TI-83 GRAPHING CALCULATOR WORKSHOP
Session III: Expressions and Equations

1. Accessing the catalog

   - The CATALOG contains an alphabetical listing of all functions and instructions on the TI-83. Nearly all of them can also be accessed from the keyboard or a menu.
   - Press [2nd] [CATALOG] to display the list.
   - You may use the arrow keys to scroll up or down the listing until you find the item you want. Press [ENTER] to paste the item to the current screen.
   - Notice that the alpha-lock is on when you enter the CATALOG. If you select the first letter of the name of the item you want to access, the calculator will jump to the first item beginning with that letter. You can then scroll down using [▼].

2. Finding the approximate values of the irrational numbers π and e

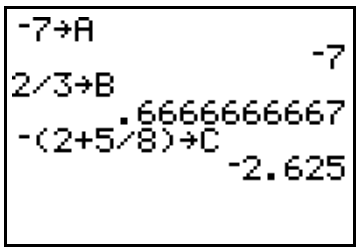
   - To find the value of π, correct to 9 decimal places, press [2nd] [π] [ENTER].
   - To find the value of e, correct to 9 decimal places, press [2nd] [e] [ENTER].
     To find a power of e, e.g. e^3: press [2nd] [e^x(] [3] [)] [ENTER]. The number e is nearly always used as a base and is very important in exponential growth and decay applications.
   - Since these are irrational numbers, they cannot be changed to fractions.

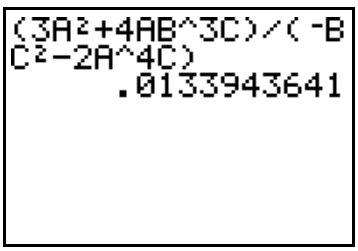
3. Accessing variables

   - To access any variable other than X, the [ALPHA] key must be used, e.g. [ALPHA] [W].
   - When you press the [ALPHA] key, you will note that the cursor will have the letter "A" in it. After you press a letter, the cursor will revert back to normal. If you wish to type several letters in a row, you can press [2nd] [ALPHA] to turn on the alpha-lock and then the letters you desire. To get out of the ALPHA mode, press [ALPHA] again. In addition to the alphabet, the alpha keys also include quotation marks (above +), colon (above .), question mark (above (-)), and a blank space (above 0).

4. Evaluating expressions

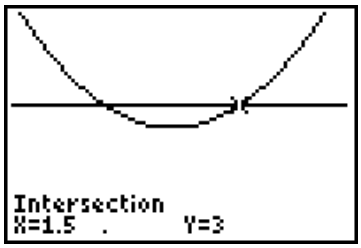
   - To evaluate an expression containing several variables, first assign the given values to the appropriate variables.
   - Evaluate $\frac{3a^2+4ab^3c}{-bc^2-2a^4c}$ for a = -7, b = $\frac{2}{3}$, and c = $-2\frac{5}{8}$.
   - First store all given values in the appropriate variables:
     [(-)] [7] [STO▸] [ALPHA] [A] [ENTER] ,
     [2] [÷] [3] [STO▸] [ALPHA] [B] [ENTER] ,
     [(-)] [(] [2] [+] [5] [÷] [8] [)] [STO▸] [ALPHA] [C] [ENTER] .
   - Enter the expression using parentheses around the numerator and the denominator:
     [(] [3] [ALPHA] [A] [X^2] [+] [4] [ALPHA] [A] [ALPHA] [B] [^] [3] [ALPHA] [C] [)] [÷] [(] [(-)] [ALPHA] [B] [ALPHA] [C] [X^2] [−] [2] [ALPHA] [A] [^] [4] [ALPHA] [C] [)] [ENTER].



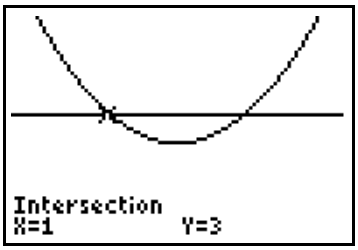


5. Solving equations graphically

- To solve $2x^2 - 5x + 6 = 3$, let Y_1 = the left side of the equation and Y_2 = the right side. Either clear or turn off all other equations. To turn an equation on or off, position the cursor over the = sign and press ENTER. If the = sign is not highlighted, the calculator will not graph that equation.
- Graph the equations on the standard viewing window. Adjust the viewing window until the point(s) of intersection can be seen.
- Press 2nd [CALC][5:intersect] to find one point of intersection. You must identify the two curves whose intersection you wish to find and make a guess. This is easiest to do if only two curves are graphed at a time: simply use the arrow keys to place the cursor as close as possible to the desired point of intersection and press ENTER three times. One solution to the equation is x = 1.5. Note that the y-value is not a part of the solution!

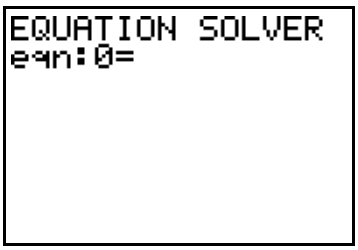


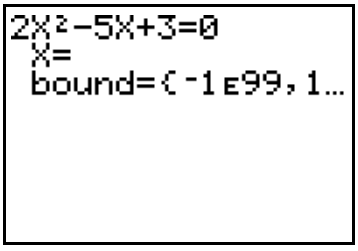
- The calculated values of X and Y are automatically stored and can frequently be changed to fractions in the home screen.
- Repeat this process to find the other solution.
- In some situations it is helpful to use different types of lines for the two curves. To change the type of line used, use ◄ to place the cursor over the \ symbol to the left of the equation. Press ENTER until you get the desired type of line.

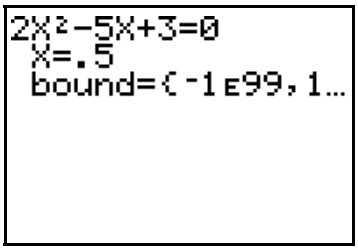


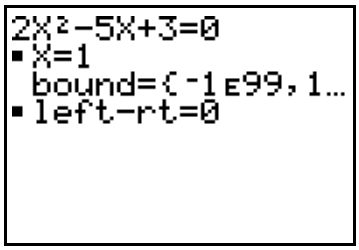
6. Solving equations using the equation solver

- First set the equation = 0: $2x^2 - 5x + 3 = 0$
- Press MATH MATH 0:Solver... ENTER.
- If necessary, clear previous equation.
- Enter the equation after 0= ; press ENTER.
- Enter your guess for one solution of the equation equation after X= ; press ALPHA [SOLVE].

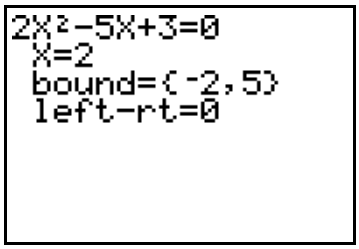


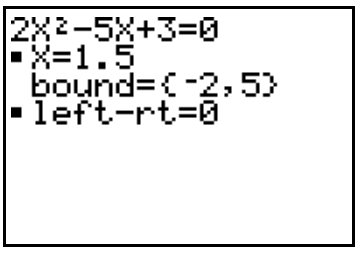






- To find the other solution you must change the guess to a number which is closer to that solution than it is to x = 1.5.
- To limit the domain of the function, press ▼ and type the desired domain after bound= . The domain must be enclosed in the curly braces which are accessed using the 2nd key. The default domain is $\{-1 \times 10^{99}, 1 \times 10^{99}\}$.
- The solutions are x = 1, 1.5.

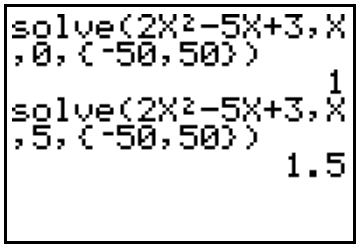




- The major disadvantages of this method are that you must know how many real solutions the equation has, and you must make reasonable guesses to find them.
- The TI-83 will only find real solutions.
- Use [2nd] [QUIT] to exit the equation solver.

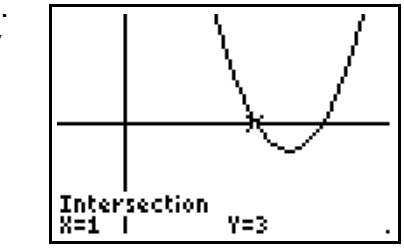
7. Solving equations using SOLVE

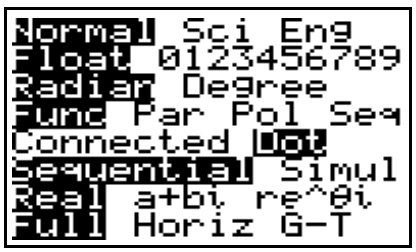
- First set the equation = 0: $2x^2 - 5x + 3 = 0$
- Press [2nd] [CATALOG] [S] , use [▾] to scroll down to [solve(] and press [ENTER]. This function can only be accessed from the CATALOG.
- After solve(type the left side of the equation, press [,] [X,T,θ,n] [,], type a guess for x, press [2nd] [{], type lower bound, press [,], type upper bound, press [2nd] [}].
- The upper and lower bounds are optional. The default settings of -1E99 and 1E99, respectively, will be used if you do not enter any bounds.
- After finding the first solution, press [2nd] [ENTRY] to redisplay the previous calculation and change the guess; press [ALPHA] [SOLVE].
- This method has the same limitations as the previous method.

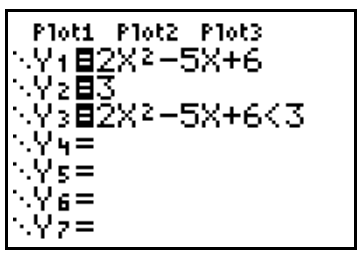


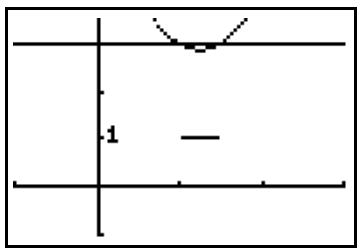
8. Solving inequalities on the calculator.

- The solution set of an inequality is typically an interval containing an infinite number of solutions.
- To solve $2x^2 - 5x + 6 < 3$ we must first find the endpoints of the solution interval. Let Y_1 = the left side of the inequality and Y_2 = the right side; press [2nd] [CALC] [5:intersect]. Repeat to find all points of intersection.
- Notice that the graph of Y_1 is below the graph of Y_2 only between x = 1 and x = 1.5. This means that the inequality is true on this interval. Since this problem is a strict inequality, the solution set is the interval (1, 1.5).
- To check your answer on the calculator, press [MODE] Dot [ENTER]. In Y_3 type the inequality as given or use the keystrokes: [Y_3=] [VARS] [ENTER] [Y-VARS] [1:Function] [1:Y_1] [2nd] [TEST] [5:<] [VARS] [ENTER] [Y-VARS] [1:Function] [1:Y_2]. Adjust the viewing window so that the x-axis is visible.
- When the calculator tests a statement, it returns a value of 1 whenever the statement is true and a value of 0 whenever the statement is false. The "number line" drawn between x = 1 and x = 1.5 verifies our solution. The calculator does not have any way of telling you whether the endpoints are included or not.









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