

## Lesson 8: Learning to use the Calculators

### *Objectives:*

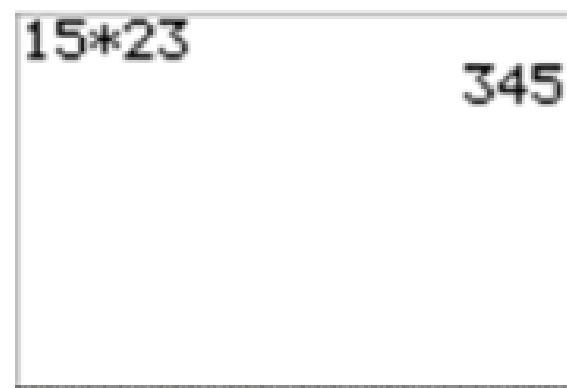
- Input basic expressions into the calculator - including grouping symbols and powers.
- Graph a function on the calculator.
- Understand how to adjust the window settings to show a complete graph.

## Lesson 8: Learning to use the Calculators

*Follow these instructions:*

Find  **$15 \times 23$**

We don't have an "equal" button on the graphing calculator, so we use the "ENTER" button (lower right hand side). Your screen should look like this:



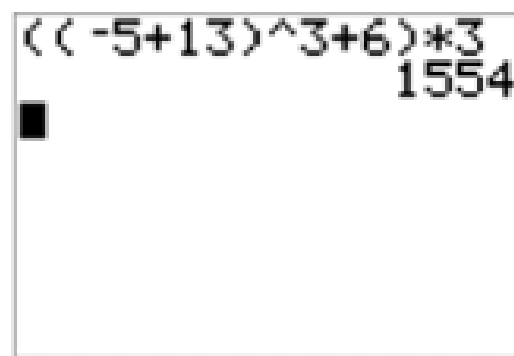
## Lesson 8: Learning to use the Calculators

*Follow these instructions:*

Find  $[(-5 + 13)^3 + 6] \cdot 3$

Your calculator doesn't do square brackets, so you will need to use parentheses wherever the square brackets appear. To input a power, you need to use the carat button (^) on the right hand side of the calculator, then enter the power. Graphing calculators don't require that we do pieces of the problem and put them together like we have to do with scientific calculators, so we will input the entire expression.

NOTE: do NOT use the minus button when inserting a negative before a number, use the (-) button on the bottom row of the number keys. Only use the minus button when you are subtracting.



## Lesson 8: Learning to use the Calculators

This example comes from page 6 of your book:

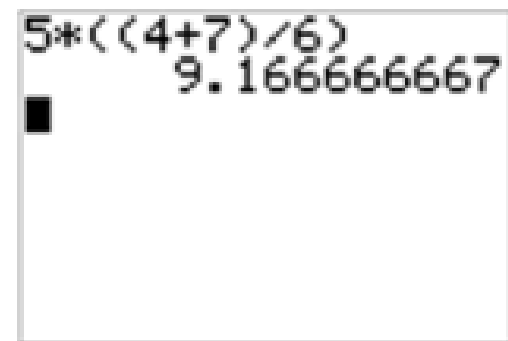
$$5 \times \frac{4+7}{6}$$

Think about this. We are multiplying 5 by a fraction, so we need to put the entire fraction into a set of parentheses.

The  $4+7$  on top of the fraction will also need to be in its own set of parentheses because we're dividing  $(4+7)$  by 6.

If we don't use parentheses, the calculator will think we only want to divide the 7 by 6.

**When in doubt, group things in parentheses!**



## Lesson 8: Learning to use the Calculators

Now let's graph some lines. Consider the line of the equation  $y - 2x = 3$

We've learned to graph these lines by hand using the x- and y- intercepts (x-intercept is at  $(-3/2, 0)$ , y-intercept is at  $(0, 3)$  ). The calculator has to have the equation in terms of what y equals. This means that we have to change the format of the equation to  $y =$  something. We add  $2x$  to both sides, and get  $y = 2x + 3$

Let's input this.

## Lesson 8: Learning to use the Calculators

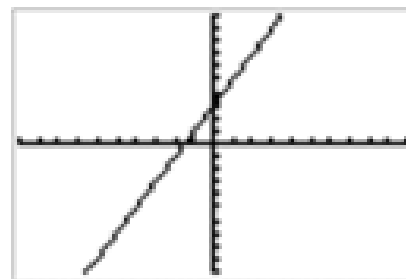
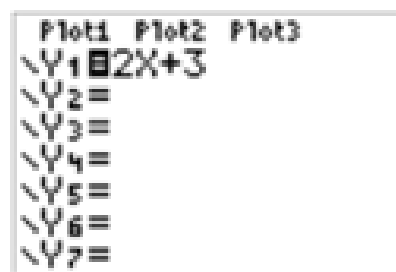
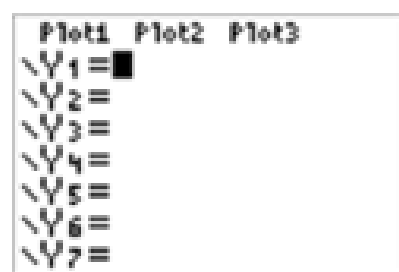
A few things you need to know: the button to input an equation for graphing is  $\boxed{Y=}$ . This button is on the top left corner of the key pad. The button you use to make an  $x$  is on the second row down, second button over. It says  $\boxed{x, t, \theta, n}$

Input in the following order:  $\boxed{Y=}$

This gets you to a screen where you input the equation.  $2 * \boxed{x, t, \theta, n} + 3$

Then  $\boxed{\text{ENTER}}$  This inputs the equation into memory.

$\boxed{\text{GRAPH}}$  This button takes you to the graphing screen. (The button is on the top right corner.)



## Lesson 8: Learning to use the Calculators

If you look at the graph, you will see that the axes go from -10 to 10 on both the x-axis and the y-axis. This is called the “Standard Window”. You can change your window settings by pressing the **WINDOW** button (2<sup>nd</sup> button over on the top row).

**Xmin** tells you the minimum value shown on the x-axis.

**Xmax** tells you the maximum value shown on the x-axis.

**Xscl** tells you the scale of the x-axis. (We’re counting by ones, twos, fives, etc.)

**Ymin** tells you the minimum value shown on the y-axis.

**Ymax** tells you the maximum value shown on the y-axis.

**Yscl** tells you the scale of the y-axis. (We’re counting by ones, twos, fives, etc.)

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

## Lesson 8: Learning to use the Calculators

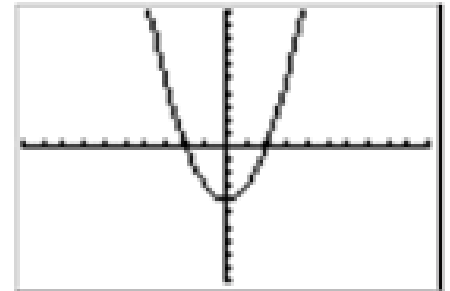
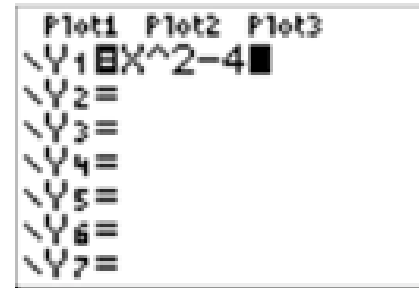
If we've changed our settings recently, and we want to return to the standard window settings, we can use a shortcut and press the "Zoom" button, then "6" (Zstandard).

Sometimes we need to change the window in order to view a "complete" graph - we should see  $x$  and  $y$ -intercepts, and if there's a curve we need to see where it changes direction.



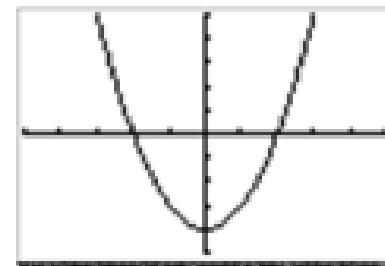
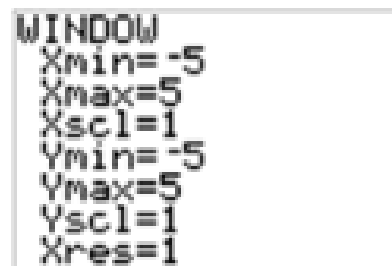
## Lesson 8: Learning to use the Calculators

Graph  $y = x^2 - 4$  using the standard window.



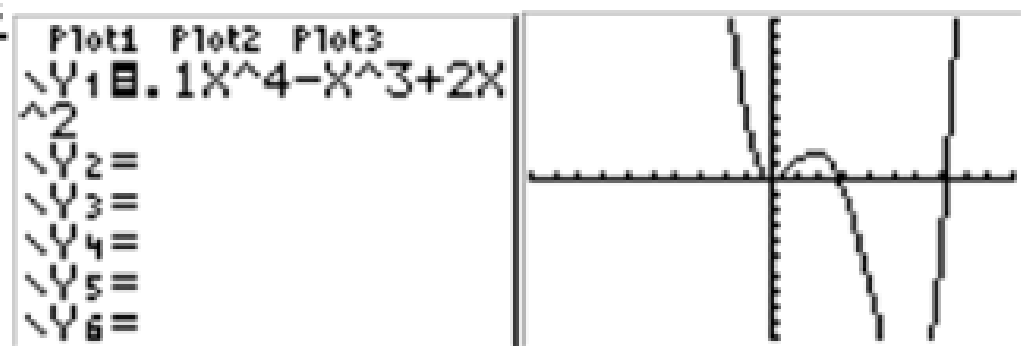
Find the  $y$ -intercept of the graph, and estimate the  $x$ -intercepts.

We know how to find the  $y$ -intercept by substituting  $x = 0$  into our equation and solving for  $y$ . This gives us a  $y$ -intercept of  $(0, -4)$ . There are two  $x$ -intercepts, though, which means that substituting  $y = 0$  and solving for  $y$  may get a little bit complicated. We can make an estimate based on our graph. This picture looks like the intercepts are at  $(-2, 0)$  and  $(2, 0)$ . If we adjust our window to make it closer, we can get a better estimate.



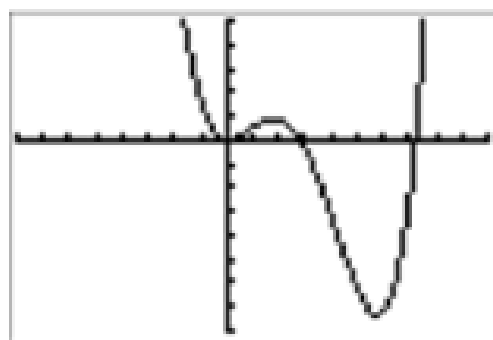
## Lesson 8: Learning to use the Calculators

Graph  $y = .1x^4 - x^3 + 2x^2$



As you can see, this isn't a complete graph, so we need to make our window adjustments larger. Let's also adjust the scale on the y-axis to 2.

```
WINDOW
Xmin=-8
Xmax=10
Xscl=1
Ymin=-16
Ymax=10
Yscl=2
Xres=1
```

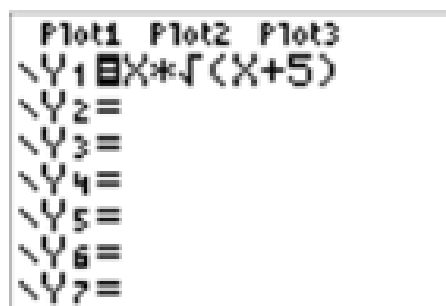


This is better - we can see the bottom of our graph and all of the obvious intercepts. The thing to remember is we changed the scale on the y-axis, so when we sketch this out we have to change that scale, too. If we plug  $x = 0$  into the equation, we find that the y-intercept is at  $(0, 0)$ . We can estimate that our x-intercepts are at  $(0, 0)$  (yes it's the same - the origin is the only place that happens),  $(3, 0)$ , and maybe  $(7.5, 0)$ . It actually looks a little less than  $x = 7.5$ , but for our purposes we'll just estimate to the nearest .5.

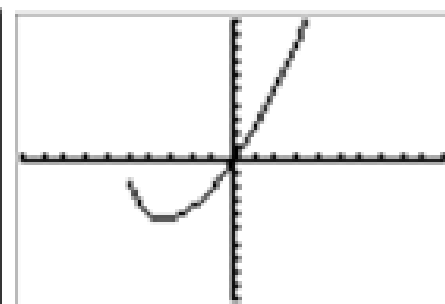
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### Graph $y = x\sqrt{x+5}$

THINK!  $x + 5$  is all under the square root sign, so we'll need to use parentheses when putting it into the calculator. The calculator will actually supply the first parentheses, but you need to remember where to close them. Also - we like to start out with a standard window, so use the ZOOM 6 feature when graphing.

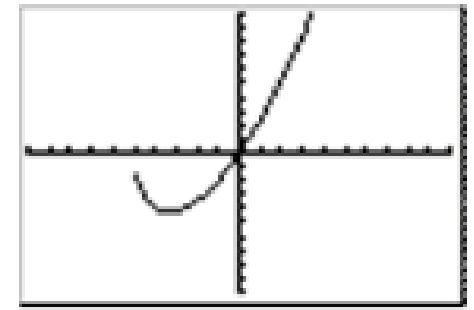
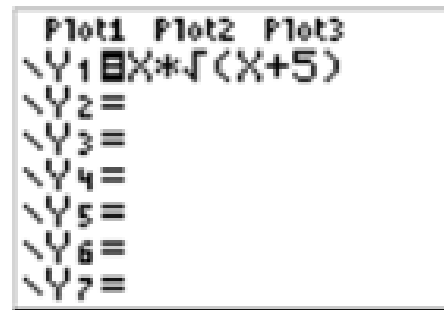


Plot1 Plot2 Plot3  
Y1  $X*\sqrt{X+5}$   
Y2 =  
Y3 =  
Y4 =  
Y5 =  
Y6 =  
Y7 =



## Lesson 8: Learning to use the Calculators

Graph  $y = x\sqrt{x + 5}$



This example shows us that the calculator is not always perfect!!! In reality, this graph should continue the curve upward until it touches the x-axis at -5. We can complete the graph on our sketch by looking at the value inside the square root. Whatever value of  $x$  makes the square root equal to zero is the value of  $x$  at our x-intercept. Since our square root contains  $(x + 5)$ ,  $x = -5$  will make it zero, and that will make  $y = 0$  if we continue. Make sure you take this step into consideration when you sketch your graphs in your homework. **This graph should have a little more information than what you see on the calculator!**

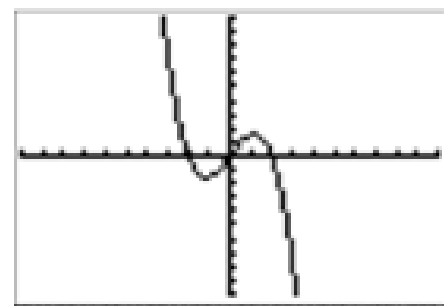
## Lesson 8: Learning to use the Calculators

Graph  $2y + x^3 = 4x$  This isn't in  $y =$  form so we have to solve for  $y$ .

Remember: we will need to keep the entire numerator in parentheses when we input it into the calculator.

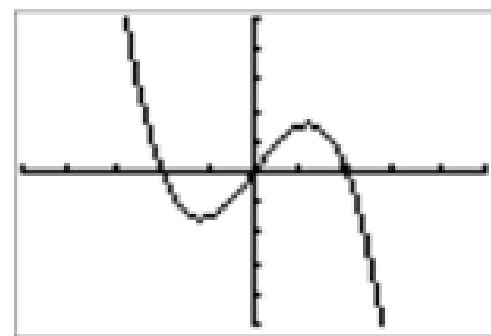
$$y = \frac{4x - x^3}{2}$$

```
Plot1 Plot2 Plot3
Y1=(4X-X^3)/2
Y2=
Y3=
Y4=
Y5=
Y6=
Y7=
```



Let's play with the window setting again.

```
WINDOW
Xmin=-5
Xmax=5
Xscl=1
Ymin=-5
Ymax=5
Yscl=1
Xres=1
```



## Lesson 8: Learning to use the Calculators

### THINGS TO THINK ABOUT WHEN SKETCHING CALCULATOR GRAPHS ON YOUR HOMEWORK.

- Draw your axes to match your window settings, and make sure you mark the scale.
- Always find your y-intercept mathematically (putting 0 in for all the x's and solving for y), but it's okay to estimate x-intercepts. Estimate to the nearest  $\frac{1}{2}$ .
- When dealing with square root equations, remember that the graph you see on the calculator is probably not quite complete. You'll need to fill it in up to the x-axis.

## Lesson 8: Learning to use the Calculators

### Some Common Issues:

“When I try to graph, it says ‘INVALID DIM.’”

TO FIX:

1. Hit “2<sup>nd</sup>”, “Y=”. (Which is “Stat Plot”).
2. Go to Option 4, “Plots off” and hit enter.
3. Now try to graph.

“There are no X or Y axis on my screen!”

TO FIX:

1. Hit “2<sup>nd</sup>”, “Zoom”. (Which is “Format”).
2. Go down to the 4<sup>th</sup> option which is “Axes ON” and select it by pushing “ENTER”.

(When you are in the “Format” screen, everything on the left should be selected for a normal graph. These are RectGC, CoordOn, GridOff, AxesON, LabelOff, ExprOn.)

## How to draw your graph:

- You need to draw the x and y axes.
- Label! (You need your first tic mark labeled for scale and the last tic mark labeled.) The standard window goes from -10 to 10.
- Draw your graph. Make sure to put arrows on the end.
- Estimate your x-intercepts. Make sure to put in point form.
- Find your y-intercept. Make sure to put in point form.



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### *Objectives:*

- Input basic expressions into the calculator - including grouping symbols and powers.
- Graph a function on the calculator.
- Understand how to adjust the window settings to show a complete graph.

Can you?

# Homework:

## Assignment 8