

TI-36X Pro Calculator Notes

DISPLAY

- adjust contrast on display with [2nd] [+] or [2nd] [-] buttons.
- some calculations will yield an exact number (e.g. [2nd] [V][8] gives $2\sqrt{2}$ as an answer). To get the decimal version, click the ‘answer toggle’ key [$<=>$].
- [clear] clears the entire screen; [delete] removes only the preceding number or operator.
- use the cursor keys ($< > \wedge \vee$) on the silver cursor pad to move around to different entries on the display.

MODES

- press [mode] to select angle options (degree, rad, grad), numeric display options (normal, scientific and engineering), decimal placement options (fix or float a certain number of digits), base (decimal, binary, octal) and math display options (“classic” = all on one line; “mathprint” = textbook format over several lines). **Probably the default values (degree, norm, float, real, decimal, mathprint) are best.** Press [enter] [clear] or [2nd] [quit] to return after changes.

ORDER OF OPERATIONS

- typical algebraic order: 1) inside parentheses; 2) functions with an argument in parentheses; 3) fractions; 4) functions with argument after operator like x^2 ; 5) exponentiation and roots (*but see below*); 6) negation; 7) multiplication (expressed or implied) and division; 8) addition and subtraction.

- *oddity in exponentiation and roots: in classic mode, expression using $[x^{\square}]$ is evaluated left to right:*

$$2^3^2 = 64 \quad \text{which is } (2 \times 2 \times 2)^2 = 64$$

but in MathPrint mode (the default mode) it is evaluated right to left:

$$2^{3^2} = 512 \quad (\text{or } 2^9 = 512) \quad \text{to do the calculation above, use parentheses } (2^3)^2 = 64$$

ENTRY

- “multi-tap keys” (mostly transcendental functions) have several functions in the same key. E.g., the [sin sin⁻¹] key includes sine (tap once), arcsine (tap twice), hyperbolic sine (tap three times) and hyperbolic arcsine (tap four times). Look at the display to see what function you have chosen.

- take logs or natural logs with the multi-tap key [ln log]; antilogs with the multi-tap key [e[□] 10[□]]

- for negation in numbers or exponents, click the negation key [(-)] BEFORE the number

E.g., for -2.5×10^{-3} click [(-)] 2.5 [EE] [(-)] 3

- exponentiation with any exponent (positive, negative, fractional) is done with the $[x^{\square}]$ key, rather than a \wedge . After use of this key the cursor stays in the exponent. If there are additional calculations, you can use the cursor right key (>) to get back to normal entry, or just hit [enter] to complete the calculation to that point.

- There is also a separate exponentiation key just for squares $[x^2]$.

- for entering numbers in scientific notation, use the [EE] key before the exponent. Mids will often use 10^{\square} (on a multi-tap key [e[□] 10[□]]) to create the exponential part, but this can lead to mistakes. **Use the [EE] key for exponents.** Remember that $10^2 = 100$ is 1[EE]2, not 10[EE]2 (which is 1000).

- in MathPrint mode it is possible to enter expressions directly as fractions, with the fraction key $[\frac{\square}{\square}]$. The number before pressing that key is the numerator. For example 27 $[\frac{\square}{\square}]$ 5 gives $27/5 = 27/5$ which can be toggled to [$<=>$] 5.4

- inverses are entered with the inverse key [2nd] $[\frac{1}{\square}]$

- After you evaluate an expression, the expression and its result are added automatically to the history. On the scroll pad, use \wedge and \vee to scroll through the history. You can reuse a previous entry by pressing [enter] to paste it on the bottom line, where you can edit it and evaluate a new expression.

- The last entry performed on the home screen is stored to the variable ans. This variable is retained in memory, even after the calculator is turned off. To recall the value of ans, press [2nd] [answert] [enter], or press any operations key (+, *, and so forth) as the first part of an entry. ans and the operator are both displayed.

STORING VALUES

- you can store values for up to 8 variables x, y, z, t, a, b, c, and d. Use the store button [sto->], then the multi-tap variable button $[x \frac{y z t}{a b c d}]$ to choose which variable name you want to use. If the chosen variable already exists it will be replaced.

E.g., 6.022 [EE] 23 [sto->] $[x \frac{y z t}{a b c d}]$ stores Avogadro’s number as variable “y”.

- the entry [2nd] [recall] will recall a list of all variables stored in the calculator. Use the cursor keys (^V) to select the one you want and press [enter]. If a calculation string is underway, the value of the variable will be entered into the string.

- reset all variables to zero with [2nd] [clear var], then 1:Yes.

STATISTICS The calculator will perform 1- and 2-variable statistics, including several types of regressions and distributions. See the manual for details. A common hand-calculator procedure is obtaining the **average and standard deviation (S_x)** of a set of numbers:

1. Press [data].
2. Press [data] again to clear previously entered values. Toggle to Clear L1, [enter].
3. Enter your numbers into the column for L1 (first column). Press [enter] after each value.
4. Press [2nd] [stat-reg/distr].
5. Toggle to or press 2, for 1-Var Stats.
6. On the next screen, L1 and ONE should be highlighted. Press [enter] to select CALC.
7. On the next screen, n is the number of entries, \bar{x} is the average, and S_x is the standard deviation.
8. Press [clear] twice to exit. (To test, the standard deviation of 1, 2, 4 is $S_x = 1.5275\dots$)

CONVERSIONS

The CONVERSIONS menu permits you to perform a total of 20 conversions. To access the CONVERSIONS menu, press [2nd] [convert]. Press one of the numbers (1-5) to select, or press ^ and V to scroll through and select one of the CONVERSIONS submenus. For example, enter 25 on your home screen, press [2nd] [convert], temperature, °C → °K, then [enter]. The answer should be 298.15 (25°C = 298.15 K). [Clear] or [2nd] [quit] to escape.

CONSTANTS

CONSTANTS lets you access scientific constants to paste in various areas of the TI-36X Pro calculator. Press [2nd] [constants] and use the toggle keys to select either the NAMES or UNITS of 20 physical constants. Note that the listed value of R is in J/mol-K; pressure is in Pa, and atomic mass units (u) and subatomic particle masses m_p , m_e are in kg.

SOLVERS

There are three solvers, the first of which will be the most useful:

- o the Numeric Solver [num-solv] which asks for and solves an arbitrary equation up to 40 characters long
- o the Polynomial Solver [poly-solv] which will solve for the values of a 2nd- or 3rd- order polynomial, for which you enter the coefficients
- o the System of Linear Equations solver [sys-solv] which can solve a 2x2 or 3x3 system.

To use the num-solver to find the solubility of Ag_2SO_4 ($K_{\text{sp}} = 1.2 \times 10^{-5}$) (i.e., solve $1.2 \times 10^{-5} = (2x)^2 x$ for x), do the following:
[2nd] [num-solv] display shows $\blacksquare = \square$

(If an equation is already there, rather than boxes, you can clear the left side with [clear], then use the cursor key to get on the right side of the equal sign, then [clear] again)

1.2 [EE] [-]5 (enters left side of equation)	display shows 1.2E-5 = \square
[>] (moves to right side of equation)	display shows 1.2E-5 = \blacksquare
[(] 2 [x $\frac{y z t}{a b c d}$] [)] [x ²] [*] [x $\frac{y z t}{a b c d}$]	display shows 1.2E-5=(2x) ² *x>
press [enter]	display shows: ENTER AND SOLVE x=1.16732763657 SOLVE: x

displayed x might differ

The cursor will be at the trial solution value 1.16732763657 (which happened to be in the x register). For most equilibrium problems the trial value of x will be zero. Click 0 [enter] [enter] and it will solve. Final display reads:

SOLUTION
x = 0.0144224957
L - R = 0
SOLVE AGAIN QUIT

Select quit to exit.

The solution is $x = 0.0144$. The “L-R = 0” shows the difference in values between the left and right side of the equation; 0 is ideal. Choosing “solve again” will allow an iterative approach. The calculator *may* arrive at the same solution starting with whatever was in “x”, instead of replacing it with zero. It seems to work with a wide variety of values, but may take longer if the trial value is far off. That may not always be true, but will depend on the equation and value. It is better to use the physical problem to establish a trial value, if possible.

CALCULUS – the calculator will perform numerical integration and differentiation. See the manual.

The manual for the TI-36X Pro calculator can be found at:

http://education.ti.com/media/838E418957544F4784B8819BC5B2B67E/ti36pro_guidebook_en