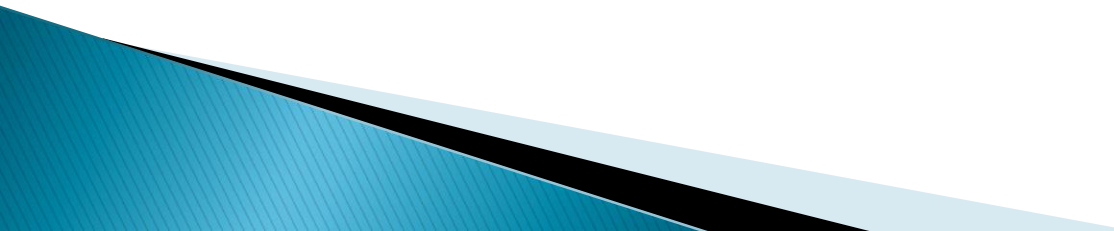# Getting to Know Your Calculator

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INTRODUCTION

▸ Using a calculator can be extremely helpful but only if you know its particular conventions. While there are different types out there many of the features are the same.

▸ This tutorial will be of most benefit if you have your calculator at hand as you follow along.

Getting to Know Your Calculator

- Look for the number pad and the four basic operations, multiplication × addition + subtraction − and division ÷.
- To perform a calculation, make the necessary keystrokes and then hit ENTER.
  - For example, key 4 ÷ 2 ENTER. The calculator should show the answer we expect, 2.
- Try some small calculations, like 2 + 3 and 4 × 5, and take note of the following:
  - Is the input still showing on the screen after I hit ENTER?
  - Can I scroll back through previous inputs using arrow keys?
  - The answers to these questions will depend on what type of calculator you have.

Accessing Additional Functions

- Your calculator keys may have another function written in small type above each key.
  - These additional functions are less commonly used than the others, but you might need to use some of them.
- Look for a 2nd, SHIFT or ALPHA key. Consult the manual for your calculator if you cannot locate this key.
- In order to access these additional functions on your calculator, press the aforementioned key and then the key below the additional function you need.
  - There might be more than one additional function per key, in which case they will be matched by color to their access key.

Calculator Tips

- Check your syllabus to find out what types of calculators are recommended/allowed for your particular course, and when they can be used. If you're not sure, ask the instructor.
- Do your homework and studying with the same calculator you will have on the day of the test. That way you won't waste valuable time figuring out how the calculator works.
  - If your calculator uses batteries, bring extras with you for the test.

The Order of Operations

▸ Some calculators possess algebraic logic; others do not. If your calculator is a scientific calculator it follows the order of operations, which you may have learned in a previous math class. It goes:
- ◦ **P**arenthesis
- ◦ **E**xponents
- ◦ **M**ultiplication/**D**ivision
- ◦ **A**ddition/**S**ubtraction

▸ Be aware that this means that multiplication and division should be performed from left to right in the expression regardless of their order, and the same with addition and subtraction.

- If your calculator is NOT a scientific calculator it does NOT follow order of operations and calculates the result in the order in which the entries were made. In this case, you will not get a correct answer so you will have to adjust how you enter the values. To see if your has algebraic logic enter 2 + 3 x 4.
- If you get 14 it has algebraic logic.
- If you get 20 it does not.

Parenthesis

- Find the right and left parenthesis buttons ( ) on your calculator, probably located above the number pad.
  - These will be necessary for complex calculations.
- Remember that the first thing to do in the order of operations is to simplify anything inside parenthesis.
  - If there are nested parenthesis, start with the innermost set and follow the order of operations inside each parenthesis. For example:

    $3 + (4 \times (5 - 1 \times 2)) = 3 + (4 \times (5 - 2)) = 3 + (4 \times 3) = 3 + 12 = 15$
  - Try entering the same expression in your calculator with no parenthesis. The result is different.
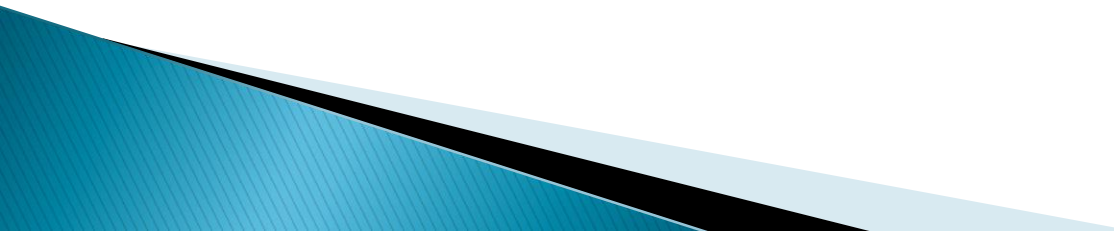- Parenthesis are just one type of grouping symbol, [ ] and { } work the same way.

Exponents

- Find the exponent key on your calculator, probably represented by ^ or y^x .
  - There may also be an x^2 key, which can only be used for squaring.
- Any calculations to be done with an exponent should be put in parenthesis, for example
  - 5^{2+1} becomes 5^(2 + 1), not 5^2 + 1.

Fractions

- Fraction bars represent division, and we need to put parentheses around the numerator and denominator.
- For example, say we need to calculate $\dfrac{1}{2+3}$.
  - Using the rule above, this should simplify to ⅕ or 0.2.
- If we use the keystrokes 1 ÷ 2 + 3, the calculator gives back 3.5, which is certainly not the same as ⅕. Why?

- Because the calculator can't see the fraction bar.
- We need to use parenthesis to tell the calculator what order to do things in.

▸ So in this example, we would need to key 1 ÷ (2 + 3) in order to return the correct answer, 0.2.

▸ Don't forget about this rule in more complicated calculations.

The Mathematical Constant *e*

- *e* is a constant approximately equal to 2.71828 which has many applications in mathematics.
- Locate the key on your calculator for *e*, possibly denoted e^x. This is because *e* almost always appears in equations with an exponent.
  - If you need the value of *e* with no exponent, you can use an exponent of 1 because remember anything raised to the exponent of 1 gives a result of the original number.
    - $2^1 = 2$
    - $a^1 = a$
- The e^x key on your calculator may bring up *e^(*. You will have to fill in what you need and close the parenthesis.

Example with *e*

- We want to calculate the quantity $300 \times e^{0.06 \times 5}$.

- We could key in $3000 \times e^{x}$ 0.06×5) ENTER, which would display as $300 \times e^{\wedge}(0.06 \times 5)$ and return 404.96.

Logarithms

- The logarithm is a function which, in a sense, "undoes" the act of taking something to a power.
- $y = \log_b(x)$ implies that $b^y = x$. In this example, b is called the base.
- The two most common bases for logarithms are 10 and e. 10 is so common that we often drop the subscript 10 and just use *log*.
  - For example, log(10,000)= 4 because 10^4= 10,000.
  - Logarithms with base e are denoted *Ln* for natural logarithm.
- Most calculators have keys *Log* and *Ln*.
  - The *Log* button on your calculator is understood to be base 10, so there is no need to key in the 10 when performing calculations.
  - Pressing the LOG key brings up *log(* and you are left to close the parenthesis.

An Example with Logarithms

- Suppose we want to evaluate $\frac{\log_{10}(2)}{\log_{10}(1+0.2)}$.
- Following the order of operations, we want to evaluate the quantity inside the parenthesis in the denominator first.

    1+0.2 returns 1.2
- We can key LOG 2) ÷ LOG 1.2), which displays as log(2)/log(1.2) and hit ENTER.
- Why do we need to put the right parentheses? For the same reason as earlier to show where the division occurs. Otherwise we wouldn't know if it was $\frac{Log2}{Log7.2}$ or log(2÷log7.2)

    ◦ We get an output of approximately 3.8018.

Taking Notes

- During class, don't let using the calculator interfere with note-taking and learning.
- Still write out the steps to example problems, even if they are primarily done on the calculator.
  - Also consider writing out a list of keystrokes necessary to do the problem along with the mathematical steps.
- This way, you'll still be taking notes instead of just working it out on the calculator and getting the right answer. And you'll be more likely to remember how you got that right answer later on.

Recall Functions

- Scientific and graphing calculators have functions that allow you to recall the answer to the last calculation performed.
  - This answer will generally be denoted as ANS on the screen.
- If you start a calculation with an operation, the calculator will automatically begin the line with ANS.
  - This is useful if you need the answer from your last calculation in the beginning of the new one.
  - Otherwise you can recall the last answer in the middle of the line, usually using a 2nd function.

Negative Signs

- Most calculators differentiate between subtraction signs and negative signs.
  - In order to put a negative number into a calculation, use the smaller negative sign, sometimes denoted (–), located near the decimal point at the bottom of the number pad.
  - This is necessary since the – key in the basic operations triggers subtraction.

Rounding

- Determine what digit you need to round to and look one to the right:
  - If this digit is 0, 1, 2, 3 or 4, do not change the rounding digit.
  - If this digit is 5, 6, 7, 8 or 9, move it up by one.
- When working problems dealing with money:
  - Keep the intermediate calculations in your calculator to make your answer as exact as possible, using the recall function.
    - To show your work on your paper, write intermediate steps but round the numbers.
  - For the final answer, round to two places after the decimal. Don't forget the $ sign!

Scientific Notation

- When a number is too big or too small for your calculator to display, it will use scientific notation.
  - It will represent the number as a number between 1 and 10 times a power of 10.
  - For example: 3,200,000,000,000 becomes 3.2×10^{12}
- Your calculator may use the symbol E (for exponent) to mean "10 to the power of."
  - So, 3.2×10^{12} will be displayed as 3.2E12.

- You can input numbers in scientific notation by keying in

    $#\times10\wedge$

    or your calculator might have an EE button (possibly as an additional function), which brings up the symbol E as above.
    - Your calculator may also have a 10^x key for these situations, which works similarly to the e^x key.

A Worked Example

- Let's say we want to evaluate the following quantity using our calculator: $$\dfrac{7000 \times \left(\frac{0.08}{6}\right)}{\left[1 - \left(1 + \frac{0.08}{6}\right)^{-(6\times 2)}\right]}$$

- The denominator has nested parenthesis, so let's start there.

- Evaluating $0.08 \div 6$ we obtain 0.0133. Now we want to add 1 to this quantity, so we can just key in $+\ 1$, press ENTER and obtain 1.0133.

- Moving on in the order of operations, next we'll take care of that exponent. $$\dfrac{7000 * \left(\frac{.08}{6}\right)}{0.8530}$$
  - Key in ^–(6×2) ENTER.

- Moving out to the next set of parenthesis, we should key 1 – ANS to finish out the denominator.
- At this point we will move on to the numerator, then use the recall function to divide.
  - We only have multiplication and division left, so we can run it all in one line.
- We can key in $7000 \times 0.08 \div 6 \div ANS$ and obtain our final answer, 635.116005.
  - If this is a money problem, we will round this to $635.12.

Conclusion

- As you can see the calculator is a valuable tool. You are totally knowledgeable about how your particular calculator works. I hope this was helpful. For additional info consult your calculator's manual and the website of the manufacturer.