Calcpad

Version 5.9 quick reference guide

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

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

- Real numbers: digits "**0**" - "**9**" and decimal point "**.**";
- Complex numbers: $re \pm im\,i$ (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: " ∅ ", "Ø", " ° ", "∡";
  - "**_**" 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 $f(x; y; z; ...)$;
- 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.

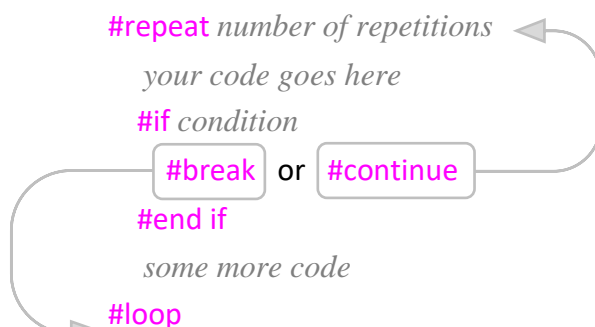- Iteration blocks:

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 down to the current line and waits for the user to resume 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;

- Dimensionless units: *%*, *‰*;

- Angle units *°*, *′*, *″*, *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*;

   Speed: *kmh*;

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

Temperature: *°C*, *Δ°C*, *K*;

Amount of substance: *mol*;

Luminous intensity: *cd*;

Area: *a*, *daa*, *ha*;

Volume: *L*, *mL*, *cL*, *dL*, *hL*;

Force: *dyn N*, *daN*, *hN*, *kN*, *MN*, *GN*, *TN*, *gf*, *kgf*, *tf*;

Moment: *Nm*, *kNm*;

Pressure: *Pa*, *daPa*, *hPa*, *kPa*, *MPa*, *GPa*, *TPa*,
  dPa, *cPa*, *mPa*, *μPa*, *nPa*, *pPa*,
  bar, *mbar*, *μbar*, *atm*, *at*, *Torr*, *mmHg*;

Viscosity: *P*, *cP*, *St*, *cSt*;

Energy work: *J*, *kJ*, *MJ*, *GJ*, *TJ*, *mJ*, *μJ*, *nJ*, *pJ*,
  Wh, *kWh*, *MWh*, *GWh*, *TWh*, *cal*, *kcal*, *erg*,
  eV, *keV*, *MeV*, *GeV*, *TeV*, *PeV*, *EeV*;

Power: *W*, *kW*, *MW*, *GW*, *TW*, *mW*, *μW*, *nW*, *pW*, *hpM*, *ks*,
  VA, *kVA*, *MVA*, *GVA*, *TVA*, *mVA*, *μVA*, *nVA*, *pVA*,
  VAR, *kVAR*, *MVAR*, *GVAR*, *TVAR*, *mVAR*, *μVAR*, *nVAR*, *pVAR*;

Electric charge: *C*, *kC*, *MC*, *GC*, *TC*, *mC*, *μC*, *nC*, *pC*, *Ah*, *mAh*;

Potential: *V*, *kV*, *MV*, *GV*, *TV*, *mV*, *μV*, *nV*, *pV*;

Capacitance: *F*, *kF*, *MF*, *GF*, *TF*, *mF*, *μF*, *nF*, *pF*;

Resistance: *Ω*, *kΩ*, *MΩ*, *GΩ*, *TΩ*, *mΩ*, *μΩ*, *nΩ*, *pΩ*;

Conductance: *S*, *kS*, *MS*, *GS*, *TS*, *mS*, *μS*, *nS*, *pS*,
  ℧, *k℧*, *M℧*, *G℧*, *T℧*, *m℧*, *μ℧*, *n℧*, *p℧*;

Magnetic flux: *Wb* , *kWb*, *MWb*, *GWb*, *TWb*, *mWb*, *μWb*, *nWb*, *pWb*;

Magnetic flux density: *T*, *kT*, *MT*, *GT*, *TT*, *mT*, *μT*, *nT*, *pT*;

Inductance: *H*, *kH*, *MH*, *GH*, *TH*, *mH*, *μH*, *nH*, *pH*;

Luminous flux: *lm*;

Illuminance: *lx*;

Radioactivity: *Bq*, *kBq*, *MBq*, *GBq*, *TBq*, *mBq*, *μBq*, *nBq*, *pBq*, *Ci*, *Rd*;

Absorbed dose: *Gy*, *kGy*, *MGy*, *GGy*, *TGy*, *mGy*, *μGy*, *nGy*, *pGy*;

Equivalent dose: *Sv*, *kSv*, *MSv*, *GSv*, *TSv*, *mSv*, *μSv*, *nSv*, *pSv*;

Catalytic activity: *kat*;

- Non-metric units (Imperial/US):

Mass: *gr*, *dr*, *oz*, *lb*, *kip* , *st*, *qr*, *cwt*, *cwt*_UK, *cwt*_US, *ton*, *ton*_UK, *ton*_US, *slug*;

Length: *th*, *in*, *ft*, *yd*, *ch*, *fur*, *mi*, *ftm*, *cable*, *nmi*, *li*, *rod*, *pole*, *perch*, *lea*;

Speed: *mph*, *knot*;

Temperature: *°F*, *Δ°F*, *°R*;

Area: *rood*, *ac*;

Volume (fluid): *fl_oz*, *gi*, *pt*, *qt*, *gal*, *bbl*, (dry) *bu*;
  *fl_oz*_UK, *gi*_UK, *pt*_UK, *qt*_UK, *gal*_UK, *bbl*_UK, (dry) *bu*_UK;

fl_oz_US, gi_US, pt_US, qt_US, gal_US, bbl_US, (dry) bu_US;

Force: ozf, lbf, $kipf$, $tonf$, pdl;

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

Energy/work: BTU, $therm$, $therm$_UK, $therm$_US, $quad$;

Power: hp, hpE, hpS.