

### Calculator Skills:

- Know the difference between the “negative” button (by the decimal point) and the “subtraction” button (above the plus sign). Know that your calculator automatically does order of operations, so if you need to group anything together, like numbers added on the top (numerator) or bottom (denominator) of a fraction, you use parentheses. Know how to use the MATH button to change a decimal to a fraction in lowest terms.

Example: Simplify  $\frac{-8.5-9.8}{4.7+5.6}$  using your calculator:

type in  $(-8.5 - 9.8) / (4.7 + 5.6)$  ENTER (get a decimal answer), MATH (so you can change to a fraction in lowest terms), ENTER, ENTER

\*\*the parentheses buttons are above the buttons for the numbers 7 & 8\*\*

$$\text{Answer} = \frac{-183}{103}$$

- Know how to use the “2<sup>nd</sup>” button to access the matching color operations above each button

Example: Find a 3 decimal approximation for  $\sqrt{13}$  : type 2<sup>nd</sup>, hit the  $x^2$  button, the number 13, close parenthesis, ENTER. **Answer** = 3.606

- Know that the “^” button, above the division symbol, is the generic exponent button.

Example: Raise the base of 4 to the exponent of 7: type in  $4 \wedge 7$ , ENTER. **Answer** = 16384

- Know how to find the cube root button on your calculator.

Example: Find a 3 decimal approximation for  $\sqrt[3]{16}$  : hit the MATH button, choose the cube root symbol, type in your number, close parentheses, hit ENTER. **Answer**: 2.520

- Know that your calculator uses “E” for scientific notation:

Example: type in  $50 \wedge 12$ . **Answer**: 2.44 E 20, which means =  $2.44 \times 10^{20}$  (often we will round the number in front to two or three decimals)

**Calculator Skills: Use your calculator to fill in a table and answer the questions in BOLD:**

SET UP: Hit  $2^{\text{nd}}$  + (to get to memory menu), choose Reset (you can either hit the number 7 in the TI-84 or scroll down to highlight 7 and hit enter), choose Defaults, and then choose Reset. You should see "Defaults set" on your screen. You will only need to do this once. The menu numbers given are for the TI-84, if you have a different model, just look for "reset" or "defaults" and choose accordingly.

Start by identifying an equation, and solving for your y-variable. **Example:  $y = -63x - 119$ .** Use this equation to answer the questions below.

- Hit "y=" button, CLEAR any old equations, and enter the above equation carefully. Use the button next to ALPHA (reads X,T,θ, n) for your variable. Remember the difference between negatives (-) and subtraction ( - ) on your calculator
- Hit  $2^{\text{nd}}$  WINDOW to get to TABLE SETUP
  - If your x-numbers follow a pattern, fill in the first x-number you want to see by TblStart, the amount your x's are changing by  $\Delta\text{Tbl}$  (so if counting in 10s, put 10 next to  $\Delta\text{Tbl}$ )
  - Highlight both AUTOs – highlight by placing your cursor on top of AUTO using the arrow buttons and then hitting ENTER.
  - Hit  $2^{\text{nd}}$  GRAPH to see your table filled in. You can use the up or down arrows to scroll to see more x's (and their matching y-values). Move your cursor over the y-values to see all the decimals, if any: your calculator will round to fit numbers in the column, but you see the actual answer by highlighting the y-value.)

**What is the ordered pair that has an x-value of 40? ANSWER: \_\_\_\_\_**

- If your x's did not follow an easy pattern, or you want to plug in specific numbers to your equation, go back to  $2^{\text{nd}}$  WINDOW (TblSet), and change Indpnt (stands for Independent, the x-variable) to ASK (highlight the first ASK). Leave Depend (y-variable) on AUTO so the y-values are automatically filled in for you.
  - Hit  $2^{\text{nd}}$  GRAPH – you may or may not see numbers in your table. If you see values for x, you can highlight each number and hit DEL to delete them individually. Go ahead and type in the first x-number you want to see, hit ENTER. Repeat as needed.

**What is the ordered pair that has an x-value of -62.5? ANSWER: \_\_\_\_\_**

- If the matching y-value is too large to fit in the column, or has been rounded, you can see more information by highlighting the y-coordinate. Note you have to have the highlighted part in the x-column to scroll or plug in additional numbers.

**What is the ordered pair that has an x-value of -99999, written using standard notation?**

**ANSWER: \_\_\_\_\_**

**What is the ordered pair that has an x-value of 6.1725, using exact values? ANSWER: \_\_\_\_\_**

**Calculator Skills 1:** Be able to graph a line\* and check the y-intercept

\* you can graph many types of equations, not just lines, on your calculator: put the equation in function form first by solving for y, enter the equation in your calculator, and follow the steps below:

- Start by putting your linear equation in slope-intercept form (solve for y, isolate the y variable)
- Hit “y=” button, CLEAR any old equations, and enter equation carefully.
  - Use the button next to ALPHA (says X,T,θ, n) for your variable.
  - Remember the difference between negatives (-) and subtraction ( - ) on your calculator
- Hit GRAPH to see the picture
- To change which part of the line you are looking at, you can change your viewing screen:
  - Start by hitting ZOOM 6: this will return you to the standard viewing window: 10 units away from the origin in every direction.
  - Hit WINDOW to see these numbers as xmin (smallest x you can see), xmax (largest x-value you can see), ymin (smallest y you can see), and ymax (largest y-value you can see). Xscl and Yscl (scales) are the size of your tick marks on the graph. Xres should be left at 1.
  - Change Mins and Maxes to see more of your line, use ZOOM 6 to reset and start over
- You can also use your ZOOM button to change which part of the line you are looking at:
  - If you pick 0: ZoomFit, then your calculator will keep the xmin and xmax numbers the same, but will pick different ymin and ymax for you.
  - If you pick 2: Zoom In, then you have to hit ENTER once you see the graph before your calculator will zoom in. You can hit ENTER again to zoom in again, but don’t hit ENTER too fast. If you see a string of dots in the top right corner that don’t stop, your calculator froze. Turn it off, then back on and start over.
  - Picking 3: Zoom Out is similar to picking Zoom In – you have to hit ENTER when you get to the graph screen, you can hit ENTER again to zoom again, but don’t hit ENTER too fast.
  - Zoom 5: Square will set your window so that the size of the x and y tick marks are the same. Play around with other options, and use Zoom 6: Standard to reset.
- To check your y-intercept, hit TRACE, type in 0 (the x-coordinate of the y-intercept) and hit ENTER. Your calculator will put the cursor on the y-intercept, and the coordinates of the y-intercept are at the bottom of the screen.
  - You can use this feature to check other points as well: hit TRACE, type in the x-coordinate, and your calculator will show you the point with that x-coordinate.

### Calculator Practice 1:

**Graph  $y = -15x + 25$**  on your calculator. You cannot see your y-intercept on the standard view screen. Change your window so you can see your y-intercept.

**Fill in the window settings you used:**

**and copy your graph screen:**

Xmin:

Xmax:

Ymin:

Ymax:

You should always check what you see on your calculator against what you know has to be true:

The slope of this line is \_\_\_\_\_, so the line should be \_\_\_\_\_ from left to right.

The y-intercept of this line as an ordered pair is \_\_\_\_\_, which you can verify in both the equation and on screen.

**Calculator Skills 2:** Given two different linear equations, find their point of intersection; solve an equation by looking at the two sides of an equation separately and finding the point of intersection.

- Start by putting your equations in slope-intercept form (solve for y, isolate the y variable)
- Hit “y=” button, CLEAR any old equations, and enter both equations carefully.
  - Use the button next to ALPHA (says X,T,θ, n) for your variable.
  - Remember the difference between negatives (-) and subtraction ( - ) on your calculator
- Hit GRAPH to see the picture
- If you cannot see the point of intersection, adjust your WINDOW
- Now you are ready to let your calculator calculate the point of intersection for you. Press 2<sup>nd</sup> TRACE to get to the CALCULATE menu. Pick option 5: intersect
- Answer your calculator questions carefully:
  - 1<sup>st</sup> Curve? Check that the equation in the top left corner looks good, then hit enter
  - 2<sup>nd</sup> Curve? Check that the equation in the top left corner looks good, then hit enter
  - Guess? Move your cursor using the left and right arrows close to the point of intersection, and then hit ENTER. When you see INTERSECTION at the bottom, then the coordinates of the point of intersection are given below.

\*\*sometimes your calculator can get really close but not exactly on the answer. This is happening if you see a string of zeros or nines. If you see a string of zeros or nines, round appropriately. Example: your calculator gives you the answer  $x = 1.000000002$ ,  $y = 7.99999996$ . You correctly round the answer to  $x = 1$ ,  $y = 8$

**Application for this method: Finding the x-intercept.** We know that all x-intercepts have a y-coordinate of zero. So if we want our calculator to find our x-intercept, we want to see where our equation intersects the x-axis, or the line  $y = 0$ .

Example:  $y = 8x - 1$ , find the x-intercept. In your calculator, enter  $y1 = 8x - 1$ , AND enter  $y2 = 0$

The x-intercept will be the point of intersection.

**What is the x-intercept?** \_\_\_\_\_

**Check your answer by solving for the x-intercept by hand. Show your work:**

#### **Calculator Skills (optional):** Graphing an inequality

- Once you have rearranged your inequality so that the dependent variable is isolated (solved for  $y$ ), enter the rule like you would enter an equation under the “ $y=$ ” button.
- Hit GRAPH so you can see the border line of your inequality graph. Adjust WINDOW if need be. Note at this point, you are looking at the graph of a line, not an inequality.
- While you must know if the border line is solid (equal sign included with the inequality), or dotted (strict inequality), your calculator can shade for you:
  - If your inequality simplified to  $y >$  or  $y \geq$ , then you must shade above your border line: on your calculator, after hitting “ $y=$ ”, move your cursor to the left of  $y1$ . Then hit ENTER repeatedly until you see an up-triangle (  $\blacktriangle$  ). Now hit GRAPH.
  - If your inequality simplified to  $y <$  or  $y \leq$ , then you must shade below your border line: on your calculator, after hitting “ $y=$ ”, move your cursor to the left of  $y1$ . Then hit ENTER repeatedly until you see a down-triangle (  $\blacktriangledown$  ). Now hit GRAPH.

### Calculator Skills:

- Graph polynomials of different degrees (review of graphing skills)
- Evaluate a polynomial (review of number skills)
- Factor by finding the x-intercepts on the graph:
  - Start by placing your equation in standard form, so that zero is one side (or if you are working with an expression, imagine you had such an equation)
  - Enter the left side of your equation as y1, the right side of your equation as y2. One of these should be  $y = 0$
  - Find the point(s) of intersection. If there is more than one point of intersection, then you will need to start at the CALCULATE menu for each one. Make sure to move your cursor carefully when your calculator asks for a guess.
  - Use the x-coordinates of your x-intercepts to factor your equation: each x-intercept corresponds to a factor of the form  $(x - \text{x-intercept})$ . Be careful with your signs.

### Calculator Skills:

- Know how to enter exponents using the parentheses and exponent (^) button.  
Example:  $(-4)^2 = 16$
- Know how to evaluate radicals on your calculator by first rewriting with fractional exponents, then by using the parentheses and exponent (^) button. Example:  $\sqrt[5]{32} = 32^{1/5} = 32^{(1/5)} = 2$
- Approximate radicals to a specific decimal place using the calculator. Example: approximate the following to the thousandth position:  $\sqrt[3]{135} = 2.015$

### Calculator Skills:

- Graph a quadratic function:
  - Put your equation in function form: isolate your y-variable
  - Hit "y=" button and enter your equation
  - Hit GRAPH, adjust the WINDOW if you need to (the graph of a quadratic function is a parabola, a u-shaped curve: make sure you can see the vertex)
- Find the vertex of a quadratic function:
  - Graph the quadratic function
  - Hit 2<sup>nd</sup> TRACE to get to your CALCULATE menu.
    - If your vertex is a minimum (the parabola opens upward), pick 3:minimum
    - If your vertex is a maximum (the parabola opens downward), pick 4:maximum
  - Answer the questions carefully:
    - Left Bound? Move the cursor to the left of the vertex and hit ENTER
    - Right Bound? Move the cursor to the right of the vertex and hit ENTER  
\*\* you should see two arrows pointing towards your vertex, if not, start over!\*\*
    - Guess? Move cursor near the vertex and hit ENTER

\*\* when you see the word MINIMUM or MAXIMUM at the bottom of the screen, the vertex is below. Remember, if you see a string of zeros or nines, you should round the answer\*\*
- Try graphing some of the examples in 8.1 and using your calculator to find the given vertex.

### Calculator Skills:

- Your calculator can work with complex numbers, just like it can work with real numbers. To allow your calculator to work with complex numbers, you need to change the MODE. Hit the MODE button, and change “Real” to “a + bi” by moving your cursor on top of “a + bi” and hitting ENTER. The “i” on the calculator is above the decimal point – remember to hit the 2<sup>nd</sup> button first. Type in  $i^2$ , hit ENTER.  
(answer = -1)
- You can get your calculator programmed to use the quadratic formula (ask a tutor in the Studio). BE CAREFUL! While this is a nice option, it will only give you estimations if your answer is irrational. If you are asked for an exact answer, you must proceed by hand (you could try on your calculator first, but if you see long decimal answers, then go back and redo by hand).