GNU Calc Reference Card
(for GNU Emacs version 26)

Starting and Stopping

- start/stop standard Calc: C-x * c
- start/stop X keypad Calc: C-x * k
- start/stop either: C-x * *
- stop standard Calc: q

Calc tutorial
- run Calc in other window: C-x * t
- quick calculation in minibuffer: C-x * q

Getting Help

- read Info manual: h f
- describe key fully: h c
- describe key briefly: h f
- read Info manual: h i or C-x * i
- read full Calc summary: h s or C-x * s

Error Recovery

- abort command in progress: C-g
- display recent error messages: w
- undo last operation: U
- redo last operation: D
- recall last arguments: M-RET
- edit top of stack: ;
- reset Calc to initial state: C-x * 0 (zero)

Transferring Data

- grab region from a buffer: C-x * g
- grab rectangle from a buffer: C-x * r
- grab rectangle, summing columns: C-x * :
- grab rectangle, summing rows: C-x * -
- yank data to a buffer: C-x * y

Also, try C-k/C-y or X cut and paste.

Examples

In RPN, enter numbers first, separated by RET if necessary, then type the operator. To enter a calculation in algebraic form, press the apostrophe first.

<table>
<thead>
<tr>
<th>RPN style:</th>
<th>algebraic style:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>2 RET 3 +</td>
<td>’ 2+3 RET</td>
</tr>
<tr>
<td>2 RET 3 + 4 *</td>
<td>’(2+3)*4 RET</td>
</tr>
<tr>
<td>2 RET 3 RET 4 +</td>
<td>’2+(3+4) RET</td>
</tr>
<tr>
<td>3 RET 6 + Q 3</td>
<td>’sqrt(3+6)*3 RET</td>
</tr>
<tr>
<td>P 3 / n S</td>
<td>’sin(-pi/3) RET =</td>
</tr>
</tbody>
</table>

Arithmetic

- add, subtract, multiply, divide: +, -, *, /
- raise to a power, nth root: ^, I ^
- change sign: n
- reciprocal 1/x: k
- square root \( \sqrt{x} \): Q
- round off last two digits: c 2
- convert to fraction, float: c F, c f
- enter using algebraic notation: ’
- refer to previous result: ’
- refer to higher stack entries: ’
- finish alg entry without evaluating: LFD
- set mode where alg entry used by default: m a

Stack Commands

Here \( S_n \) is the \( n \)th stack entry, and \( N \) is the size of the stack.

<table>
<thead>
<tr>
<th>key</th>
<th>no prefix</th>
<th>prefix n</th>
<th>prefix n-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RET</td>
<td>copy ( S_1 )</td>
<td>copy ( S_1 )</td>
<td>copy ( S_n )</td>
</tr>
<tr>
<td>LFD</td>
<td>copy ( S_2 )</td>
<td>copy ( S_2 )</td>
<td>copy ( S_1 )</td>
</tr>
<tr>
<td>DEL</td>
<td>delete ( S_1 )</td>
<td>delete ( S_1 )</td>
<td>delete ( S_n )</td>
</tr>
<tr>
<td>M-DEL</td>
<td>delete ( S_2 )</td>
<td>delete ( S_2 )</td>
<td>delete ( S_1 )</td>
</tr>
<tr>
<td>TAB</td>
<td>swap ( S_1 \leftrightarrow S_2 )</td>
<td>roll ( S_1 ) to ( S_n )</td>
<td>roll ( S_1 ) to ( S_n )</td>
</tr>
<tr>
<td>M-TAB</td>
<td>roll ( S_1 ) to ( S_2 )</td>
<td>roll ( S_1 ) to ( S_n )</td>
<td>roll ( S_1 ) to ( S_n )</td>
</tr>
</tbody>
</table>

With a 0 prefix, these copy, delete, or reverse the entire stack.

Display

- scroll horizontally, vertically: <, >, {, }
- home cursor: o
- line numbers on/off: d l
- trail display on/off: t d
- scientific notation: d s
- fixed-point notation: d f
- floating-point (normal) notation: d n
- group digits with commas: d g

For display mode commands, H prefix prevents screen redraw and I prefix temporarily redraws top of stack.

Notations

- scientific notation: 6.02e23
- minus sign in numeric entry: _23 or 23 n
- fractions: 3:4
- complex numbers: (x, y)
- polar complex numbers: (r; \( \theta \))
- vectors (commas optional): [1, 2, 3]
- matrices (or nested vectors): [1, 2; 3, 4]
- error forms (p key): 100 \( \pm \) 0.5
- interval forms: [2 .. 5]
- modulo forms (M key): 6 mod 24
- HMS forms: 50 30' 0"
- date forms: <Jul 4, 1992>
- infinity, indeterminate: inf, nan

Scientific Functions

- ln, \( \log_10 \), \( \log_b \): L, H, L, B
- exponential \( e^x \), \( 10^x \): E, H, E
- sin, cos, tan: S, C, T
- arcsin, arccos, arctan: I S, I C, I T
- inverse, hyperbolic prefix keys: i
- two-argument arctan: f T
- degrees, radians modes: m d, m r
- \( \pi \) (\( \pi \)): P
- factorial, double factorial: !, k d
- combinations, permutations: k c, H k c
- prime factorization: k f
- next prime, previous prime: k n, I k n
- GCD, LCM: k g, k l
- random number, shuffle: k r, k h
- minimum, maximum: f n, f x
- error functions erf, erfc: f e, f I e
- gamma, beta functions: f g, f b
- incomplete gamma, beta functions: f G, f B
- Bessel \( J_n \), \( Y_n \) functions: f j, f y
- complex magnitude, arg, conjugate: A, G, J
- real, imaginary parts: r f, f i
- convert polar/rectangular: c p

Units

- enter with units: M \( \% \)
- convert to percentage: c \( \% \)
- percentage change: b \( \% \)
- present value: b P
- future value: b F
- rate of return: b T
- number of payments: b M
- size of payments: b R
- net present value, int. rate of return: b H, b I

Above computations assume payments at end of period. Use I prefix for beginning of period, or H for a lump sum investment.

Straight-line depreciation: b S
- sum-of-years'-digits: b V
- double declining balance: b D

Common units:
- distance: m, cm, mm, km; in, ft, mi, mfi; point, lyr
- volume: l or L, ml, gal, pt, cup, floz, tsp, tsp
- mass: g, mg, kg, t; lb, oz, ton
- time: s or sec, ms, us, ns, min, hr, day, wk
- temperature: degC, degF, K

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**Programmer’s Functions**

- Binary, octal, hex display: d 2, d 8, d 6
- Decimal, other radix display: d 0, d r
- Display leading zeros: d z
- Entering non-decimal numbers: 16#7FFF
- Integer quotient, remainder: s u
- Arithmetic right shift: b l
- Binary DIFF, NOT: b d
- Binary word size: 16#7FFF
- Entering non-decimal numbers: d 0
- Decimal, other radix display: d 2
- Programmer’s Functions:
  - Sum columns in matrix: V R : +
  - Sum rows in matrix: V R _ +
  - Sum elements in vector (i.e., reduce add vectors elementwise (i.e., map +))
  - Cardinality of set:
  - Intersection, union, diff of sets:
  - Add vectors elementwise (i.e., map +)
  - Sum elements in vector (i.e., reduce +)
  - Sum rows in matrix
  - Sum columns in matrix
  - Sum elements, accumulate results

**Vector Operations**

- Vector of 1, 2, ..., n: vector n
- Vector of n counts from a by b: vector of copies of a value
- Concatenate into vector: v x
- Pack many stack items into vector: v v
- Unpack vector or object: v t
- Length of vector (list): v v
- Reverse vector:
- Sort, grade vector:
- Histogram of vector data:
- Extract vector element:
- Matrix determinant, inverse:
- Matrix transpose, trace:
- Cross, dot products:
- Identity matrix:
- Extract matrix row, column:
- Intersection, union, diff of sets:
- Cardinality of set:
- Add vectors elementwise (i.e., map +):
- Sum elements in vector (i.e., reduce +):
- Sum rows in matrix:
- Sum columns in matrix:
- Sum elements, accumulate results

**Variables**

- Variable names are single digits or whole words.
  - Store to variable:
  - Store and keep on stack:
  - Recall from variable:
  - Shorthands for digit variables:
  - Integer quotient, remainder:
  - Integer square root, logarithm:
  - Floor, ceiling, round to integer:

**Representational Shorthands for Digit Variables**

- Recall from variable:
- Store and keep on stack:
- Variable names are single digits or whole words.

**Programming**

- Begin, end recording a macro:
- Replay keyboard macro:
- Read region as written-out macro:
- If, else, endif:
- Equal to, less than, member of:
- Repeat n times, break from loop:
- “for” loop: start, end; body, step:
- Define function with formula:
- Define function:
- Put finished macro on a key:
- Record user-defined command permanently:
- Record variable value permanently:
- Record mode settings permanently:

**Selections**

- Select subformula under cursor:
- Select nth subformula:
- Select more:
- Unselect all:
- Copy indicated subformula:
- Delete indicated subformula:
- Commute selected terms:
- Commute term leftward, rightward:
- Distribute, merge selection:
- Isolate selected term in equation:
- Negate, invert term in context:
- Rewrite selected term:

**Graphics**

- Graph function or data:
- Graph 3D function or data:
- Replot current graph:
- Print current graph:
- Add curve to graph:
- Set number of data points:
- Set line, point styles:
- Set log vs. linear for x, y axis:
- Set range for x, y axis:
- Close graphics window:

**Algebra**

- Enter an algebraic formula:
- Enter an equation:
- Symbolic (vs. numeric) mode:
- Fractions (vs. float) mode:
- Suppress evaluation of formulas:
- Return to default evaluation rules:
- “Big” display mode:
- C, Pascal, FORTRAN modes:
- TyX, LaTeX, eqn modes:
- Maxima:
- Unformatted mode:
- Normal language mode:
- Simplify formula:
- Put formula into rational form:
- Evaluate variables in formula:
- Evaluate numerically:
- Let variable equal a value in formula:
- Declare properties of variable:

**Common Markers**

- Common deck: pos, int, real, scalar, [a..b].
- Expand, collect terms:
- Factor, partial fractions:
- Polynomial quotient, remainder, GCD:
- Derivative, integral:
- Taylor series:
- Principal solution to equation(s):
- List of solutions:
- General solution:
- Rewrite to both sides of eqn:
- Rewrite formula:

**Numerical Computations**

- Sum formula over a range:
- Product of formula over a range:
- Tabulate formula over a range:
- Integrate numerically over a range:
- Find zero of formula or equation:
- Find local min, max of formula:
- Fit data to line or curve:
- Mean of data in vector or variable:
- Median of data:
- Geometric mean of data:
- Sum, product of data:
- Minimum, maximum of data:
- Sample, pop. standard deviation:

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