

TI-83 Graphing Calculator Skills for Math 0098
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Last Revised: Jan. 27, 2005

Though these steps were written for the TI-83 calculator, they apply to the TI-83 Plus and the TI-84.

Skill 1: Simplify numerical expressions requiring parentheses

Parentheses are needed to demonstrate to the calculator where groupings are located in the numerical expression. Remember that the fraction bar, square root, absolute value, and exponents including more than a single number will require the use of parentheses to enter on the calculator.

Examples:

$$\frac{4+\sqrt{7}}{5}$$

$$\sqrt{5} + 7$$

$$\sqrt{5+7}$$

$$49^{3/2}$$

$$\frac{7}{2 \cdot 3}$$

```
(4+√(7))/5
1.329150262
√(5)+7
9.236067977
√(5+7)
3.464101615
■
```

```
49^(3/2)
343
7/(2*3)
1.166666667
```

Skill 2: Evaluate a function or an algebraic expression

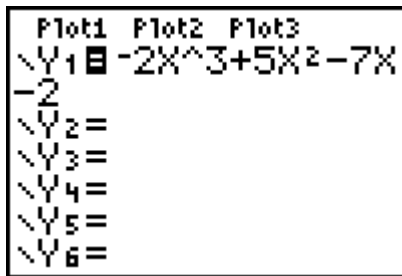
Problem: Let $f(x) = -2x^3 + 5x^2 - 7x - 2$. Find $f(-2)$.

This may also be stated as "Find the value of $-2x^3 + 5x^2 - 7x - 2$ when $x = -2$."

Method One: On the main window of the calculator, type in the numerical expression that results when -2 is substituted in for x .

```
-2(-2)^3+5(-2)^2-
7(-2)-2
48
■
```

Method Two: Input the function into your equation editor. Press $\boxed{Y=}$ and type in the corresponding function. Use $\boxed{x, t, \theta, n}$ for the variable x .



From here there are several options to evaluate the function for $x = -2$.

First Option: Press $\boxed{2^{nd}}$ \boxed{GRAPH} and examine the table for the x value for which the function is being evaluated. The corresponding y value is the answer to $f(-2)$.

Note: This options works best when the value of x is an integer value.

Second Option: Press \boxed{GRAPH} to view the graph of the function. Then press \boxed{TRACE} and type in the x value for which the function is being evaluated. The corresponding y value is the answer to $f(-2)$.

Note: The x -value must be within the window settings for x . That is, it must fall between the x -min and x -max values.

Third Option: Press $\boxed{2^{nd}}$ \boxed{WINDOW} and change the table set-up by placing the cursor on the word ASK and pressing enter for the Indpnt Row only. Then view the table by pressing $\boxed{2^{nd}}$ \boxed{GRAPH} . In the x column, type in the value for which the function is being evaluated and press enter. You may continue to do this for as many values as needed.

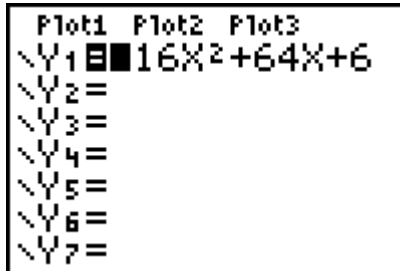
Skill 3: Graph an equation

When asked to graph an equation on the calculator or by hand, it is necessary to view the complete graph of the equation. A complete graph shows the basic shape of the graph and the x and y intercepts of the graph. The basic shape of the graph is based on its function type. If the function is linear, then the graph is a line. If the function is quadratic, the graph is a vertical parabola. If the function is a square root function, the basic shape is a half-parabola opening to the right or to the left. If the function involves absolute value of a linear expression, then the graph is V-shaped. The basic shapes and different classes of functions will be discussed more fully in Math 1111.

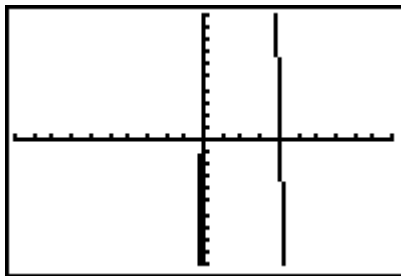
Problem: Graph the equation $y = -16x^2 + 64x + 6$.

Note: Since this is quadratic, the graph will be a parabola. A parabola has a turning point at its vertex.

Method: Press $\boxed{Y=}$ and input the expression into the calculator.



In the standard viewing window (ZOOM 6), a complete graph of this equation cannot be viewed since the vertex point is not shown.



To view the complete graph, the WINDOW settings must be adjusted. To determine appropriate values, examine the table by pressing $\boxed{2^{nd}} \boxed{GRAPH}$.

X	Y1	
-1	-74	
0	6	
1	80	
2	154	
3	266	
4	414	
5	600	
6	824	
7	1086	
8	1486	
9	2024	
10	2700	
11	3514	
12	4466	
13	5556	
14	6784	
15	8150	
16	9654	
17	11296	
18	13080	
19	15006	
20	17074	
21	19284	
22	21636	
23	24130	
24	26766	
25	29544	
26	32464	
27	35526	
28	38730	
29	42076	
30	45564	
31	49194	
32	52966	
33	56880	
34	60936	
35	65134	
36	69474	
37	73956	
38	78580	
39	83346	
40	88254	
41	93304	
42	98496	
43	103830	
44	109306	
45	114924	
46	120684	
47	126586	
48	132630	
49	138816	
50	145144	
51	151614	
52	158226	
53	164980	
54	171876	
55	178914	
56	186094	
57	193416	
58	200880	
59	208486	
60	216234	
61	224124	
62	232156	
63	240330	
64	248646	
65	257104	
66	265704	
67	274446	
68	283330	
69	292356	
70	301524	
71	310834	
72	320286	
73	329880	
74	339616	
75	349494	
76	359514	
77	369676	
78	379980	
79	390426	
80	401014	
81	411744	
82	422616	
83	433630	
84	444786	
85	456084	
86	467524	
87	479106	
88	490830	
89	502696	
90	514704	
91	526854	
92	539146	
93	551580	
94	564156	
95	576874	
96	589734	
97	602736	
98	615880	
99	629166	
100	642594	

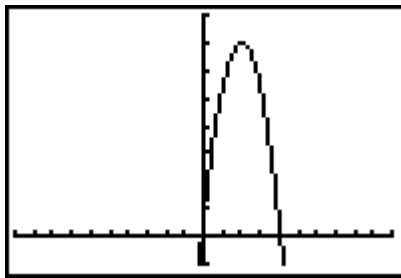
Since the graph in the standard window shows the x and y intercepts but not the vertex of the parabola, the x values do not need to be adjusted; only the y values. In examining the tables above, you should notice that the largest y value shown is 70 but there is no minimum y -value. (Verify this on your own by examining the table on your calculator.) So, it is only necessary to change our y -max value to view the vertex. (Since the graph reaches a maximum y - value but then continues decreasing, there are no other turning points to be found.) As a general rule, you do not want to set your window values at the

exact maximum and minimum values of the function, but rather a little above (for maximum) and below (for minimum).

To adjust the WINDOW settings, press **WINDOW** and make the following changes.

```
WINDOW
Xmin=-10
Xmax=10
Xscl=1
Ymin=-10
Ymax=80
Yscl=10
Xres=1
```

Now press **GRAPH** to view the complete graph of the equation.



Rule of Thumb for setting the Xscl and Yscl:

$$\text{Let } Xscl = \frac{X_{\max} - X_{\min}}{10} \text{ and } Yscl = \frac{Y_{\max} - Y_{\min}}{10}.$$

Skill 4: Solve a system of equations graphically

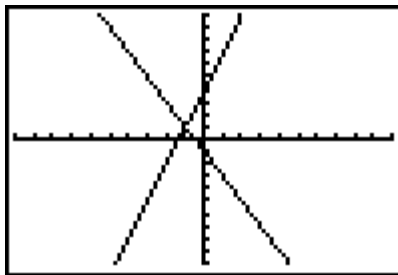
Problem: Solve the system $\begin{cases} y = 3x + 4 \\ y = -2x - 1 \end{cases}$

Method: Input the first equation into **Y₁** and the second equation into **Y₂**. Now press **GRAPH**. The solution to the system is the ordered pair at which the two graphs intersect - the point of intersection. (Note: Some systems require some work to get the equations solved for y before entering on the calculator.) First view your graph in the standard window (Zoom, 6). If the standard window, does not show the point of intersection, then you will have to adjust your window.

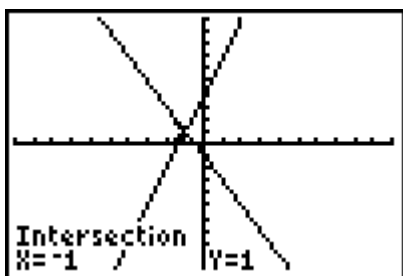
```

Plot1 Plot2 Plot3
Y1=3X+4
Y2=-2X-1
Y3=
Y4=
Y5=
Y6=
Y7=

```



To find this point of intersection, press 2^{nd} TRACE , 5, Enter, Enter, move the cursor to the point of intersection and press enter. The point of intersection is displayed at the bottom of the window.



Therefore, the ordered pair $(-1, 1)$ is the solution to the system given above.

Skill 5: Evaluating the root of a number

Methods:

- 1) To find the square root of a number, simply press 2^{nd} x^2 and then type in the radicand, close parentheses, and press enter.
- 2) To find the cube root of a number, denoted $\sqrt[3]{x}$, press MATH , 4, type in the radicand, close parentheses, and press enter.
- 3) To find any other root of a number: Type in the root to be taken on the main window, press MATH , 5, type in the radicand, and press enter.

Problem: Approximate the value of $\sqrt[6]{100}$.

```

6 *√100
2.15443469

```

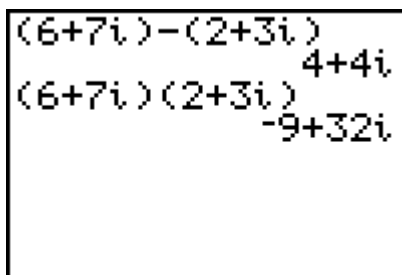
Recall that $\sqrt[n]{x} = x^{1/n}$, so the expression above could be evaluated using the exponential expression $100^{1/6}$.

Skill 6: Perform operations with complex numbers

Your calculator can perform operations with complex numbers. To enter the number i , press $\boxed{2^{\text{nd}}}$ $\boxed{\cdot}$.

Problems: $(6 + 7i) - (2 + 3i)$
 $(6 + 7i)(2 + 3i)$

Method: On the main window, enter the problem just as it is given.



```
(6+7i)-(2+3i)
              4+4i
(6+7i)(2+3i)
              -9+32i
```

If you want a non-real number, e.g. $\sqrt{-4}$, to be displayed in complex form, you need to change the MODE. Press $\boxed{\text{MODE}}$ and move the cursor down to the row beginning with the word Real. Move the cursor on top of the expression $a + bi$ and press Enter. Now your calculator will display all non-real complex numbers in this form.

Method: Enter $\sqrt{-4}$ on your calculator and your display is $2i$.

Note: You do not necessarily need to change the mode back to real. Normal operations will not be affected if your calculator is in complex mode.

Skill 7: Enter data points and graph

Sometimes it will be necessary to view the graph of a list of ordered pairs to determine if there is an equation that models this set of data. To enter the data points, you will use the STAT menu.

Problem: View the plot of ordered pairs given below.

x	y
1	3
2	5
3	8
4	12

Method: To enter this list of data, press $\boxed{\text{STAT}}$, 1. Then type in the x values in the L_1 column and then type in the y values in the L_2 column. (To clear out the columns, move cursor to top of column and press CLEAR and ENTER. Do not press DEL as this will remove the entire column.)

L1	L2	L3	1
1	3	-----	
2	5		
3	8		
4	12	-----	
L1(5)=			

To view the graph of these data points, press $\boxed{2^{\text{nd}}}$ $\boxed{\text{Y} =}$, 1, press enter on the word On, choose the first type on the first row, make sure that Xlist is L_1 and Ylist is L_2 , and the mark is the box. After these things have been selected you may have to adjust your window to view all of the points. In this case we will need to adjust the Ymax to 15 since our largest y value is 12. To view the graph, press $\boxed{\text{GRAPH}}$. You should see the picture below. (Make sure all equations are cleared out of the $\text{Y} =$ screen before graphing these data points.)

