# Calcpad

Version 5.6.3 quick reference guide

ПРОЕКТСОФТ®
34-36 Peyo Yavorov blvd, Sofia 1164, Bulgaria
+359 2 423 4455
proektsoft.bg@gmail.com

## 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 PDF or MS Word W 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** ± **im***i* (e.g. **3** - **2***i*);
- Variables:

  - Latin letters: "*a*" - "*z*", "*A*" - "*Z*";

  - Greek letters: "*α*" - "*ω*", "*Α*" - "*Ω*";

  - digits: "**0**" - "**9**";

  - comma: " **,** ";

  - prime symbols: " **′** ", " **″** ", " **‴** ", " **⁗** ";

  - special symbols: " **ø** ", "**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 $f(x; y; z; \ldots)$;
- Built-in functions:

**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;

**log2**$(x)$ - binary logarithm;

**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**$(x;\ y;\ z\ldots)$ - minimum of multiple values;

**max**$(x;\ y;\ z\ldots)$ - maximum of multiple values;

**sum**$(x;\ y;\ z\ldots)$ - sum of multiple values = $x + y + z\ldots$;

**sumsq**$(x;\ y;\ z\ldots)$ - sum of squares = $x^2 + y^2 + z^2\ldots$;

**srss**$(x;\ y;\ z\ldots)$ - square root of sum of squares = **sqrt**$(x^2 + y^2 + z^2\ldots)$;

**average**$(x;\ y;\ z\ldots)$ - average of multiple values = $(x + y + z\ldots)/n$;

**product**$(x;\ y;\ z\ldots)$ - product of multiple values = $x{\cdot}y{\cdot}z\ldots$;

**mean**$(x;\ y;\ z\ldots)$ - geometric mean = **n-th root**$(x{\cdot}y{\cdot}z\ldots)$;

**if**(*<cond>*; *<value-if-true>*; *<value-if-false>*) - conditional evaluation;

**switch**(*<cond1>*; *<value1>*; *<cond2>*; *<value2>*; … ; *<default>*) - selective evaluation;

**take**$(n;\ a;\ b;\ c\ldots)$ - returns the n-th element from the list;

**line**$(x;\ a;\ b;\ c\ldots)$ - linear interpolation;

**spline**$(x;\ a;\ b;\ c\ldots)$ - Hermite spline interpolation;

- Comments: **"Title"** or **'text'** in double or single quotes, respectively. **HTML**, **CSS**, **JS** and **SVG** are allowed.
- Graphing and plotting:

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

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

\$Plot { $\boldsymbol{f}_1(x)$ & $\boldsymbol{f}_2(x)$ & … @ $x = a : b$ } - multiple;

\$Plot { $\boldsymbol{x}_1(t)$ | $\boldsymbol{y}_1(t)$ & $\boldsymbol{x}_2(t)$ | $\boldsymbol{y}_2(t)$ & … @ $x = a : b$ } - multiple parametric;

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

*PlotHeight* - height of plot area in pixels;

*PlotWidth* - width of plot area in pixels;

- Iterative and numerical methods:

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

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

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

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

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

\$Area { $\boldsymbol{f}(x)$ @ $x = a : b$ } - numerical integration;

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

\$Sum { $\boldsymbol{f}(k)$ @ $k = a : b$ } - 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 or omit as many "#else if's" as needed. Only one "#else" is allowed. You can omit this too.

- Iteration blocks:

  Simple:

  ```
  #repeat <number of repetitions>
     <Your code goes here>
  #loop
  ```

  With conditional break:

  ```
  #repeat <number of repetitions>
     <Your code goes here>
     #if <condition>
        #break
     #end if
     <Some more code>
  #loop
  ```

- 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);

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

- Units for trigonometric functions: #deg - degrees, #rad - radians;
- Separator for target units: |;
- 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: *°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*, *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*;

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*;

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*;

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*;

  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*.