constant:
- Name: Kts2Kmh
- Value: 1,609344
- Description: Convert Kts to Km/h

type	Constant	Value	Mesure	Description
•USED	g	9,81	m/s^2	Gravitational accelleration
UNUSED	f2m	0,3048	undefined	Converts feet to meters
UNUSED	Kts2Kmh	1,609344	undefined	Convert Kts to Km/h

- Go to the equation view pressing 'f' in the switch control in the menu bar
- Create a new equation using the '+' button
- Delete the default proposed  $x=y$  body
- Press the 'v' minibutton under the body field, a popup will show all the available variables, select the  $V_{kmh}$  and it will be inserted

Now insert an '='

Now digit 'V<sub>kts</sub>'

Now add a '\*'

And now from the 'k' add Kts2Kmh

Final result will be:

$$V_{kmh} = V_{kts} * Kts2Kmh$$

At this point something interesting changed inside the document:

Selecting any equation we can see in the drawer on the side: the output variables, input variables and constant used by the equation

We see that our simple equation we inserted is correctly managed:

- Vkmh indicated as output variable
- Vkts indicated as input variable
- Kts2Kmh indicated as used constant

Now click in the toolbar the 'Calc' button in the view selector

There is an interesting change

Before adding this new equation the variable 'Vkmh' was indicated as input variable

Now 'Vkmh' is in the output variable section (it is calculated by the last equation)

and

'Vkts' is in the input area

Type	Variable	Value	Result	Mesure	Description
•INPUT	x	1.000	✓	m	coordinate x of target to hit (horizontal coord...
•INPUT	y	0	✓	m	Coordinate y of target to hit
•OUTPUT	v	178,816	✓	m/s	Velocity at wich the projectile is launched
•OUTPUT	Teta1	81,066736	✓	°	Angle 1 to use to take target
•OUTPUT	Vms	178,816	✓	m/s	Projectile lauch speed in m/s calculated from ...
•OUTPUT	Vkmh	643,7376	✓	Km/h	Projectile lauch speed in Km/h
•OUTPUT	Teta2	8,933264	✓	°	Angle 2 to use to take target
•INPUT	Vkts	400	✓	Kts	Launch Speed Knots

If you want to revert to the previous situation you can go in the equation list and disable the new equation  $Vkmh = Vkts * Kts2Kmh$  unchecking the 'Active' check box

#	status	f	Mode	Description
1	OK	Teta1=atan( (v^2+sqrt(v^4-g*(g*x^2+2*y*v^2...	DEG	Equation 1
2	OK	Vms=Vkmh/3,6	RAD	Equation 2
3	OK	v= Vms	RAD	Equation 3
4	OK	Teta2=atan( (v^2-sqrt(v^4-g*(g*x^2+2*y*v^2...	DEG	Equation 4
5	HOLD	Vkmh = VKts * Kts2Kmh	RAD	Equation 5

Up to you now to insert two new equation to insert coordinate x and y in feet using the f2m created constant ...

TS Calc assist you creating new function providing you list of variables and constant and available function and informing you of error inside equations, variables or constants

Let see how the error detection works

Try to insert an error in a function

Modify the function

'Vkmh =Vkts\* Kts2Kmh'

to:

'Vkmh =Vkts\* Kts2Kmh +'

adding a '+' at the end without any final element to add

TS Calc will indicate the syntax error and will indicate in red the equation

✖ ERROR IN EQUATION				
#	status	f	Mode	Description
1	OK	Teta1=atan( (v^2+sqrt(v^4-g*(g*x^2+2*y*v^...	DEG	Equation 1
2	OK	Vms=Vkmh/3,6	RAD	Equation 2
3	OK	v= Vms	RAD	Equation 3
4	OK	Teta2=atan( (v^2-sqrt(v^4-g*(g*x^2+2*y*v^...	DEG	Equation 4
5	ERR!	Vkmh = VKts * Kts2Kmh +	RAD	Equation 5

Fix the error and modify a variable name as example modify the variable name 'Vkmh' to 'Vk mh' with a space inside (space inside a variable name is not admitted) TS Calc will indicate the error in the upper part of the window and will also hiligh in red the variable indicating the error with a red label

# Reference

TS Calc is an application to manage and calculate mathematical models and solve it

It provides functionalities not available in any other software to accomplish this task in the better way

TS Calc is a standard document based application, it means you can manage an unlimited number of documents, saved on disk, each associated with a separate window with a specific set of equation to solve a specific mathematical problem.

## TS Calc Data organization

A TS Calc document window has 4 different views:

- Calc
- Equations
- Variables
- Constant

Each of this view show in details different elements or views of the problem the document solve.

Type	Variable Input	Value	Result	Mesure	Description
•INPUT	x	1.000	✓	m	coordinate x of target to hit (horizontal coor...
•INPUT	y	0	✓	m	Coordinate y of target to hit
•INPUT	VKts	400	✓	Kts	Launch Speed Knots

Type	Variable Output	Value	Result	Mesure	Description
•OUTPUT	v	178,816	✓	m/s	Velocity at wich the projectile is launched
•OUTPUT	Teta1	81,066736	✓	°	Angle 1 to use to take target
•OUTPUT	Vms	178,816	✓	m/s	Projectile lauch speed in m/s calculat...
•OUTPUT	Vkmh	643,7376	✓	Km/h	Projectile lauch speed in Km/h
•OUTPUT	Teta2	8,933264	✓	°	Angle 2 to use to take target

From Wikipedia, the free encyclopedia

### Trajectory of a projectile (no air friction resistance)

- $g$ : the [gravitational acceleration](#)—usually taken to be  $9.81 \text{ ms}^{-2}$  near the Earth's surface
- $\theta$ : the angle at which the projectile is launched
- $v$ : the velocity at which the projectile is launched
- $x$ : horizontal coordinate of target to hit
- $y$ : vertical coordinate of target to hit

#### Angle $\theta$ required to hit coordinate $(x,y)$

To hit a target at range  $x$  and altitude  $y$  when fired from  $(0,0)$  and with initial velocity  $v$  the required angle(s) of launch  $\theta$  are:

$$\theta = \tan^{-1} \left( \frac{v^2 \pm \sqrt{v^4 - g(gx^2 + 2yv)}}{gx} \right)$$

Above formula doesn't consider air friction resistance

As said a document can be used to solve a specific mathematical problem storing inside the formulas, variables and constant values solving it.

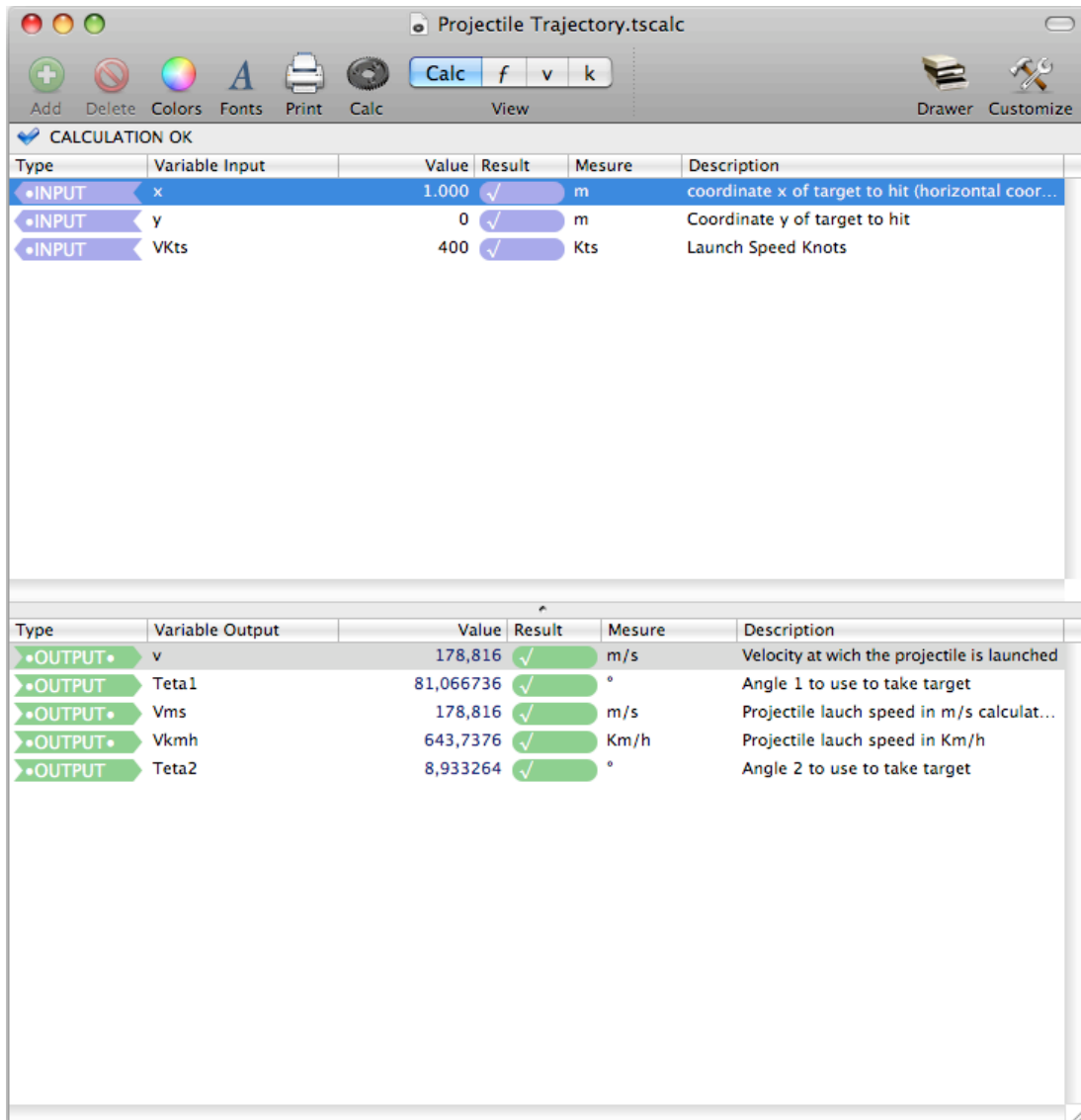
TS Calc allow also to include a description with pictures to explain in details what the document is dedicated to.

## The Calc view

Calc (Calc) View shows the input variables and the output variables

Using the Calc View the user can insert the input values and see instantly the output values as they are calculated by the equations inside the document

TS Calc analyzing the equations know by itself if a variable is an input or output variable



The screenshot shows the 'CALCULATION OK' dialog box in the TS Calc software. The dialog box contains two tables: one for input variables and one for output variables. The top table lists input variables 'x', 'y', and 'VKts' with their respective values (1.000, 0, and 400) and units (m, m, and Kts). The bottom table lists output variables 'v', 'Teta1', 'Vms', 'Vkmh', and 'Teta2' with their calculated values (178,816, 81,066736, 178,816, 643,7376, and 8,933264) and units (m/s, °, m/s, Km/h, and °). Each row in both tables has a 'Result' column with a checkmark indicating successful calculation.

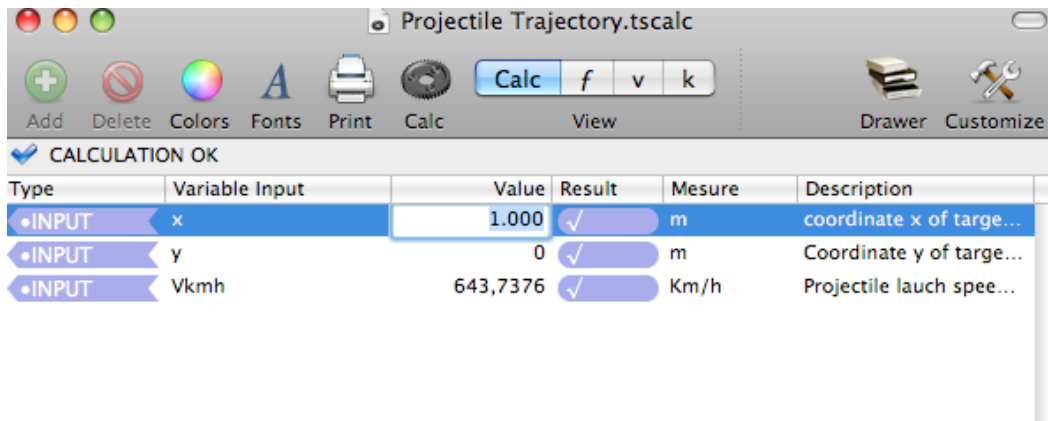
Type	Variable Input	Value	Result	Mesure	Description
•INPUT	x	1.000	✓	m	coordinate x of target to hit (horizontal coor...
•INPUT	y	0	✓	m	Coordinate y of target to hit
•INPUT	VKts	400	✓	Kts	Launch Speed Knots

Type	Variable Output	Value	Result	Mesure	Description
•OUTPUT	v	178,816	✓	m/s	Velocity at wich the projectile is launched
•OUTPUT	Teta1	81,066736	✓	°	Angle 1 to use to take target
•OUTPUT	Vms	178,816	✓	m/s	Projectile lauch speed in m/s calculat...
•OUTPUT	Vkmh	643,7376	✓	Km/h	Projectile lauch speed in Km/h
•OUTPUT	Teta2	8,933264	✓	°	Angle 2 to use to take target

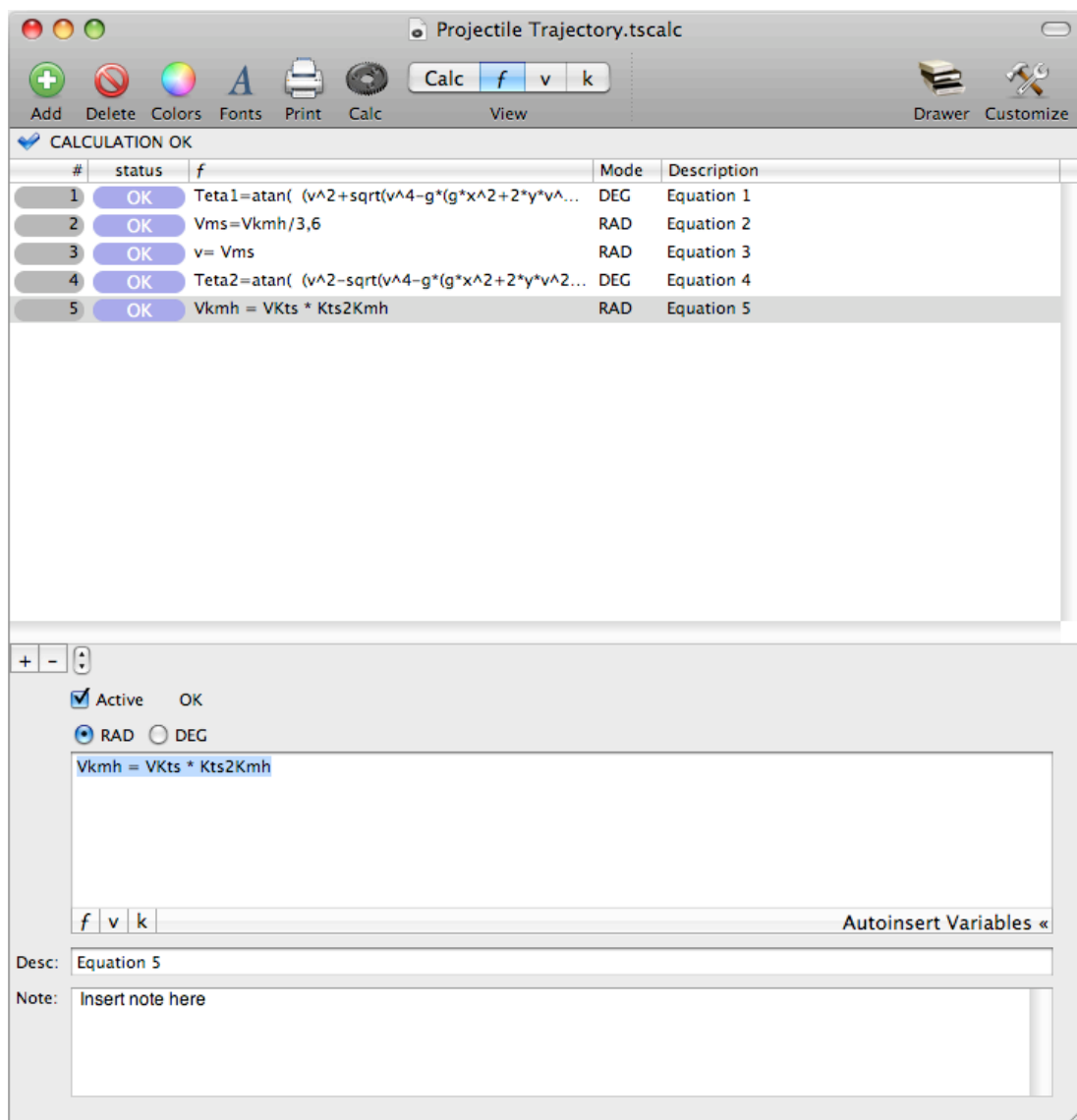
You can instruct TS Calc to inform if a variable value is outside an acceptable range  
A smart detection system analyze all the data inside the document and inform you about calculation errors

To change the value of an input variable, the user has to double click its value inside the window, the variable value will become editable



## The Equations view

Equations (*f*) View shows all the equations inside the document, any enabled equation is calculated and its output considered inside the document calculation, if an equation is deactivated using the checkbox it is not considered as part of the calculation



## The Variables view

Variables (v) View shows all the variables used inside all the enabled equations in the document.

TS Calc automatically recognize if a variable is an input variable or an output one. Variables can be added manually or automatically as they are found in equations. A utility function allows to automatically insert new variables in the document as they are found inside any equations into the variables area.

Variables can be transformed in constant as long as they are used as input value only using the apposite button.

Type	Variable	Value	Result	Mesure	Description
+INPUT	x	1.000	✓	m	coordinate x of target to hit (horizontal coord...
+INPUT	y	0	✓	m	Coordinate y of target to hit
+OUTPUT	v	178,816	✓	m/s	Velocity at wich the projectile is launched
+OUTPUT	Teta1	81,066736	✓	°	Angle 1 to use to take target
+OUTPUT	Vms	178,816	✓	m/s	Projectile lauch speed in m/s calculated from ...
+OUTPUT	Vkmh	643,7376	✓	Km/h	Projectile lauch speed in Km/h
+OUTPUT	Teta2	8,933264	✓	°	Angle 2 to use to take target
+INPUT	VKts	400	✓	Kts	Launch Speed Knots

Variable: VKts    Measure Unit: Kts    [Move to Constants](#)

Min Max: Do Not Use – Accepts any value

Min: 0    Max: 0

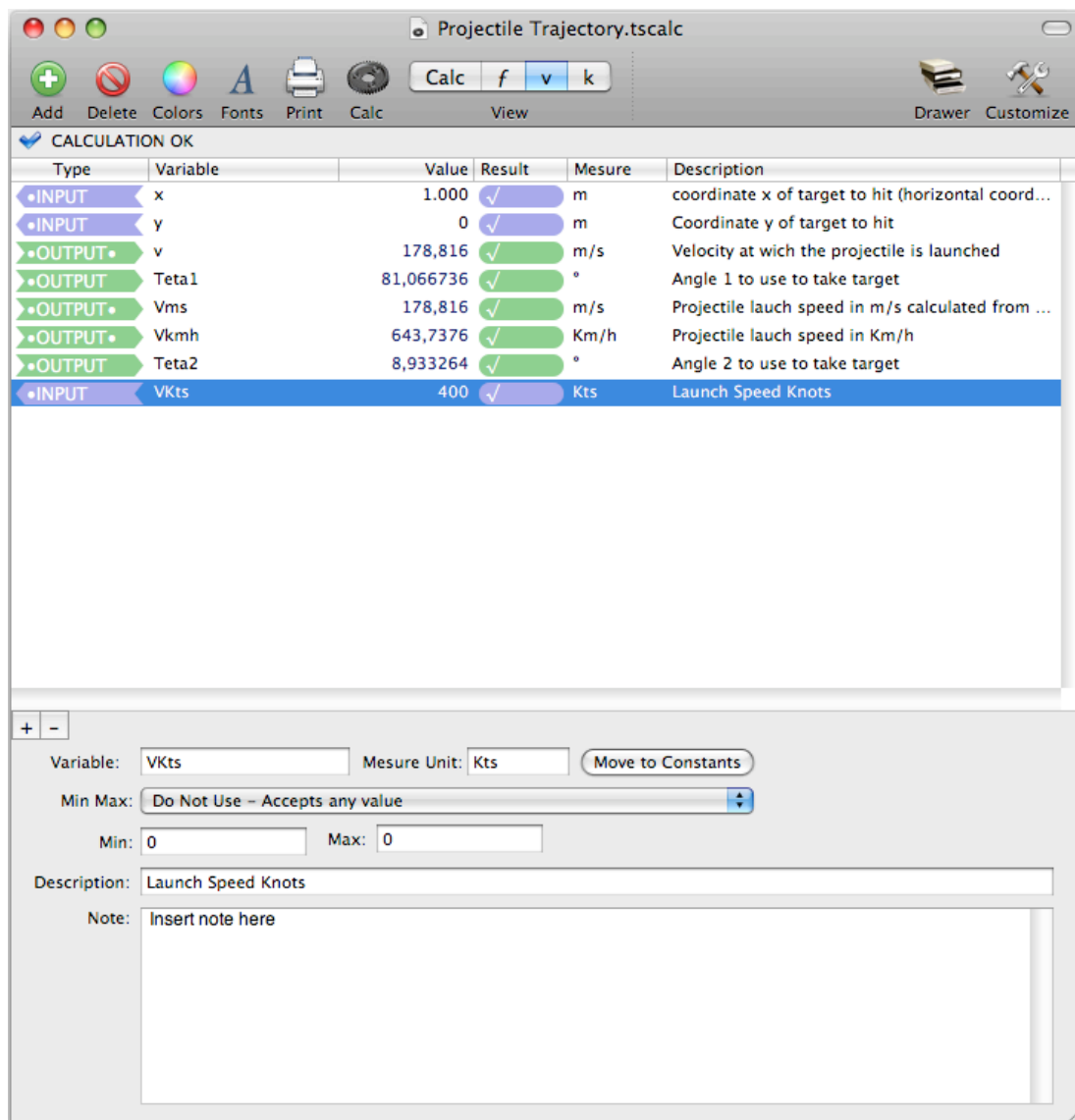
Description: Launch Speed Knots

Note: Insert note here

## The Constants view

Constants (k) show all the constants used inside the equations

The user can manually insert a constant or move a variable in the constants area transforming it in a constant.



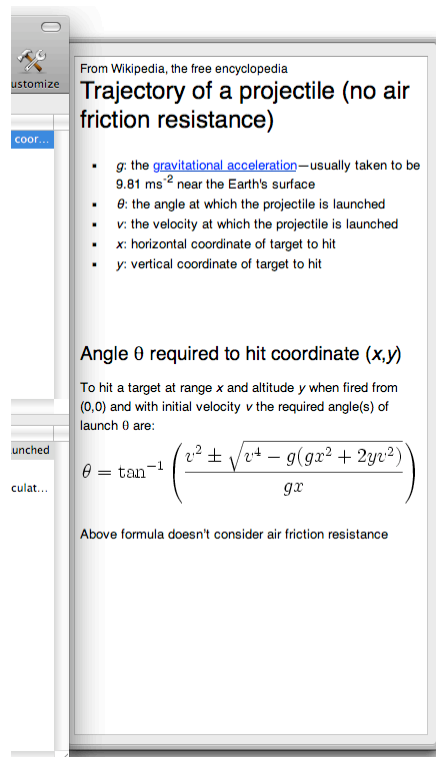
When the automatic feature to add variable used inside an equation is used, the user has to manually move a variable to the constant area if it has to be managed as a constant, the application has no way to know it in advance. A constant can be transformed in a variable using the apposite button.

## The Drawer

The drawer is a panel that slides out from the main window with additional informations. The additional informations in the drawer are on what is selected in the main window. Changing the view in the main window changes the content of the drawer.

## The Drawer when in the Calc view

The drawer shows a Rich text area where the user can insert RTF text and pictures, using it as an advanced word processor area. Its purpose is to describe the document, how to use it, the main purpose, which kind of problem it solves and theory used.



The capability to use formatted text and picture allows to create a very rich and clear explanation  
The user can create a very rich graphical explanation about the document created.

## The Drawer when in Expression (f) view

The drawer provides 3 tables related to the expression selected in the main window  
These 3 tables provide:

- 1) The variable calculated by the selected expression with measure unit and description
  - 2) The variables used by the selected expression with measure unit and description
  - 3) The constant used by the selected expression with measure unit and description
- These tables are filled automatically by the application and updated as the user modify the document content and or change the selection

A double click on any element of each of these tables jumps to the variable or constant specification in the Variables/Constant view

Customize

f:  $V_{kmh} = V_{Kts} * Kts2Kmh$

Variables output by current equation:

Out Variable	UM	Description
Vkmh	Km/h	Projectile lauch speed in Km/h

Variables input used by current equation:

In Variable	UM	Description
VKts	Kts	Launch Speed Knots

Constants used by current equation:

In Constant	UM	Description
Kts2Kmh	undefined	Convert Kts to Km/h

tables «

## The Drawer when in the Variable view

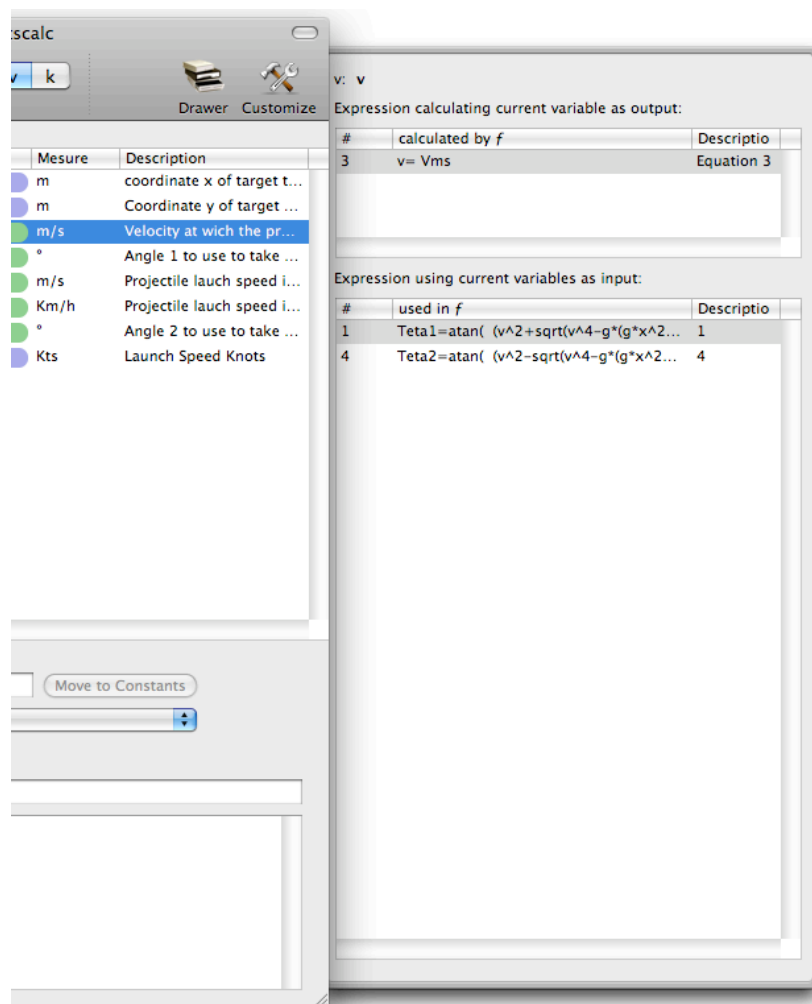
The drawer provides 2 tables related to the variable selected in the main window  
 These 2 tables provide:

The equation calculating the selected variable (if is an output variable)

The equation using this variable

These tables are filled automatically by the application and updated as the user modify the document content and or change the selection

A double click on any element of each of these tables jumps to the equation specification in the Equation view



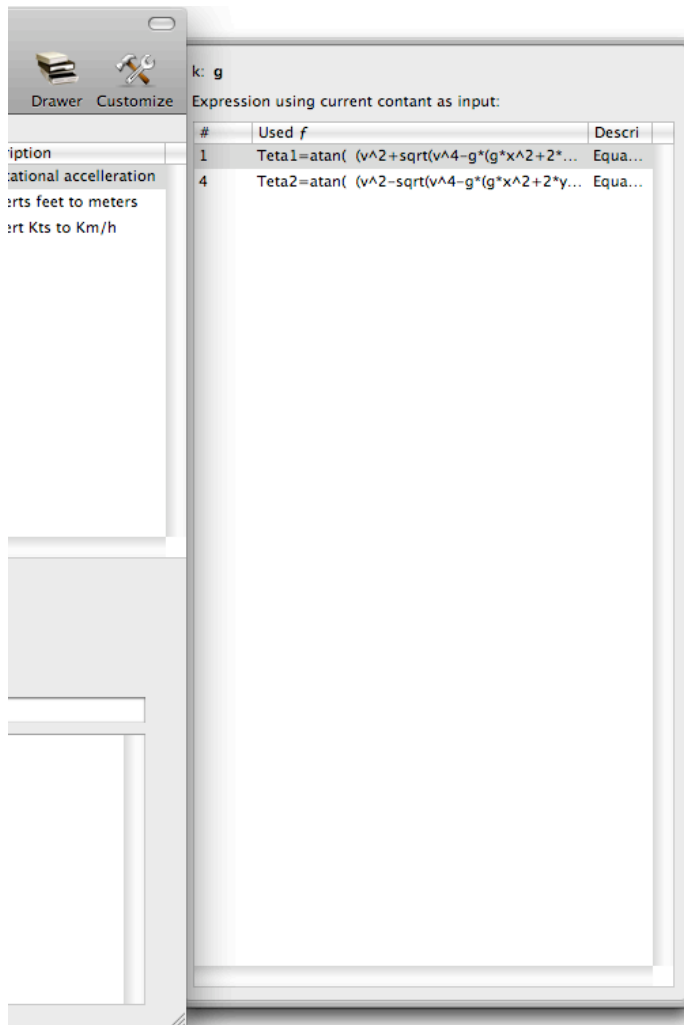
## The Drawer when in the Constant view

The drawer provides 1 table related to the constant selected in the main window

This table provides:

The equations using this constant

A double click on any element of each of this table jumps to the equation specification in the Equation view



## Equations in detail

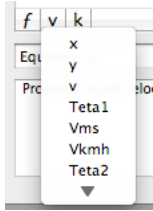
Equations can be created by selecting the '+' button in the Equations view

After an equation is created it can be edited.

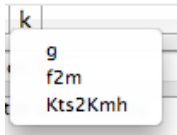
To edit a previously created equation simply select it.

You can edit in place also inside the table.

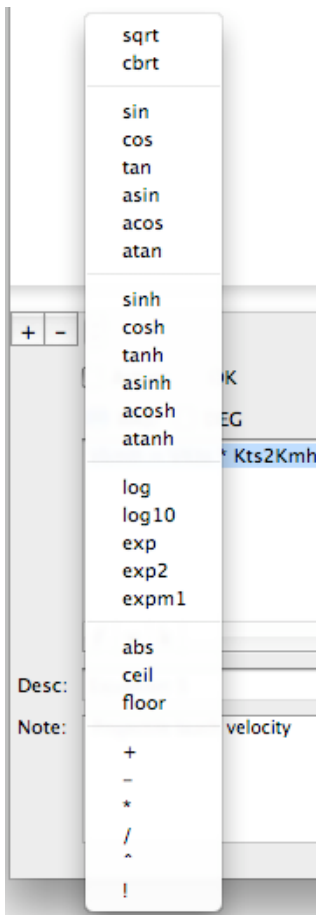
- Active: indicate if the equation must be used in calculation, if an equation is not active is just stored in the document but not used at all, also for reference by other variables in the drawer
  - RAD/DEG: indicates if calculation must be performed by trigonometric functions using radians or degree
  - Body: the mathematical equation to calculate
  - Description: description of the equation, it will be displayed also in the drawer when variables and constant view is active, so it is useful to use this field to comment about the equation
  - Note: a more extended comment about the equation used
- (There are 4 button under the body of the equation, they popup the variables,



constants and functions available to put inside the functions and a fourth button 'Autoinsert Variables <<' used to recognize new variables, inserted in the body of the function, and to add them in the Variables View )



Equations must be correct from an algebraic syntax point of view, the only functions admitted inside equations are the one listed in the popup under the equation body field:



sqrt() square root  
cbt() cube root

sin() trigonometric sine  
cos() trigonometric cosine  
tan() trigonometric tangent

asin() trigonometric arcsine, the inverse of the sine function  
acos() trigonometric arccosine, the inverse of the cosine function  
atan() trigonometric arctangent, the inverse of the tangent function

sinh() hyperbolic sine  
cosh() hyperbolic cosine  
tanh() hyperbolic tangent  
asinh() hyperbolic arcsine, the inverse of the hyperbolic sine  
acosh() hyperbolic arccosine, the inverse of the hyperbolic cosine  
atanh() hyperbolic arctangent, the inverse of the hyperbolic tangent

log() natural logarithm  
log10() base 10 logarithm  
exp() returns  $e^x$   
exp2() returns  $2^x$   
expm1() returns  $e^x - 1$

- abs() absolute value  
- ceil() round to ceil integer  
- floor() round to floor integer

Plus the operators:

+ addition  
- subtraction  
\* multiplication  
/ division  
^ power  
! factorial

Where inside the parenthesis, as function argument, a numerical value or a variable or a constant value is accepted.

If an equation uses an unknown variables or an unknown function it generates an error

A utility function allows to insert any unknown variables contained inside an equation in the variables list inside the variables view, this to avoid the need any time a new variable is needed to have to go in the Variables View to create it and then go back in the Equation View and use it inside a new equation.



Using this utility function is simple.

In a new equation the user can edit all the new variables the equation needs. After that if 'Auto Insert Variables' is enabled from the 'Utility Menu' the new variables will be created confirming the data with a simple return key.

If 'Auto Insert Variables' is not enabled the function can be called pressing the 'Autoinsert Variables <<' button at the foot of the edit field containing the equation body.



All the new variable found inside of the equation body will be inserted as new variable in the Variables View

## Variables in detail

Variables can be created by selecting the '+' button in the Variables view  
 After a variable is created it can be edited. To edit a previously created variable simply select it. You can edit in place also inside the table.  
 Variable: the name used by the variable, used in equations to make use of the variable itself.

A variable name to be acceptable must be alphanumeric, start with a letter and with no space inside, the only non alphanumeric acceptable char is '\_'  
 Measure Unit: measure unit of the variable  
 Min Max: Defines range value, mandatory or suggested  
 Min: Minimum value according with MinMax popup setting  
 Max: Maximum value according with MinMax popup setting  
 Description: description of the variable, it will be displayed also in the drawer when equation view is active, so is useful to use this field to comment about the equation  
 Note. A more extended comment about the variable  
 Move to Constant Button: Transform the variable in a constant. It will be moved in the variable list. To be enabled the variable must be of input type. If an equation use the variable as output, it can't be considered a constant, it would be a mathematical nonsense to calculate a value already considered a constant

Variables can be created also from the 'Equations View' clicking the 'Auto-insert Variables <<' any unknown variable typed inside the equation will be created ex-novo inside the 'Variables List'

## Constant in details

Constants can be created by selecting the '+' button in the Constants view

After a constant is created it can be edited.

To edit a previously created constant simply select it.

You can edit in place also inside the table.

Constant: the name used by the constant, used in equations to make use of the variable itself

A constant name to be acceptable must be alphanumeric, start with a letter and with no space inside, the only non alphanumeric acceptable char is '\_'

Measure Unit: measure unit of the constant

Value: The constant value, unmodifiable except inside the constant specification in the 'Constant view'

The screenshot shows a form for editing a constant named 'g'. The form has the following fields and controls:

- Constant:** A text input field containing 'g'.
- Measure Unit:** A text input field containing 'm/s^2'.
- Value:** A text input field containing '9,81'.
- Description:** A text input field containing 'Gravitational acceleration'.
- Note:** A text area containing 'Variable on earth depending of latitude' and 'Considered constant with good aproximation'.
- Move to Variables:** A button located to the right of the Constant field.

Description: description of the constant, it will be displayed also in the drawer when equation view is active, so is useful to use this field to comment about the equation

Note: a more extended comment about the constant

'Move to Variable' Button: Transform the constant in a variable. It will be moved in the variable list

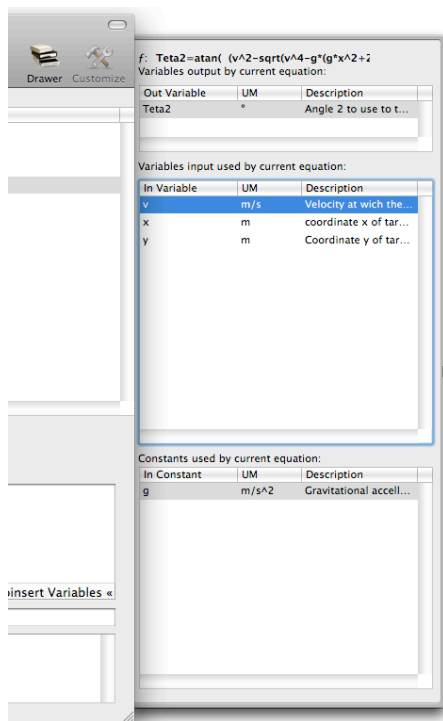
## Error checking

TS Calc indicates errors in various ways to help the user fix and solve problems

Inserting the equations to solve a technical problem is often a difficult task, specially if there are many equations and many variables to manage.

When in functions view, TS Calc shows for any equation, in the drawer, all the variables and constant used in 3 different tables:

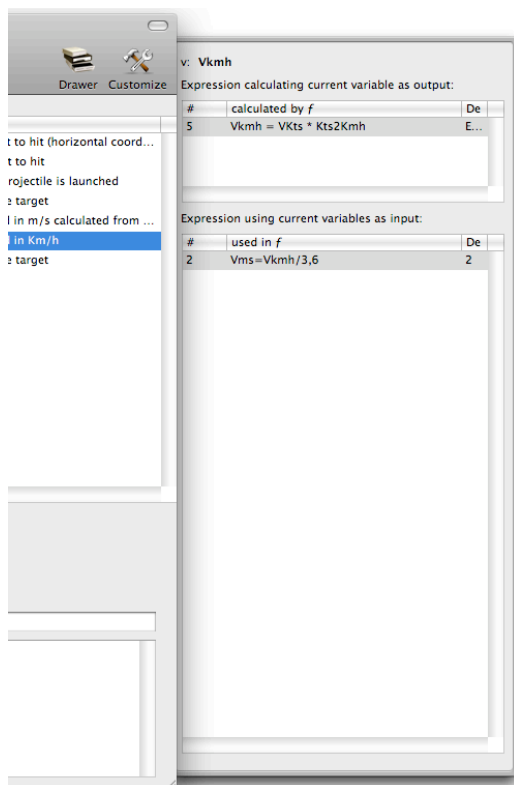
- Out Variable
- In Variables
- In Constant



Double clicking a name for any of this variable or constant in the drawer changes the current view to the Variables View or Constants View details

When in the Variables View for any variable the drawer shows the equations using it (same for the constant)

Double clicking in the drawer on an equation changes the current view back to the Equation View, this facilitate the debugging of your first writing of the equations to rapidly accomplish the task to realize a working math model inside your document.



## The new Mac OS X 10.7 Lion features

TS Calc adopt and make use of the latest Apple technologies available in Mac OS X 10.7 Lion

They are used in the standard Apple way, so nothing new to learn if you already know how to use them.

- Resume – the app will reopen at the point and state the user left it included opened documents and unsaved one
- Auto save – the app saves using the Mac OS X Lion autosave functionality
- Versions – the user can look at previous versions of documents and restore to any earlier version (just select Revert to Saved from the menu or the down arrow at the right of the title window, it appears only if you move the cursor over)

To use the Versions you can select 'revert' from the file menu or clicking 'Browse All Versions...' form the pop arrow in the title window

- Full Screen - the user can switch at any time to full screen using the native OS X Lion full screen mode and commands (use the upper right icon in the window to go full screen and bang the mouse in the upper part of the screen to re-obtain the menu and eventually clicking the standard icon to exit the full screen mode)

## Preferences

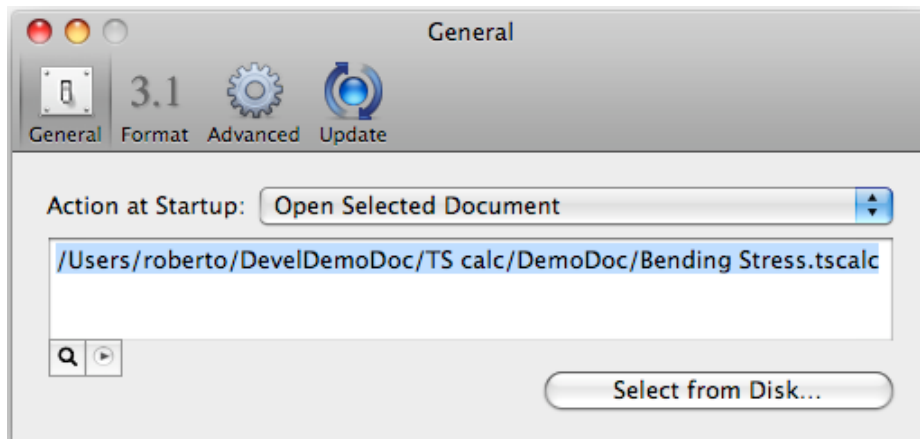
### General

Specify the action to do at startup

- New Document create a new document at startup
- File browser open the dialog to select a TS Calc document from disk to launch
- None performs nothing at startup
- Open Selected Document allows to select a document and have it launched automatically at startup, this is a standard way to operate in case you use just a single document as the main repository of your notes or use often the same document.

To select a document you have 3 way:

- Pressing the select from disk button and select it from the open dialog that will follow
- Dragging it from the finder or dragging it using the proxy icon (the icon in an opened document in the title bar)
- Editing it in the edit field by keyword (the hard way)



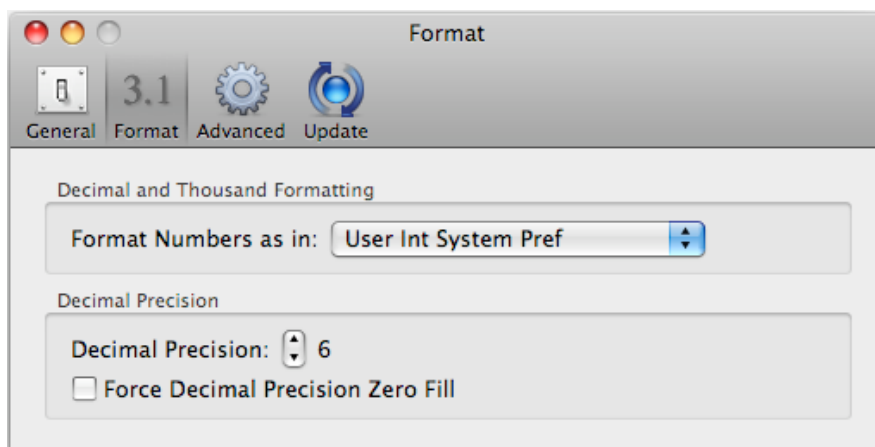
At any successive relaunch TS Calc will execute the option selected.

The additional two buttons at the foot of the edit field let you:

- Show in the finder the selected file
- Test open the selected file as it will be done at the next application launch

## Format

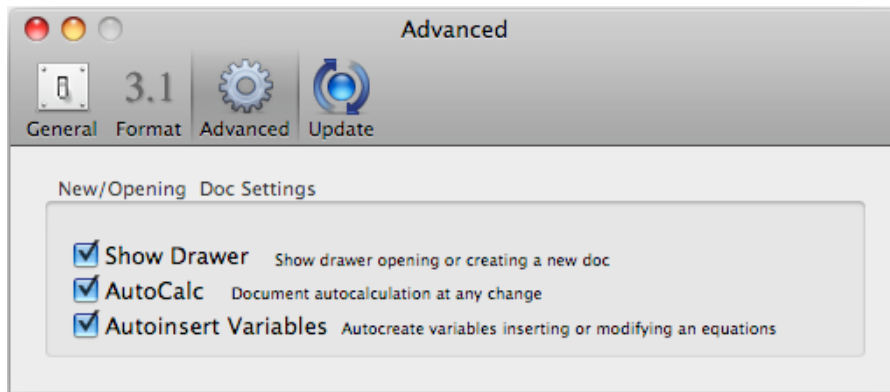
Allows you to select the format for numbers and decimal precision to use:



## Advanced

Allows you to select some advanced options:

- To show the drawer at startup
- To auto-calculate the result any time the user changes and input value
- To auto insert variables used inside a formula, in the variable list, if not yet inside the variable list a variable with that exact name



## Update

**\* Update section is not available in the App Store Release (if you purchased via the App Store, to obtain an update use the App Store Update function)**

TS Calc can inform you if an update is available.

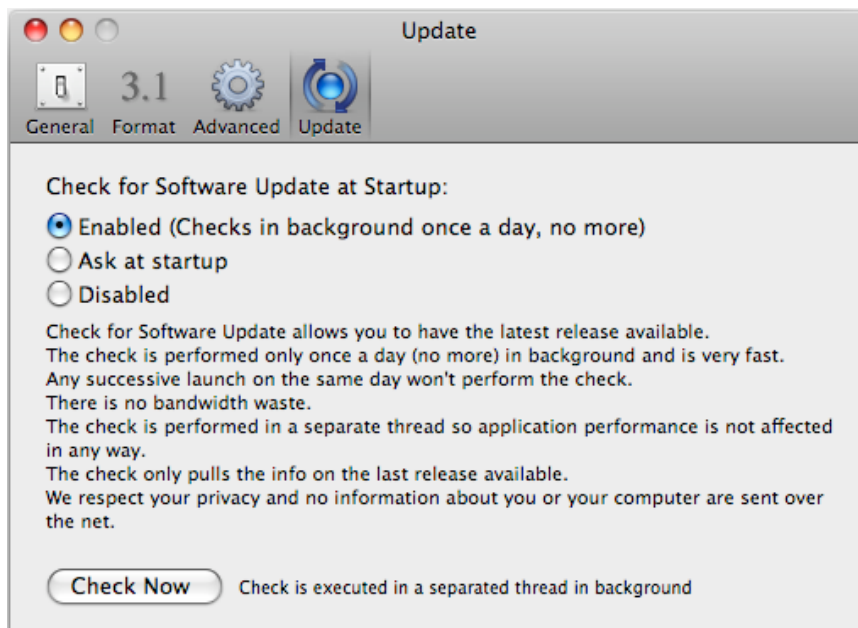
If enabled, the application will check no more than once a day.

'Ask at startup' asks you if you like to have the application check if an update is available when you start the application

'Disabled' avoids any check

When you check if an update is available, the application ping the Tension Software server and receive an answer about the last release available, the application can in that way know if its obsolete or not.

In case the application will ask you if you like to download an upgrade.



If you download the upgrade, you need to install it.

A common error is to download an upgrade and install it maintaining the old application somewhere on the hard disk.

Then using to open the documents sometime the old application and sometime the new one. This cause some problems\*. To avoid it simply install your application in the place dedicated to it, the Application folder. When you install an update on the standard Application folder, the system will ask if you want to replace the old one with the new, answering yes will install the new one replacing the old.

\*If the application says the document you are trying to open was created with a newer version of the application, probably you have two different release of the application on your Hard Disk and you are trying to open a document with the older version after having modified the document with the new one. When you receive a similar message open the about box inside the application and see if you are running the last release. In case download it, install it and USE it!

## Help

TS Calc provides a standard help menu ...maybe you already found it!  
Under the help menu use the Visit [Pomola.com](http://Pomola.com) to access our site a download the very last version of TS Calc and other software for Mac we make.

### Licensing the program

You can use the command under the Help menu to access our web site  
From there you can purchase a license to use TS Calc using one of the payment service we provide. It easy, fast, and secure.

Purchasing a license remove all the limitations inside TS Calc

If you are evaluating to purchase this software, consider that it is realized in Cocoa and in Objective-C, the basis of all the last generation software for mac OS X, and you can expect a long life for any products based on Cocoa. Mac OS X and the Cocoa technology are estimated to have really really long life with continuous improvements (more then the life of Mac OS Classic of around 15 years) because Mac OS X and Cocoa are solid technologies (Mac OS classic was just a toy if confronted with Mac OS X) and new features can be added without problems as the time request them.

This software is Universal Binaries and runs native on both PPC Mac and Intel Mac.

If you decide to purchase a license, thank you for your support. When you see on the net how much quality software there is for Mac and how much software is added every day it is because users support small developers buying software.

## Support

You can also obtain support using the 'Support Email...' command. An email will be prepared using your email client with the correct address to send to.  
Yes, we answer to your emails.

## TS Calc is a Commercial Program

You can use our software for a test period of 10 days  
After that you are required to buy a license to be legally authorized to continue to use our software

## Licensing TS Calc

### **\* In case of the App Store release a license is already included with your App Store purchase and you don't need to buy a license**

You can buy a license to use our software using the 'Buy License' command under the Help menu.

You will open in your browser our license web page on our web site

From there you can buy a license to use TS Calc using one of the payment service we provide. It easy, fast, and secure and all most important form of payment are accepted.

We carefully selected or international reseller to be sure the buying experience for our customer will be as best as possible and without any problems.

After purchase you will receive from Tension Software a license email containing your full name and a license code

Open the License dialog with the command 'license' under the 'TS Calc' menu and insert these data in the License dialog. The software will become fully licensed and fully enabled for future use.

Name and license code are remembered by the program and don't need to be re-inserted at successive launch.

In case you move on a new Mac you need to re-insert your name and license

The license is valid for a single Macintosh. You can purchase for two Mac as long as they are not used at the same time, as example a desktop and a laptop used by the same user.

## Consideration about Licensing TS Calc

### **\* In case of the App Store release a license is already included with your App Store purchase and you don't need to buy a license**

If you are evaluating to purchase this software, consider that it is realized using the Cocoa library (the native last generation library on Mac OS X) and in the Objective-C language (the first class language development on Mac OS X)

The two technology are the basis of all the last generation software for Mac OS X, and you can expect a long life for any products based on Cocoa and coded in Objective-C.

Mac OS X and the Cocoa technology are estimated to have a really long life with continuous improvements (more then the life of the now ancient Mac OS Classic which was around 15 years) because Mac OS X and Cocoa are solid technologies (Mac OS classic was just a toy if confronted with Mac OS X) and new features can be added without problems by Apple when they are required.

It was not so easy with previous generation of OS.

In our opinion the Cocoa technology will live and grow for many decades from now, so Cocoa based software are today the best way to go if you have to select software to use.

If you decide to purchase a license, thank you for your support.

When you see on the net how much software there is for Mac and how much software is added every day, it is because users support small developers buying

software and because the Macintosh software ecosystem it's really a great place to work due to the incredible success the Macintosh has today and the common feeling of the community (we use the Mac because we love doing things in a smart way).