

Scientific Calculator Workshop

Part 1: Basic Functions

Order of Operations:

Your scientific calculator is programmed to work based on the order of operations. This means that, when you put in a long string of inputs, look at those inputs in the following order;

Parenthesis, Exponents, Multiplication and Division, Addition and Subtraction.

For instance, if you input $3 + 4 \times 5$, the calculator will first multiply 4 and 5 (getting 20), and then add 3, giving 23.

Ex. Solve the following using the calculator.

- 1) $5 \times 6 \div 15 + 2 \div 2$
- 2) $1 + 8 \div 4 \times 2$

Fractions and Decimals:

Your calculator can work directly with fractions and decimals. To input a fraction, you can simply use the division symbol \div to divide two numbers. Decimals are also simple to utilize, requiring only that you apply the decimal point $.$ at the appropriate place. Using these, your calculator can add, subtract, multiply, and divide fractions and decimals. Additionally, using the $F < > D$ function (for this press 2^{nd} PRB), you can change your calculator's answer between fraction and decimal forms.

Ex. Solve the following using the calculator. Find the answers in both fractional and decimal forms

- 3) $\frac{1}{2} + \frac{1}{3}$
- 4) $\frac{2}{3} - \frac{1}{5}$
- 5) $\frac{1}{2} / 4$
- 6) $3.5 + 2.25$

Parenthesis:

As stated above, order of operations are observed on your calculator. We can therefore use this to our advantage, as parentheses serve to both group items within the parentheses and be the first operation the calculator will consider. For instance, if you input $3 + 4 \div 6 + 1$, your calculator will interpret this as $3 + \frac{4}{6} + 1$. By contrast, if you input $(3 + 4) \div (6 + 1)$ your calculator will interpret this as $\frac{3+4}{6+1}$.

Ex. Solve the following using the calculator

- 7) $\frac{250+50}{100}$
- 8) $\frac{36-4}{3+5}$

Radicals and Powers:

You can raise one number to the power of another by using the \wedge key on your calculator. Inputting 3^2 will be interpreted by the calculator as 3^2 . Radicals can be inputted through either the $\sqrt{\quad}$ function or the $\sqrt[x]{\quad}$ function (the difference being that $\sqrt{\quad}$ always gives the square root, and $\sqrt[x]{\quad}$ gives the xth root, where x is whatever you put in front of the radical) These two functions can be reached by inputting 2^{nd} x^2 and 2^{nd} \wedge respectively. This means that if you want to get $\sqrt[3]{8}$, you merely need to input 3, 2^{nd} , \wedge , 8.

Ex. Solve the following using the calculator

9) $\sqrt[5]{32}$

10) $\sqrt{49}$

11) $e^3 + \pi^2 - 8$

12) $32^{1/5}$

13) $49^{1/2}$

14) 5^3

Factorials, Permutations and Combinations:

When you see something like 5! This means "Five Factorial". Factorial just means that the number is multiplied by each number less than it. For instance, $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$. Factorials can be performed on your calculator by pressing the PRB button, and going to the exclamation point (!). Just type in 5, PRB, !, and you will get 5!, which the calculator will calculate as 120.

Permutations and Combinations are functions that work based on factorials. When in the PRB sub menu, you will see "nPr" and "nCr". These are used in statistics to calculate probability, and they have formulae of the following form: $nPr = \frac{n!}{(n-r)!}$, $nCr = \frac{n!}{(n-r)!r!}$. Your calculator can calculate these for you. Simply type in a number for n, press the PRB menu, choose either nPr or nCr (depending on the problem), and then enter another number after for r.

Ex. Solve the following using the calculator

15) 7!

16) $\frac{8!}{7!}$

17) ${}_{13}P_3$

18) ${}_{11}C_7$

Part 2: Advanced Functions

Quadratic Equation:

Quadratic equations is $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, where $ax^2 + bx + c = 0$. When you solve the quadratic equations using your calculator, you need to follow the order of operations: PEMDAS. To find the x value, split it into two separate parts, $x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$ and $x = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$. Then, you can evaluate them separately by inputting the individual values, a , b , and c . You will get two final answers for x .

Ex. 1) Evaluate $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ using the calculator when $a = 2$, $b = 4$, $c = -6$.

Logs:

Logs are the opposites of powers. If $10^3 = 1000$, then $\log 1000 = 3$. This is read "The log of one thousand equals 3". Your calculator has two log functions already on it: Log and Ln. Ln means "the natural log", or \log_e , and Log is usually interpreted as \log_{10} .

Ex. Solve the following using the calculator

2) $\log 135/3$

6) $\log 4 - 1$

3) $\log 1$

7) $\ln(100)$

4) $\ln 1$

8) $\ln 4 - 1$

5) $\log(100)$

Trig Functions:

In trigonometry, there are three main functions: Sin, Cos, and Tan (read "Sine, Coh-sine, and Tangent"). These functions relate angles to sides in a right triangle, which is helpful in physics and engineering. To use them, simply hit SIN, COS, or TAN. Follow this with the number you are taking the function of, and a closing parenthesis. It is important, however, to also ensure that you are in the correct **mode**. You can use the DRG button to switch between DEG (degree), RAD (radians), and GRD (which is 9/10 of a degree. We generally do not use GRD). Unless a number has the degree symbol (ex. 45°), assume that it is in radians.

Ex. Solve the following using the calculator

9) $\cos(60^\circ)$

10) $\sin\left(\frac{\pi}{4}\right)$

11) $\tan(45^\circ)$

Scientific Notation:

In science, it is often useful to use this notation to denote numbers, due to orders of magnitude. For instance, which is easier to write: 18,960,000,000,000 or $1.8961.896 \times 10^{13}$? Your calculator supports this in two main ways. To start with, you can type in scientific notation numbers very easily using the EE function (which you can use by pressing 2^{nd} and then x^{-1} buttons). If you type 2 EE 5, your calculator will interpret in as 2×10^5 .

The second way that your calculator supports scientific notation can be found in the SCI/ENG function (to reach this press 2^{nd} and DRG). When you get into this menu, you can choose between Flo, Sci, and Eng. Flo means float, or in other words the decimal place is not fixed to a specific location. Sci means scientific notation, and will always rewrite numbers so that the decimal place is after the first digit, and the number is multiplied by an appropriate power of 10. Eng is for engineering notation, which is similar to scientific notation – the main difference between the two is that in engineering notation, the number is only multiplied by 10 to the power of a multiple of three. The decimal place in engineering notation is not as fixed as in scientific notation.

Ex. Solve the following using the calculator

- 12) Find what $4/9$ is in scientific notation
- 13) Express 20001.96 in scientific notation and engineering notation
- 14) $1.789 \times 10^{-1} + 0.456 \times 10^2$ (express in scientific, engineering and float notations)

Answers to Exercises:

Basic

- 1) 3
- 2) 5
- 3) 0.8333333333 or $\frac{5}{6}$
- 4) 0.466666667 or $\frac{7}{15}$
- 5) 0.125 or $\frac{1}{8}$
- 6) 5.75 or $5\frac{3}{4}$ or $\frac{23}{4}$
- 7) 3
- 8) 4
- 9) 2
- 10) 7
- 11) 21.95514132
- 12) 2
- 13) 7
- 14) 125
- 15) 5040
- 16) 8
- 17) 1716
- 18) 330

Advanced

- 1) $x = 1, -3$
- 2) 1.653212514
- 3) 0
- 4) 0
- 5) 2
- 6) -0.397940009
- 7) 4.605170186
- 8) 0.386294361
- 9) 0.5
- 10) 0.707106781
- 11) 1
- 12) $4.444444444 \times 10^{-1}$
- 13) 2.000196×10^4 or 20.00196×10^3
- 14) 45.7789 or 4.57789×10^1 or 45.7789×10^0