Calcpad

Version 5.8 quick reference guide

ПРОЕКТСОФТ®
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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** ± **im***i* (e.g. **3** - **2***i*);
- Variables:
  - Latin letters: "*a*" - "*z*", "*A*" - "*Z*";
  - Greek letters: "*α*" - "*ω*", "*A*" - "*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:

  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.
- 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: *°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*;

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*;

  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*.