Graphing Calculator Workshops

**For the TI-83/84 Classic Operating System
&
For the TI-84 New Operating System (MathPrint)**
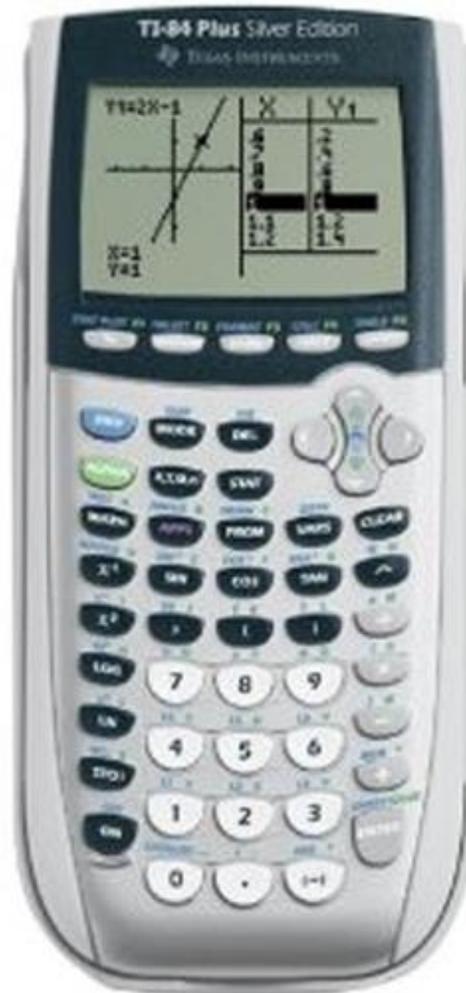
Overview

Workshop I

➢ Learn the general layout of the calculator
- Graphing Keys
- Editing Keys
- Advanced Function Keys
- Scientific Calculator Keys

➢ Learn basic operating procedures
- Order of operations
- Parentheses – You can limit your usage of them with the new OS
- Two minus signs
- Fractions – Like you would write them
- Exponents – Like you would write them
- Fixing typos
- Basic memory features

Graphing Calculator Workshop I

Graphing Calculator Basics

I. Layout
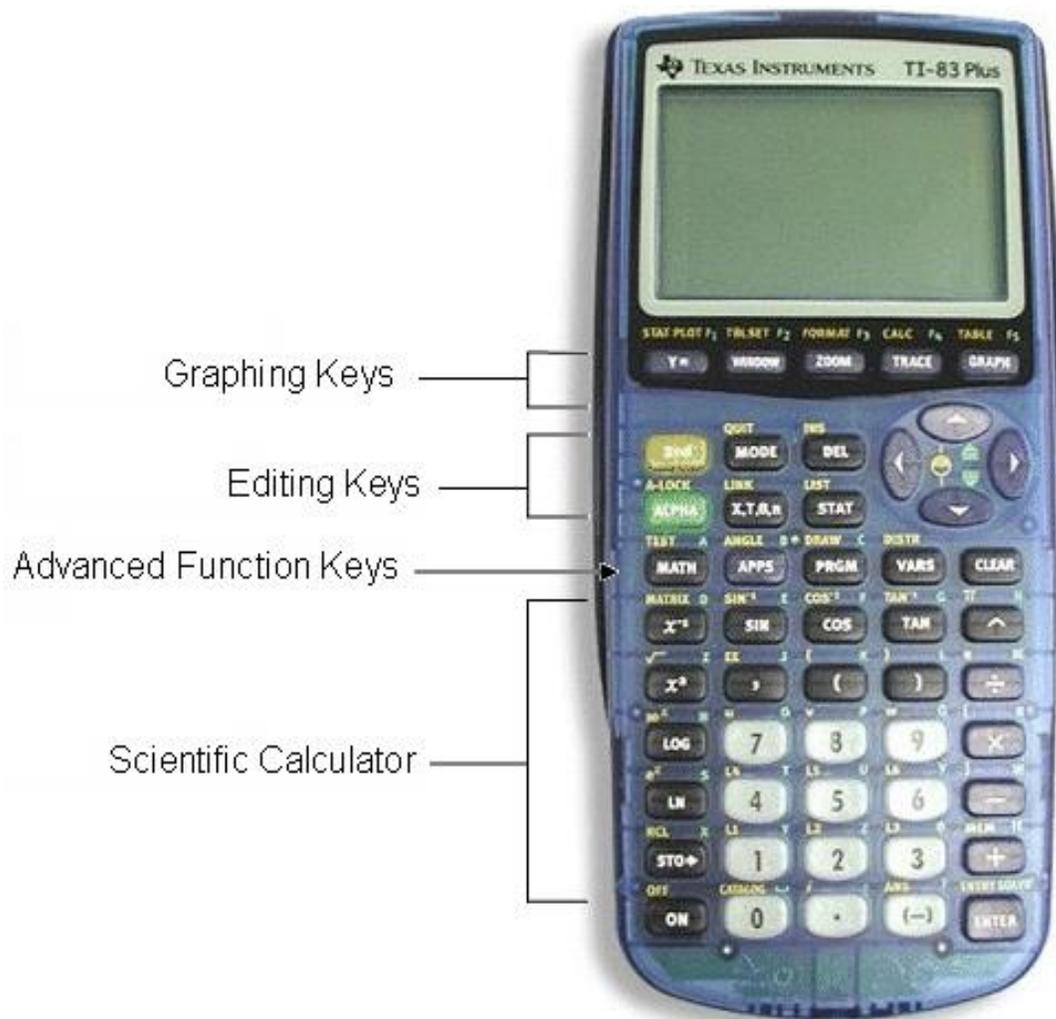
- <u>Scientific Calculator Keys:</u> Perform the basic operations of arithmetic like any scientific calculator

- <u>Advanced Function Keys:</u> Access menus for additional features of the calculator

- <u>Editing Keys:</u> Change expressions or values that have been entered in; also access options highlighted in yellow or green

- <u>Graphing Keys:</u> Display graphs, scatter plots and tables

II. Operations

1. ON / OFF -
2. 2nd / ALPHA – most keys are color-coded for multiple uses, governed by these two keys.

   2nd – The cursor shows an arrow pointing upwards to indicate that the 2nd functions of the keys are now turned on

   ALPHA – The cursor shows the letter "A" to indicate that the ALPHA functions of the keys are now turned on

   If you pressed one of these buttons by mistake, you can return to the regular all-black cursor by repressing the 2nd or ALPHA key.

3. MODE – Located to the right of the 2nd key, this key allows you to change the calculator's settings. The Classic OS has one page of settings, the new OS has two pages of settings.

   Classic OS mode settings (page 1 of the New OS mode settings)

   a. **NORMAL**   SCI   ENG
   b. **FLOAT**   0 1 2 3 4 5 6 7 8 9
   c. **RADIAN**   DEGREE
   d. **FUNC**   PAR   POL   SEQ
   e. **CONNECTED**   DOT
   f. **SEQUENTIAL**   SIMUL
   g. **REAL**   a+bi   re^θi
   h. **FULL**   HORIZ   G-T
           ↓NEXT↓

   a. Controls numeric notation – Normal, Scientific, Engineering
   b. Controls decimal rounding – Float indicates no rounding, 0 means only whole numbers; 1 for one decimal place; 2 for two decimal places, etc.
   c. Angle units – Radians or Degrees
   d. Type of graphing – FUNC: regular graphing (uses X as the input variable); PAR: parametric graphing (uses T as the input variable); POL: polar graphing (uses Θ [theta] as the input variable); SEQ: sequential graphing (uses n as the input variable).
   e. Connects graph data points or does not connect graph data points
   f. Whether to plot simultaneously (if you have two or more functions to graph, SEQUENTIAL will graph them one at a time while SIMUL will do them simultaneously)
   g. Number systems – REAL: the real number system; $a+bi$: rectangular complex number system; $re^{\theta i}$: polar complex number system
   h. Screen Options – FULL: full screen
      HORIZ: Two screens   G – T: Graph and Table split screen
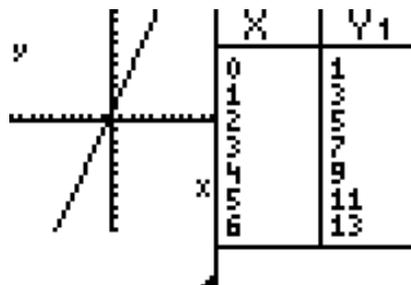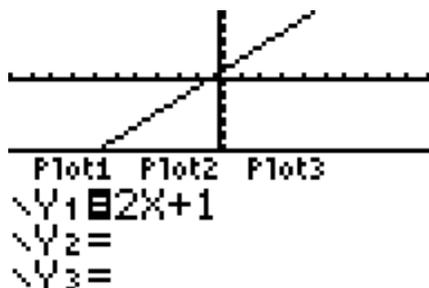
↑BACK↑

i. **MATHPRINT** CLASSIC
j. **n/d** Un/d
k. ANSWERS: **AUTO** DEC FRAC
l. GOTO FORMAT GRAPH: **NO** YES
m. STAT DIAGNOSTICS: OFF **ON**
n. SET CLOCK **04/30/01 3:13AM**

i. Choose Operating System (OS) – MATHPRINT: New OS; CLASSIC: Old OS
j. Display of fractions – n/d: proper or improper fractions; Un/d: Mixed number (whole number and a fraction)
k. Formats the answer – AUTO: Decimal or fraction; DEC: Decimal; FRAC: Fraction
l. Shortcut to FORMAT GRAPH screen

RectGC PolarGC
CoordOn CoordOff
GridOff GridOn
AxesOn AxesOff
LabelOff **LabelOn**
ExprOn ExprOff

m. STAT DIAGNOSTICS: When selected ON, displays correlation coefficient (r) and coefficient of determination (r^2).
n. Allows you to set the clock/date

FORMAT: M/D/Y D/M/Y Y/M/D
YEAR: 2015
MONTH: 6
DAY: 4
TIME: 12HOUR **24HOUR**
HOUR: 16
MINUTE: 36

SAVE

4. ENTER – Evaluates an expression (The "equals" key) or executes an instruction
5. Home Screen – Calculation screen
6. QUIT – Pressing the 2nd key then QUIT returns to home screen from any other screen
7. Contrast – You can set the contrast of the screen using the 2nd key and then the up arrow for a darker screen, or the 2nd key and the down arrow for a lighter screen. The contrast can be set for values between 0 (lightest) and 9 (darkest). A setting of 0 means you cannot see the characters on the screen, so don't go that light! A setting of 4-5 usually suffices. If your batteries get low, set the screen at a darker setting so you can see the characters.

III. The "scientific" portion of your calculator

1. The calculator works using the algebraic order of operations: PEMDAS

   Parentheses, **E**xponents, **M**ultiplication/**D**ivision, **A**ddition/**S**ubtraction

2. Type the expression into the calculator exactly as you read it on your page.
   BUT you must make sure you utilize parentheses when necessary so that the answer is calculated exactly as you would like it to be when using the Classic OS. <u>When in doubt, insert the parentheses.</u>

3. Press $\boxed{\text{ENTER}}$ to evaluate the expression you have entered on the home screen. The calculator will display the answer on the next line.

PARENTHESES ARE IMPORTANT!

<u>**Evaluate**</u>

$$\frac{4 \times 6}{3 + 5}$$

```
4*6/3+5
                13
4*6/(3+5)
                 3
(4*6)/(3+5)
                 3
```

If using the New OS, you don't need the parentheses. First, select "fraction" mode by pressing the ALPHA key followed by the Y= key, you should see this screen:

```
1: n/d
2: Un/d
3: ▶n/d◀▶Un/d
4: ▶F◀▶D
FRAC FUNC MTRX YVAR
```

Select option 1, now you should see an "empty" fraction on the screen ⁞⁞⁞ Enter the numerator (top) and
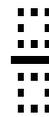
press the down arrow to enter the denominator (bottom). $\frac{4*6}{3+5\square}$ Press the ENTER key and you have your result without using parentheses!

4. Why are there two minus signs?
   a. The subtraction symbol is on the far right of the calculator. This minus sign usually indicates subtracting from a previous number or answer.
   b. The (−) button just to the left of the enter key indicates a negative number. This minus sign is usually inserted in front of a number.

Evaluate

Both ways

$$2-3$$

```
2 -3             ERR:SYNTAX
         Error  1 Quit
■                2:Goto
```

```
2-3
                      -1
■
```

Evaluate

$$-2-(-3)$$

```
-2-(-3)
                       1
-2--3
                       1
```

5. Fractions (Classic OS)
   a. Use the divide key (on far right of calculator) to indicate a fraction.
   b. If you are calculating with a fraction, use parentheses around the fraction to indicate that it is one quantity.

Evaluate

$$\frac{2}{3\!\!\diagup\!4}$$

```
2/3/4
          .1666666667
2/(3/4)
          2.666666667
```

6. Fractions (New OS)

    a. Select the "fraction" mode by pressing the ALPHA key followed by the Y= key, you should see this screen:

```
1: n/d
2: Un/d
3: ▶n/d◀▶Un/d
4: ▶F◀▶D
FRAC FUNC MTRX YVAR
```
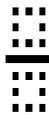
    b. Select option 1, now you should see an "empty" fraction on the screen ⁞⁞⁞ Enter the numerator (top) and press the down arrow to enter the denominator (bottom).

7. Converting between decimal and fraction (and vice versa) using one of the MATH menus.

    a. Decimal to fraction, if possible:
type the decimal– (MATH) – **Frac** – (ENTER) – (ENTER)
The answer will be given in lowest terms.

Convert the answers to the previous calculations to fractions.

```
2/3/4
              .1666666667
Ans▶Frac
                      1/6
2/(3/4)
              2.666666667
Ans▶Frac
                      8/3
```
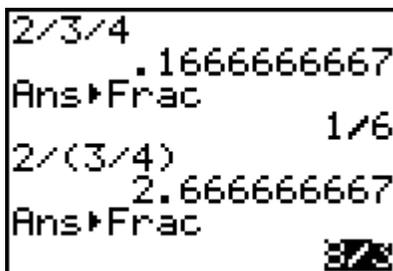
    b. In the new OS, as long as you enter the original expression as a fraction (see item 3 or 6 above), then the result will also be written as a fraction (if possible):

```
 2
───
3/4

                      8
                      ─
                      3
```

Note that some decimals do not have fraction forms (these are called irrational numbers), e.g., e, √2. If this is the case, the quantity will remain a decimal after you program the calculator to turn it into a fraction:

```
√2
              1.414213562
Ans▶Frac
              1.414213562
```
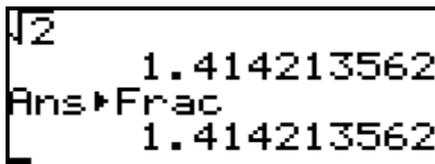
c. Fraction to decimal:
   Just divide, OR

   Type the fraction– (MATH) – **Dec** – (ENTER) – (ENTER)

Convert to a decimal	`4/12` `.3333333333` `4/12▶Dec` `.3333333333`
$\dfrac{4}{12}$	

8. Exponents
   a. Squaring button (x²)
   b. Square root – (2nd) (x²)   Note that with the Classic OS, the square root button automatically opens a parenthesis before you enter the expression you'd like to evaluate; with the MathPRINT OS, no parenthesis appears and you "toggle" out using the right arrow key.

    ← This is the "toggle" out indicator. If you are done with the quantity under the root, then you right arrow to get out of the root. You can always go back under the root by using the left arrow key!

   c. Other powers - use the carrot key (^)
   d. Other roots – use the xth root key under the (MATH) menu: index (what root you want to take) of the radical – (MATH) – $\sqrt[x]{}$ – (( ) – type your expression – ( ))

   e. Fractional exponents

Evaluate	New OS	Classic OS
$5^{2\bullet3}$ $5^{(2\bullet3)}$ $\left(\sqrt[3]{8}\right)^4$	`5^2*3` `15625` `³√8⁴` `16` `8^4/3` `16`	`5^2*3` `75` `5^(2*3)` `15625` `³√(8)^4` `16` `8^(4/3)` `16`

9. Fixing mistakes: Clear, Delete, or Insert.
   a. **CLEAR** – completely erases everything on the screen.
   b. (DEL) – erases the value that the cursor is on. Move the cursor using arrows.
   c. To insert (**INS**) a character into your expression
      i. Put your cursor to the right of where you want the new character to go

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Example: Let's say I want to evaluate 56+478, but I have typed in 56+78. I need the "4" to go the left of the

"7", so I place the cursor on the "7" and then press (2nd) and then press (DEL). The screen should look
like this:

$$56+78 \qquad 56+\_8$$

The "7" is flashing on and off

      ii. Type in the new character or expression (in the example, the "4")
      iii. Press enter (if done), or, arrow to the end of the expression and continue

10. Your calculator's got memory!
    a. To use the previous answer in a new calculation, we need the ANS option:
       i. Enter the next operation to use the previous answer as the first number.
       ii. Use (2nd) (‑) to call the previous answer into an expression.

Use the answer to the first calculation in the next two.

$$2+8$$

$$\frac{Ans}{2}$$

```
2+8
           10
Ans/2
            5
9-Ans*3
           -6
■
```

b. You can store up to 27 quantities (A – Z and Θ) in the calculator. To do this we need to use the STO Key in conjunction with the ALPHA key.

    i. Type the quantity or the expression. Press the 2nd key and then the STO key (located just above the ON key). Press the ALPHA key and choose which letter (A – Z or Θ) to store it in. Then press the enter key to store the quantity.

Storing a quantity

```
5→A
                    5
```
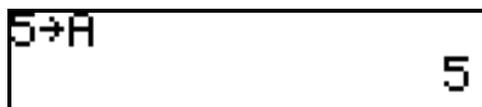
Storing an expression

```
4²+5*4-7→B
                   29
```
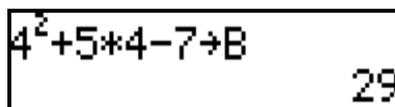
c. To restore the expression you've previously entered (after you have pressed the ENTER key), use the ENTRY option:

(2nd) (ENTER)

<u>Restore the following expression after you have the result.</u>

$$\frac{1+\sqrt{1-4(2)(-3)}}{2(2)}$$

Classic OS
```
(1+√(1-4(2)(-3))
)/(2*2)
              1.5
(1+√(1-4(2)(-3))
)/(2*2)■
```

New OS
```
1+√1-4(2)(-3)
   2(2)
              1.5
1+√1-4(2)(-3)
   2(2)      ■
```