Calcpad

Version 5.6.2 quick reference guide

ПРОЕКТСОФТ ®
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How it works?

1. **Enter** text and formulas into the "**Code**" box on the left.
2. 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: " **′** ", " **″** ", " **‴** ", " **⁗** ";
  - "_" 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;

  log$_2(x)$ - 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$(x; y; z...)$ - 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 { $\boldsymbol{f}(x)$ @ $x = a : b$ } - simple plot;

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

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

  \$Plot { $\boldsymbol{x}_1(t) \mid \boldsymbol{y}_1(t)$ & $\boldsymbol{x}_2(t) \mid \boldsymbol{y}_2(t)$ & ... @ $x = a : b$ } - 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 { $\boldsymbol{f}(k)$ @ $k = a : b$ } - 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*.