




## How it works?

1. **Enter** text and formulas into the **"Code"** box on the left.
2. Press **F5** or click  to **calculate**. The results will appear in the **"Output"** box on the right as a professionally formatted Html **report**.
3. Click  to **print** or  to **copy** the output.

You can also **export** it to **Html** , **PDF**  or **MS Word**  document.

## The language

Calcpad language includes the following elements (click an item to insert):

- Real numbers: digits **"0"** - **"9"** and decimal point **"."**;
- Complex numbers: **re ± imi** (e.g. **3 - 2i**);
- Variables:
  - Latin letters: **"a"** - **"z"**, **"A"** - **"Z"**;
  - Greek letters: **"α"** - **"ω"**, **"A"** - **"Ω"**;
  - digits: **"0"** - **"9"**;
  - comma: **" , "**;
  - prime symbols: **" ' "**, **" " "**, **" ' ' "**, **" ' ' ' "**;
  - special symbols: **" ∅ "**, **" ∅ "**, **" ° "**, **" 4 "**;
  - **"\_"** for subscript;

A variable name must start with a letter. Names are case sensitive.

- Operators:
  - "!"** - factorial;
  - "^"** - exponent;
  - " / "** - division;
  - " ÷ "** - force division bar;
  - " \ "** - division;
  - " % "** - reminder;
  - " \* "** - multiplication;
  - " - "** - minus;
  - " + "** - plus;
  - " ≡ "** - equal to;
  - " ≠ "** - not equal to;
  - " < "** - less than;
  - " > "** - greater than;
  - " ≤ "** - less or equal;
  - " ≥ "** - greater or equal;
  - " = "** - assignment;

- Custom functions of type  $f(x; y; z; \dots)$ ;
- Built-in functions:
  - sign**( $x$ ) – sign of a number;
  - abs**( $x$ ) - absolute value/magnitude;
  - sin**( $x$ ) - sine;
  - cos**( $x$ ) - cosine;
  - tan**( $x$ ) - tangent;
  - csc**( $x$ ) - cosecant;
  - sec**( $x$ ) - secant;
  - cot**( $x$ ) - cotangent;
  - sinh**( $x$ ) - hyperbolic sine;
  - cosh**( $x$ ) - hyperbolic cosine;
  - tanh**( $x$ ) - hyperbolic tangent;
  - csch**( $x$ ) - hyperbolic cosecant;
  - sech**( $x$ ) - hyperbolic secant;
  - coth**( $x$ ) - hyperbolic cotangent;
  - asin**( $x$ ) - inverse sine;
  - acos**( $x$ ) - inverse cosine;
  - atan**( $x$ ) - inverse tangent;
  - atan2**( $x; y$ ) - the angle whose tangent is the quotient of  $y$  and  $x$ ;
  - acsc**( $x$ ) - inverse cosecant;
  - asec**( $x$ ) - inverse secant;
  - acot**( $x$ ) - inverse cotangent;
  - asinh**( $x$ ) inverse hyperbolic sine;
  - acosh**( $x$ ) - inverse hyperbolic cosine;
  - atanh**( $x$ ) - inverse hyperbolic tangent;
  - acsch**( $x$ ) - inverse hyperbolic cosecant;
  - asech**( $x$ ) - inverse hyperbolic secant;
  - acoth**( $x$ ) - inverse hyperbolic cotangent;
  - log**( $x$ ) - decimal logarithm;
  - ln**( $x$ ) - natural logarithm;
  - log\_2**( $x$ ) - binary logarithm;
  - exp**( $x$ ) - exponential function;
  - sqr**( $x$ ) or **sqrt**( $x$ ) - square root;
  - cbrt**( $x$ ) - cubic root;
  - root**( $x; n$ ) -  $n$ -th root;
  - round**( $x$ ) - round to the nearest integer;
  - floor**( $x$ ) - round to the lower integer;
  - ceiling**( $x$ ) - round to the greater integer;

- trunc**( $x$ ) - round to the nearest integer towards zero;
- re**( $x$ ) - the real part of a complex number;
- im**( $x$ ) - the imaginary part of a complex number;
- phase**( $x$ ) - the phase of a complex number;
- random**( $x$ ) - random number between 0 and  $x$ ;
- min**( $x; y; z...$ ) - minimum of multiple values;
- max**( $x; y; z...$ ) - maximum of multiple values;
- sum**( $x; y; z...$ ) - sum of multiple values =  $x + y + z...$ ;
- sumsq**( $x; y; z...$ ) - sum of squares =  $x^2 + y^2 + z^2...$ ;
- srss**( $x; y; z...$ ) - square root of sum of squares = **sqrt**( $x^2 + y^2 + z^2...$ );
- average**( $x; y; z...$ ) - average of multiple values =  $(x + y + z...)/n$ ;
- product**( $x; y; z...$ ) - product of multiple values =  $x \cdot y \cdot z...$ ;
- mean**( $x; y; z...$ ) - geometric mean = **n-th root**( $x \cdot y \cdot z...$ );
- if**(*cond; value-if-true; value-if-false*) - conditional evaluation;
- switch**(*cond1; value1; cond2; value2; ...; default*) - selective evaluation;
- take**( $n; a; b; c...$ ) - returns the n-th element from the list;
- line**( $x; a; b; c...$ ) - linear interpolation;
- spline**( $x; a; b; c...$ ) - Hermite spline interpolation.
- Comments: "**Title**" or '**text**' in double or single quotes, respectively. **HTML**, **CSS**, **JS** and **SVG** are allowed.
  - Graphing and plotting:
 

**\$Plot** {  $f(x)$  @  $x = a : b$  } - simple plot;

**\$Plot** {  $x(t) | y(t)$  @  $t = a : b$  } - parametric;

**\$Plot** {  $f_1(x) \& f_2(x) \& ...$  @  $x = a : b$  } - multiple;

**\$Plot** {  $x_1(t) | y_1(t) \& x_2(t) | y_2(t) \& ...$  @  $x = a : b$  } - multiple parametric;

**\$Map** {  $f(x; y)$  @  $x = a : b \& y = c : d$  } - 2D color map of a 3D surface;

*PlotHeight* - height of plot area in pixels;

*PlotWidth* - width of plot area in pixels;

*PlotStep* - grid size for map plotting.
  - Iterative and numerical methods:
 

**\$Root** {  $f(x) = const$  @  $x = a : b$  } - root finding for  $f(x) = const$ ;

**\$Root** {  $f(x)$  @  $x = a : b$  } - root finding for  $f(x) = 0$ ;

**\$Find** {  $f(x)$  @  $x = a : b$  } similar to above, but  $x$  is not required to be a precise solution;

**\$Sup** {  $f(x)$  @  $x = a : b$  } - local maximum of a function;

**\$Inf** {  $f(x)$  @  $x = a : b$  } - local minimum of a function;

**\$Area** {  $f(x)$  @  $x = a : b$  } - adaptive Gauss-Lobatto numerical integration;

**\$Integral** {  $f(x)$  @  $x = a : b$  } – Tanh-Sinh numerical integration;

**\$Slope** {  $f(x)$  @  $x = a$  } - numerical differentiation;

**\$Sum** {  $f(x)$  @  $k = a : b$  } - iterative sum;

$\$Product \{ f(k) @ k = a : b \}$  - iterative product;

$\$Repeat \{ f(k) @ k = a : b \}$  - general inline iterative procedure;

*Precision* - relative precision for numerical methods [ $10^{-2}$ ;  $10^{-16}$ ] (default is  $10^{-12}$ )

- Program flow control:

Simple:

```
#if condition
    your code goes here
#end if
```

Alternative:

```
#if condition
    your code goes here
#else
    some other code
#end if
```

Complete:

```
#if condition1
    your code goes here
#else if condition2
    your code goes here
#else
    some other code
#end if
```

You can add as many "**#else if**"s as needed, but only one "**#else**". You can omit any of them.

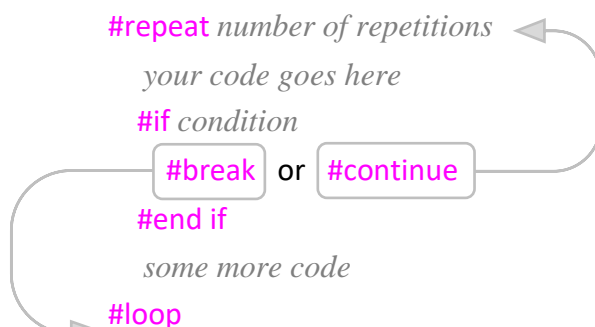
- Iteration blocks:

Simple:

```
#repeat number of repetitions
    your code goes here
#loop
```

With conditional break/continue:

```
#repeat number of repetitions
    your code goes here
    #if condition
        #break or #continue
    #end if
    some more code
#loop
```



- Modules and macros/string variables:

Modules:

**#include filename** - include external file (module);

**#local** - start local section (not to be included);

**#global** - start global section (to be included);

Inline string variable:

```
#def variable_name$ = content
```

Multiline string variable:

```
#def variable_name$
```

```
content line 1
```

```
content line 2
```

```
...
```

```
#end def
```

Inline string macro:

```
#def macro_name$(param1$; param2$; ...) = content
```

Multiline string macro:

```
#def macro_name$(param1$; param2$; ...)
```

```
content line 1
```

```
content line 2
```

```
...
```

```
#end def
```

- Output control:

**#hide** - hide the report contents;

**#show** - always show the contents (default);

**#pre** - show the next contents only before calculations;

**#post** - show the next contents only after calculations;

**#val** - show only the final result, without the equation;

**#equ** - show complete equations and results (default);

**#noc** - show only equations without results (no calculations);

**#round** *n* - rounds the output to *n* digits after the decimal point.

Each of the above commands is effective after the current line until the end of the report or another command that overwrites it.

- Breakpoints for step-by-step execution:

**#pause** - calculates to the current line and waits until resumed manually;

**#input** - renders an input form to the current line and waits for user input.

- Units for trigonometric functions: **#deg** - degrees, **#rad** - radians, **#gra** – grades;

- Separator for target units: **|**;

- Return angles with units: **ReturnAngleUnits** = 1;

- Angle units (dimensionless): °, ', ", **deg**, **rad**, **grad**, **rev**;

- Metric units (SI and compatible):

Mass: **g**, **hg**, **kg**, **t**, **kt**, **Mt**, **Gt**, **dg**, **cg**, **mg**, **µg**, **Da**, **u**;

Length: **m**, **km**, **dm**, **cm**, **mm**, **µm**, **nm**, **pm**, **AU**, **ly**;

Time: **s**, **ms**, **µs**, **ns**, **ps**, **min**, **h**, **d**;

Frequency: **Hz**, **kHz**, **MHz**, **GHz**, **THz**, **mHz**, **µHz**, **nHz**, **pHz**, **rpm**;

Velocity: **kmh**;

Electric current: **A**, **kA**, **MA**, **GA**, **TA**, **mA**, **µA**, **nA**, **pA**;

Temperature:  $^{\circ}\text{C}$ ,  $\Delta^{\circ}\text{C}$ ,  $\text{K}$ ;  
 Amount of substance:  $\text{mol}$ ;  
 Luminous intensity:  $\text{cd}$ ;  
 Area:  $\text{a}$ ,  $\text{daa}$ ,  $\text{ha}$ ;  
 Volume:  $\text{L}$ ,  $\text{mL}$ ,  $\text{cL}$ ,  $\text{dL}$ ,  $\text{hL}$ ;  
 Force:  $\text{dyn N}$ ,  $\text{daN}$ ,  $\text{hN}$ ,  $\text{kN}$ ,  $\text{MN}$ ,  $\text{GN}$ ,  $\text{TN}$ ,  $\text{gf}$ ,  $\text{kgf}$ ,  $\text{tf}$ ;  
 Moment:  $\text{Nm}$ ,  $\text{kNm}$ ;  
 Pressure:  $\text{Pa}$ ,  $\text{daPa}$ ,  $\text{hPa}$ ,  $\text{kPa}$ ,  $\text{MPa}$ ,  $\text{GPa}$ ,  $\text{TPa}$ ,  
 $\text{dPa}$ ,  $\text{cPa}$ ,  $\text{mPa}$ ,  $\mu\text{Pa}$ ,  $\text{nPa}$ ,  $\text{pPa}$ ,  
 $\text{bar}$ ,  $\text{mbar}$ ,  $\mu\text{bar}$ ,  $\text{atm}$ ,  $\text{at}$ ,  $\text{Torr}$ ,  $\text{mmHg}$ ;  
 Energy work:  $\text{J}$ ,  $\text{kJ}$ ,  $\text{MJ}$ ,  $\text{GJ}$ ,  $\text{TJ}$ ,  $\text{mJ}$ ,  $\mu\text{J}$ ,  $\text{nJ}$ ,  $\text{pJ}$ ,  
 $\text{Wh}$ ,  $\text{kWh}$ ,  $\text{MWh}$ ,  $\text{GWh}$ ,  $\text{TWh}$ ,  $\text{cal}$ ,  $\text{kcal}$ ,  $\text{erg}$ ,  
 $\text{eV}$ ,  $\text{keV}$ ,  $\text{MeV}$ ,  $\text{GeV}$ ,  $\text{TeV}$ ,  $\text{PeV}$ ,  $\text{EeV}$ ;  
 Power:  $\text{W}$ ,  $\text{kW}$ ,  $\text{MW}$ ,  $\text{GW}$ ,  $\text{TW}$ ,  $\text{mW}$ ,  $\mu\text{W}$ ,  $\text{nW}$ ,  $\text{pW}$ ,  $\text{hpM}$ ,  $\text{ks}$ ,  
 $\text{VA}$ ,  $\text{kVA}$ ,  $\text{MVA}$ ,  $\text{GVA}$ ,  $\text{TVA}$ ,  $\text{mVA}$ ,  $\mu\text{VA}$ ,  $\text{nVA}$ ,  $\text{pVA}$ ,  
 $\text{VAR}$ ,  $\text{kVAR}$ ,  $\text{MVAR}$ ,  $\text{GVAR}$ ,  $\text{TVAR}$ ,  $\text{mVAR}$ ,  $\mu\text{VAR}$ ,  $\text{nVAR}$ ,  $\text{pVAR}$ ;  
 Electric charge:  $\text{C}$ ,  $\text{kC}$ ,  $\text{MC}$ ,  $\text{GC}$ ,  $\text{TC}$ ,  $\text{mC}$ ,  $\mu\text{C}$ ,  $\text{nC}$ ,  $\text{pC}$ ,  $\text{Ah}$ ,  $\text{mAh}$ ;  
 Potential:  $\text{V}$ ,  $\text{kV}$ ,  $\text{MV}$ ,  $\text{GV}$ ,  $\text{TV}$ ,  $\text{mV}$ ,  $\mu\text{V}$ ,  $\text{nV}$ ,  $\text{pV}$ ;  
 Capacitance:  $\text{F}$ ,  $\text{kF}$ ,  $\text{MF}$ ,  $\text{GF}$ ,  $\text{TF}$ ,  $\text{mF}$ ,  $\mu\text{F}$ ,  $\text{nF}$ ,  $\text{pF}$ ;  
 Resistance:  $\Omega$ ,  $\text{k}\Omega$ ,  $\text{M}\Omega$ ,  $\text{G}\Omega$ ,  $\text{T}\Omega$ ,  $\text{m}\Omega$ ,  $\mu\Omega$ ,  $\text{n}\Omega$ ,  $\text{p}\Omega$ ;  
 Conductance:  $\text{S}$ ,  $\text{kS}$ ,  $\text{MS}$ ,  $\text{GS}$ ,  $\text{TS}$ ,  $\text{mS}$ ,  $\mu\text{S}$ ,  $\text{nS}$ ,  $\text{pS}$ ,  
 $\text{}\mathcal{U}$ ,  $\text{k}\mathcal{U}$ ,  $\text{M}\mathcal{U}$ ,  $\text{G}\mathcal{U}$ ,  $\text{T}\mathcal{U}$ ,  $\text{m}\mathcal{U}$ ,  $\mu\mathcal{U}$ ,  $\text{n}\mathcal{U}$ ,  $\text{p}\mathcal{U}$ ;  
 Magnetic flux:  $\text{Wb}$ ,  $\text{kWb}$ ,  $\text{MWb}$ ,  $\text{GWb}$ ,  $\text{TWb}$ ,  $\text{mWb}$ ,  $\mu\text{Wb}$ ,  $\text{nWb}$ ,  $\text{pWb}$ ;  
 Magnetic flux density:  $\text{T}$ ,  $\text{kT}$ ,  $\text{MT}$ ,  $\text{GT}$ ,  $\text{TT}$ ,  $\text{mT}$ ,  $\mu\text{T}$ ,  $\text{nT}$ ,  $\text{pT}$ ;  
 Inductance:  $\text{H}$ ,  $\text{kH}$ ,  $\text{MH}$ ,  $\text{GH}$ ,  $\text{TH}$ ,  $\text{mH}$ ,  $\mu\text{H}$ ,  $\text{nH}$ ,  $\text{pH}$ ;  
 Luminous flux:  $\text{lm}$ ;  
 Illuminance:  $\text{lx}$ ;  
 Radioactivity:  $\text{Bq}$ ,  $\text{kBq}$ ,  $\text{MBq}$ ,  $\text{GBq}$ ,  $\text{TBq}$ ,  $\text{mBq}$ ,  $\mu\text{Bq}$ ,  $\text{nBq}$ ,  $\text{pBq}$ ,  $\text{Ci}$ ,  $\text{Rd}$ ;  
 Absorbed dose:  $\text{Gy}$ ,  $\text{kGy}$ ,  $\text{MGy}$ ,  $\text{GGy}$ ,  $\text{TGy}$ ,  $\text{mGy}$ ,  $\mu\text{Gy}$ ,  $\text{nGy}$ ,  $\text{pGy}$ ;  
 Equivalent dose:  $\text{Sv}$ ,  $\text{kSv}$ ,  $\text{MSv}$ ,  $\text{GSv}$ ,  $\text{TSv}$ ,  $\text{mSv}$ ,  $\mu\text{Sv}$ ,  $\text{nSv}$ ,  $\text{pSv}$ ;  
 Catalytic activity:  $\text{kat}$ ;  
 • Non-metric units (Imperial/US):  
 Mass:  $\text{gr}$ ,  $\text{dr}$ ,  $\text{oz}$ ,  $\text{lb}$ ,  $\text{kip}$ ,  $\text{st}$ ,  $\text{qr}$ ,  $\text{cwt}$ ,  $\text{cwt}_{\text{UK}}$ ,  $\text{cwt}_{\text{US}}$ ,  $\text{ton}$ ,  $\text{ton}_{\text{UK}}$ ,  $\text{ton}_{\text{US}}$ ,  $\text{slug}$ ;  
 Length:  $\text{th}$ ,  $\text{in}$ ,  $\text{ft}$ ,  $\text{yd}$ ,  $\text{ch}$ ,  $\text{fur}$ ,  $\text{mi}$ ,  $\text{ftm}$ ,  $\text{cable}$ ,  $\text{nmi}$ ,  $\text{li}$ ,  $\text{rod}$ ,  $\text{pole}$ ,  $\text{perch}$ ,  $\text{lea}$ ;  
 Speed:  $\text{mph}$ ;  
 Temperature:  $^{\circ}\text{F}$ ,  $\Delta^{\circ}\text{F}$ ,  $^{\circ}\text{R}$ ;  
 Area:  $\text{rood}$ ,  $\text{ac}$ ;  
 Volume (fluid):  $\text{fl}_{\text{oz}}$ ,  $\text{gi}$ ,  $\text{pt}$ ,  $\text{qt}$ ,  $\text{gal}$ ,  $\text{bbl}$ , (dry)  $\text{bu}$ ;  
 $\text{fl}_{\text{oz}}_{\text{UK}}$ ,  $\text{gi}_{\text{UK}}$ ,  $\text{pt}_{\text{UK}}$ ,  $\text{qt}_{\text{UK}}$ ,  $\text{gal}_{\text{UK}}$ ,  $\text{bbl}_{\text{UK}}$ , (dry)  $\text{bu}_{\text{UK}}$ ;  
 $\text{fl}_{\text{oz}}_{\text{US}}$ ,  $\text{gi}_{\text{US}}$ ,  $\text{pt}_{\text{US}}$ ,  $\text{qt}_{\text{US}}$ ,  $\text{gal}_{\text{US}}$ ,  $\text{bbl}_{\text{US}}$ , (dry)  $\text{bu}_{\text{US}}$ ;  
 Force:  $\text{ozf}$ ,  $\text{lbf}$ ,  $\text{kipf}$ ,  $\text{tonf}$ ,  $\text{pdl}$ ;

Pressure: *osi, osf psi, psf, ksi, ksf, tsi, tsf, inHg*;

Energy/work: *BTU, therm, therm\_uk, therm\_us, quad*;

Power: *hp, hpE, hpS*.