

# Pre-Calculus

## Unit 1 Toolkit

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Period: \_\_\_\_\_

This toolkit is a summary of some of the key topics you will need to master in this unit.

### 1A: Basic Graphs and Regression

#### Regression with Desmos

1. Make a table and enter data
2. Use the statistics approximation function  $\sim$  to type the general regression forms (don't forget the subscript "1" after the variables):

Linear:  $y_1 \sim mx_1 + b$

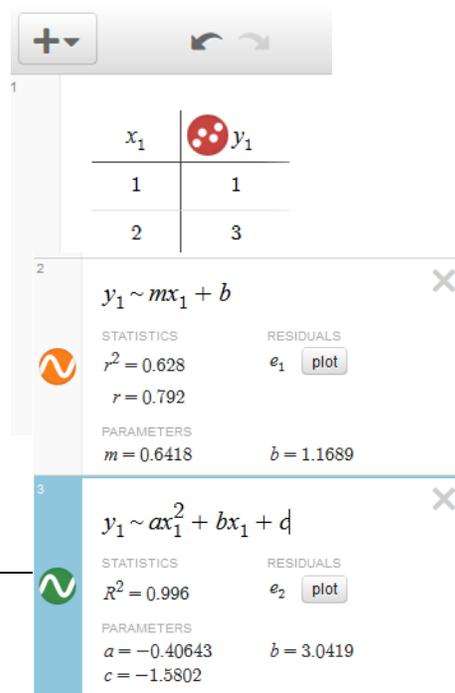
Quadratic:  $y_1 \sim ax_1^2 + bx_1 + c$

3. To extrapolate another value using this function, write the function with a number in place of  $x$ . If  $x = 25$ , type

Linear:  $m(25) + b$

Quadratic:  $a(25)^2 + b(25) + c$

Then compute a specific value like  $f(25)$



#### Steps for finding a regression equation on a TI-8x calculator:

##### **Enter Data:**

1. Go to and select to go to EDIT.
2. Enter the x-values into  $L_1$  and enter the y-values into  $L_2$ .

##### **Creating a scatterplot:**

3. Now we need to graph these values in a scatterplot with the following steps.
4. Press to get the STAT PLOT menu.
5. Choose option to get Plot 1
6. Select [On] to turn the plot on.
7. Choose the scatterplot option.
8. Since we used the lists  $L_1$  and  $L_2$ , we do not need to change the Xlist or Ylist. If we did use a different list, we would need to change these.
9. To view the graph, hit the button and choose ZoomStat which is option 9.

##### **Finding a regression equation:**

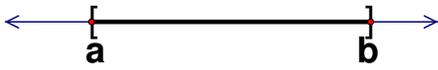
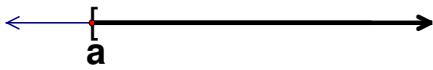
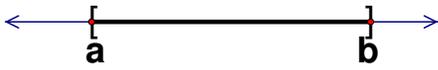
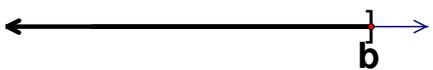
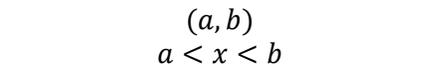
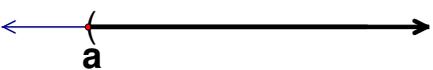
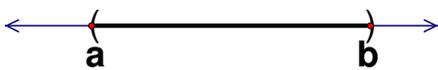
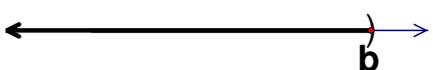
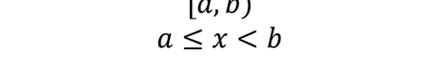
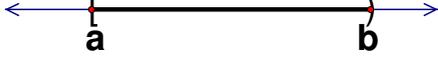
10. Now if we want find a linear regression, press and choose CALC.
11. Choose the type of regression you want. For now, we will use LinReg and QuadReg for linear and quadratic regression.
12. This will send you back to the homescreen. You now just need to hit enter to get your equation.
13. (optional) If you want to store the equation in the equation editor, do this before pressing enter: Type a left-parenthesis, go to [Vars]→[Y-Vars] and select [Y1], type a right -parenthesis, then hit enter. Hit the button to see your equation stored.

## 1B: Domain, Range, and Number Sets

### Interval Summary

Intervals can be classified in several ways. First, intervals involving infinity are “unbounded”, while intervals with two finite endpoints are called “bounded”. Secondly, if the finite endpoint(s) are included in the interval (shown by a hard-bracket or an *or equals to*), then the interval is “closed”. Otherwise, the interval is “open”.

The following is a table that summarizes the possible types of intervals shown in interval notation, as an inequality, and as a graph.

	Bounded Interval	Unbounded Interval	
Closed	$[a, b]$ $a \leq x \leq b$ 	$[a, \infty)$ $x \geq a$ 	
		$(-\infty, b]$ $x \leq b$ 	
Open	$(a, b)$ $a < x < b$ 	$(a, \infty)$ $x > a$ 	
		$(-\infty, b)$ $x < b$ 	
Half-Open	$[a, b)$ $a \leq x < b$ 	N/A	N/A
	$(a, b]$ $a < x \leq b$ 		

### Domain/Range

**Domain:** the set of all allowable  $x$ -values for a function.

**Range:** the set of all possible  $y$ -values for a function.

**Remember...** The denominator of a rational function (like  $f(x) = \frac{1}{x+7}$ ) must be non-zero, and the value inside a radical portion of a radical function (like  $f(x) = \sqrt{x+7}$ ) must be greater than or equal to zero.

## 1C: Piecewise Defined Functions

Steps for graphing piecewise functions:

For each piece of the piece-wise function, do the following...

1. Plot a point(s) for the value of the function at its boundary point(s)
  - a. Use a **closed point** if the value is included in the domain ( $\leq$  or  $\geq$ ),
  - b. Use an **open point** if the value is not included in the domain ( $<$  or  $>$ ).
2. Decide if the piece-function is to the left or right of the boundary point, or between both boundary points.
3. Plot the piece-function in this region.

## 1D: Rates of Change and Graph Behavior

Types of Extrema:

- **Local maximum** and **local minimum**: If the point is higher or lower than the *nearby points*
- **Global maximum** and **global minimum**: if the point is higher or lower than *all points* in the graph
- **Point of Inflection**: where a graph changes from concave up to concave down or vice-versa.

Interval Behavior: (*Always read a graph going left to right to determine these!*)

- If the values of graph are going up as we move left to right on a graph, then the graph is **increasing** on the interval.
- If the values of a graph are going down as we move left to right on a graph, then the graph is **decreasing** on the interval.
- **Concave up**: a cup shaped part of a graph that is opening upward (rate of change is increasing).
- **Concave down**: a cup shaped interval on a graph that is opening downward (rate of change is decreasing).

Average Rate of change formula: The *average rate of change* of a function  $f(x)$  on the interval  $[a, b]$  is

$$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{f(b) - f(a)}{b - a}$$

(*Basically, the rate of change is the slope of the secant line that connects two points on the graph of  $f(x)$ .*)