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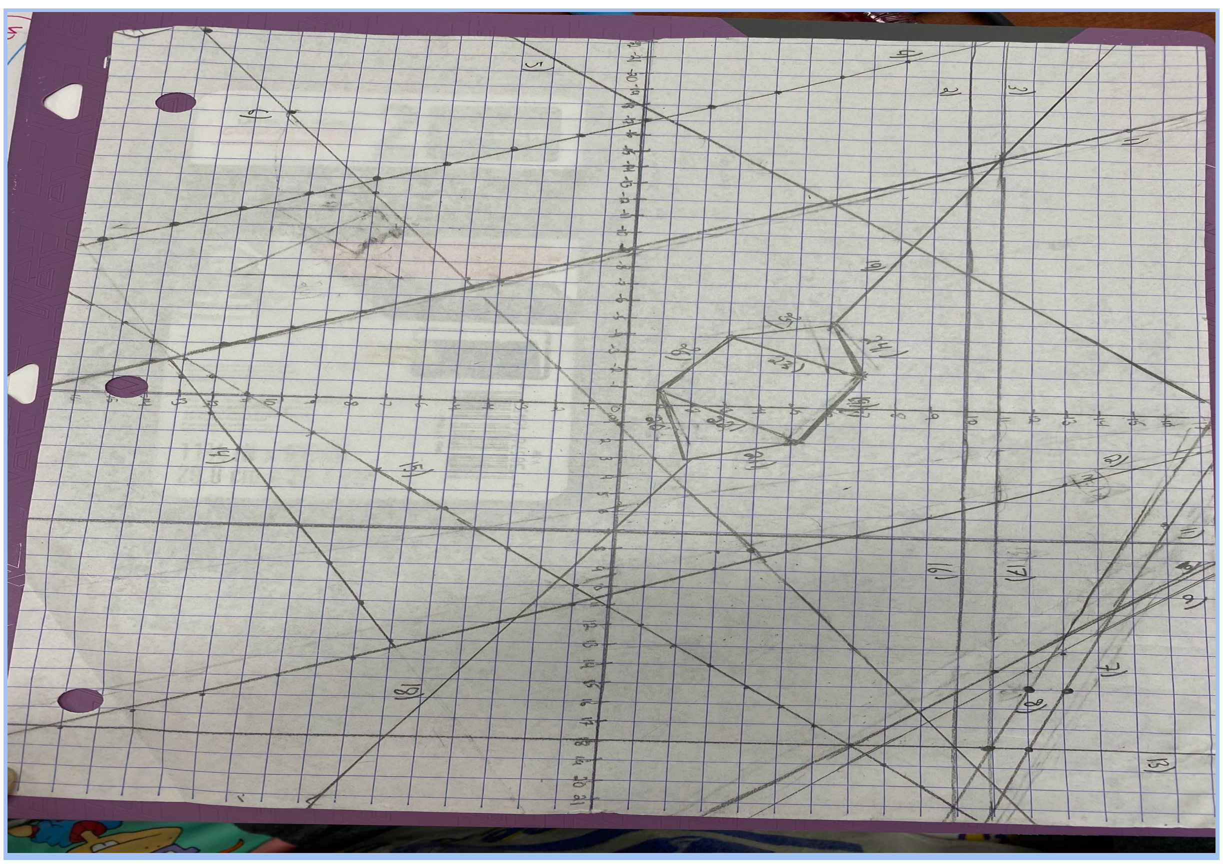
Teacher's Name: Ms. Gasser

Algebra 1, C Band

Algebra 1, Quarter 2 Benchmark: Make Your Own Design!

<u>Introduction</u>: This is our Algebra 1, Quarter 2 Benchmark. In this project, we hope to demonstrate our knowledge of Slope-intercepts form, Point-slope form, Horizontal Lines, and Vertical lines. We also hope to showcase our understanding of Range, and Domain. We didn't really have any inspiration for our line drawing. It just came from our imagination. Personally (Madison speaking) I have always liked the look of straight lines really in no particular order, or pattern. Obviously, we had requirements we had to follow, but other than that, it all was kind of a chance. We hope that you may learn something new with this project, and have a fun time reading.



1. Slope-intercept form

The equation for slope-intercept is **y=mx+b**. In this paragraph, we are going to explain exactly what that means. A more simple approach to finding the slope (m) of a line is rise over run. To complete this task, first, you need to find two coordinates on the line, the closer together they are, the better. The rise would count for the numerator, while the run would count for the denominator. After you have found two coordinates, count how much the 1st point has increased or decreased (rise) from the 2nd point. This number will count as the numerator of our slope. Next, will be how much the 1st point has gone left or right (run) from the 2nd point. This number will count for the denominator. How you know if your line is increasing, or decreasing is defined by positive and negative numbers. Positive and negative numbers also define which direction your line is going. The y-intercept (b) is just where the line goes through/meets the y-axis. This is also your starting point for graphing.

NOTE: You always read the graph left-right.

TIP: The rise always goes on, so it's easier to always count the rise first.

Now that we understand what **y=mx+b** means, let’s learn how to graph this equation. First, as I said in the paragraph above, you have to find the y-intercept (b). This will allow you to know where to start counting to find the slope when graphing your line. After you have found the y-intercept, start going through the steps to complete the rise-over-run, as previously stated. Once you find the slope of the line you can, and should, plot each point on the line. Doing this will make it easier to draw the line, and see if you need to simplify. Simplification is very important when it comes to the slope. It's why you should try to pick the two closest coordinates, to make it easier on yourself. Though it is strongly suggested, it is not mandatory, meaning it will not change our final answer. Once you have completed all of the following steps, you just have to draw the line.

NOTE: Unless you have range and domain, the lines will go on forever. You can signify this by drawing arrows at each end of the line.

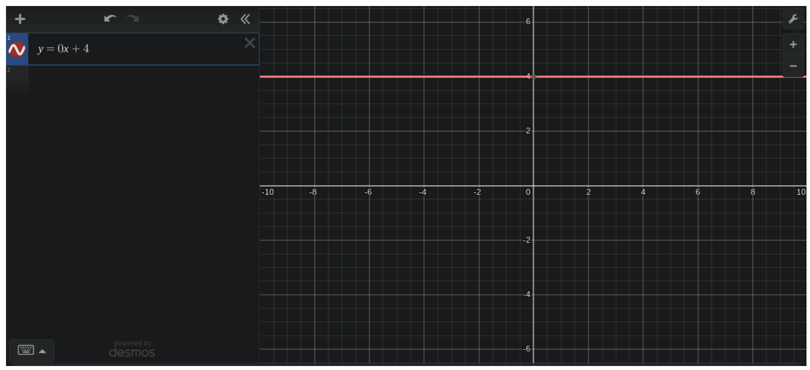
2. **Point-slope form**

The equation for Point-slope form is very similar to **y=mx+b**, it's **$y=m(x-x_1)+y_1$.** When given a line on the graph, you must find 2 coordinates on the line. Like slope-intercept form, you can count the slope (rise over run) or you could use the equation **y_2-y_1/x_2-x_1** if you are only given two coordinates. After you have found two coordinates, I suggest that you label them: **x1,y1,x2,y2**. So if the coordinates were **(3,9)(2,8)** (3=x1, 9=y1, 2=x2, 8=y2) and let's say the slope was ½. You label them, so now all you have to do is plug in the numbers. For example: **y=1/2(x-3)+9.** Now the reason you would use point-slope form, instead of slope-intercept form, is because for slope-intercept form you have to know the y-intercept. For this one, you don't.

Now if you wanted to graph this equation, I would personally simplify using our multi-step equation knowledge, and convert it into y-intercept form. To do that you would distribute ½ to both x and 3. That becomes **y=1/2x-½+9**, which simplifies to **y=1/2x+8.5**, and is now in y-intercept form. Then you can continue from there.

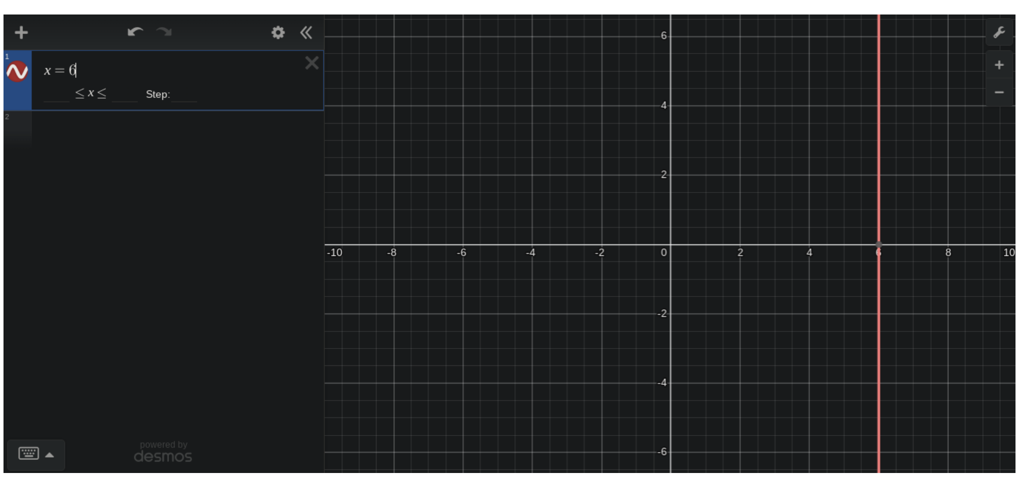
Horizontal lines

A horizontal line is when a line travels from left and right. When given the job to find the equation of a horizontal line you must remember the slope is always zero. A horizontal line has a slope of only zero, nothing more or less. To graph a horizontal line you just have to find the y-intercept. The y-intercept is the number a line passes through when traveling through the y-axis. If the horizontal line has the equation **y=0x+4**, which simplifies to **y=4**, all you have to do is find +4 on the y-axis. The line will stay horizontal going across the page passing through positive 4.



3. **Vertical lines**

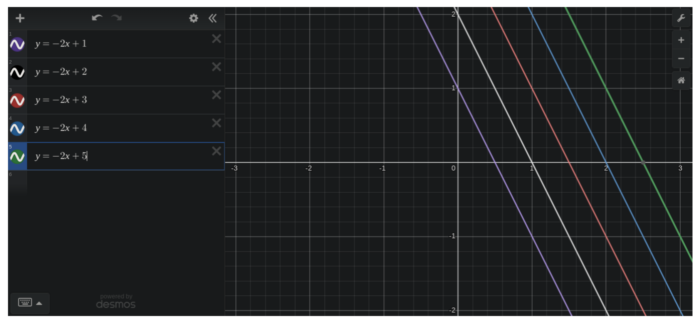
Vertical lines are lines that travel up and down. When trying to find the equation of a vertical line, you must remember the slope is undefined. This means that when writing the equation for a vertical line, it's going to just be **x=*insert* #**. Since there isn't any definite slope, it gets listed as undefined. A vertical line can only be addressed by the number on the x-axis that the line passes through. Like horizontal lines, there isn't much work to graphing these lines. For example, if the equation was **x=6**, you would find +6 on



the x-axis and draw a vertical line. This picture shows that the line is vertical and passes through positive 6 on the x-axis.

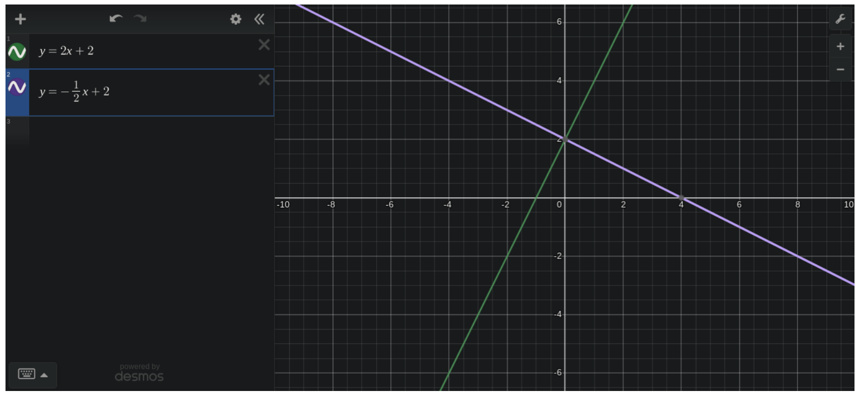
4. **Parallel lines**

Parallel lines are lines that travel at the same rate without ever touching one another. To be parallel, they also have to have the same slope. When comparing two, or more parallel lines, you will see that the slopes never change, but their location on the graph does. This is because the y-intercept can be changed to whatever you want. For example, in the picture above you can see the equation is **y=-2x+ 1.** As you go down the list of equations on the left, you will notice that the y-intercept changes. This is because if the slope of the line isn't changed, even if the y-intercepts are, the lines are considered parallel.



5. **Perpendicular lines**

Perpendicular lines are lines that intersect with one another at a 90-degree angle. When you look at a perpendicular line structure you can see a pattern. Out of the two intersecting lines below, you can see that one equation has a flipped slope and both lines have the same y-intercept. This "flipped" slope is called the opposite reciprocal. This means that the sign changes (+, or -) and the slope is flipped. While the y-intercept doesn't affect the identity of the lines, it will change the location. This doesn't matter as long as the two lines intersect at a 90-degree angle. What we'll be focusing more on is the slope. Whenever there are perpendicular lines, one line's slope is flipped within its equation. The "flipped slope law" is what makes a perpendicular line perpendicular. When graphing perpendicular lines one line's slope must be flipped. A slope of positive 2 must become negative ½. A slope of negative ¼ must become positive 4.



Next, we will talk about how all this information relates to the drawing that was introduced earlier.

Task #4 - Equations

Point of Line:	Slope:	Equation:	Type of Line:
1. (-3,-12)(-5,-8)	-2	$y=-2(x+3)+12$	Decreasing
2. (-8,10)(-7,10)	-2	$y=10$	Horizontal
3. (-17,11)(-18,11)	0	$y=11$	Horizontal
4. (-16,-2)(-15,-4)	0	$y=-2(x+16)+2$	Decreasing
5. (-2,16)(-4,14)	1	$y=1(x+2)-16$	Increasing
6. (-17,11)(-7,4)	$-7/10$	$y=-7/10(x+17)-11$	Increasing
7. (15,13)(18,12)	$-1/3$	$y=-1/3(x-6)+16$	Decreasing
8. (15,12)(18,11)	$-1/3$	$y=-1/3(x-15)+12$	Decreasing
9. (13,13)(14,12)	-1	$y=-1(x-13)+13$	Decreasing
10. (13,12)(14,11)	-1	$y=-1(x-13)+12$	Decreasing
11. (7,11)(7,12)	0	$x=7$	Vertical
12. (5,11)(7,7)	-2	$y=-2(x-5)+11$	Decreasing
13. (18,11)(18,12)	N/A	$x=18$	Vertical
14. (3,-11)(7,-9)	$1/2$	$y=1/2(x-3)+(-11)$	Increasing
15. (11,0)(12,1)	1	$y=1x+11$	Increasing
~~16. (4,10)(5,10)~~	same as 2&3		
~~17. (4,11)(4,11)~~			
18. (5,1)(3,2)	$1/2$	$y=1/2(x-5)+1$	Decreasing
19. (-13,10)(-9,8)	$-1/2$	$y=-1/2(x-(-13))+10$	Decreasing

Task #4 - Equations of Lines

Line 7 - (15,13) and (18,12) * Decreasing

$m = \frac{12-13}{18-15} = \frac{-1}{3}$

$m = \frac{-1}{3}$

$y = \frac{-1}{3}(x-6) + 16$

Line 8 - (15,12) and (18,11)

$m = \frac{11-12}{18-15} = \frac{-1}{3}$ * Decreasing

$y = \frac{-1}{3}(x-15) + 12$

Line 9 - (13,13) and (14,12)

$m = \frac{12-13}{14-13} = \frac{-1}{1}$ * Decreasing

$m = -1$

$y = -1(x-13) + 13$

Line 10 - (13,12) and (14,11)

$m = \frac{11-12}{14-13} = \frac{-1}{1}$ * Decreasing

$m = -1$

$y = -1(x-13) + 12$

Line 11 - 7 * Vertical

m = undefined

$m = 0$

$x = 7$

Line 22 - (-1,1) and (2,5)

$m = \frac{5-1}{2-(-1)} = \frac{4}{3}$ * Increasing

$m = \frac{4}{3}$

$y = \frac{4}{3}(x-(-1)) + 5$

Range $= \{1 < y < 5\}$

Line 23 - (-4,3) and (-2,7)

$m = \frac{7-3}{-2-(-4)} = \frac{4}{2}$ * Increasing

$m = 2$

$y = 2(x-(-4)) + 3$

Domain $= \{-9 < x < 7\}$

Line 24 - (-5,6) and (-2,7)

$m = \frac{7-6}{-2-(-5)} = \frac{1}{3}$ * Increasing

$m = \frac{1}{3}$

$y = \frac{1}{3}(x-(-5)) + 6$

Domain $= \{-5 < x < 7\}$

Line 25 - (-5,6) and (-9,3)

$m = \frac{3-6}{-9-(-5)} = \frac{-3}{-4}$ * Increasing

$m = \frac{3}{4}$

$y = \frac{3}{4}(x-(-5)) + 6$

Range $= \{3 < y < 6\}$

Line 26 - (-9,3) and (-1,1)

$m = \frac{1-3}{-1-(-9)} = \frac{-2}{8}$ * Decreasing

$m = \frac{-1}{4}$

$m = \frac{-1}{4}(x-(-9)) + 3$

Domain $= \{-9 < x < -1\}$

Line 12 - (5,11) and (7,7) *Decreasing

$m = \frac{7-11}{7-5} = \frac{-4}{2}$

$m = -2$

$y = -2(x-5)+11$

Line 13 - 18 * Vertical

m = undefined

$x = 18$

Line 14 - (3,-11) and (7,-9) * Increasing

$m = \frac{-9-(-11)}{7-3} = \frac{2}{4}$

$m = \frac{1}{2}$ Domain = $\{-2 < x < 13\}$

$y = \frac{1}{2}(x-3)+(-11)$

Line 15 - (11, 0) and (12,1) * Increasing

$m = \frac{1-0}{12-11} = \frac{1}{1}$

$m = 1$

$y = 1x + 11$

Line 16 - 10 * Horizontal

$m = 0$

$y = 10$

*PS line 16 and 17 are the same line as 2 and 3.

Line 17 - 11

$m = 0$

$y = 11$ *Horizontal

Line 18 - (5,1) and (3,2)

$m = \frac{2-1}{3-5} = \frac{1}{-2}$ * Increasing

$m = \frac{1}{2}$

$y = \frac{1}{2}(x-5)+1$

Domain = $\{3 < x < 21\}$

Line 19 - (-13,10) and (-9,8)

$m = \frac{8-10}{-9-(-13)} = \frac{-2}{4}$ * Decreasing

$m = \frac{-1}{2}$

$y = \frac{-1}{2}(x-(-13))+10$

Domain = $\{-21 < x < -5\}$

Line 20 - (-1,1) and (3,2)

$m = \frac{2-1}{3-(-1)} = \frac{1}{4}$ *Increasing

$m = \frac{1}{4}$ Domain = $\{-1 \leq x < 3\}$

$y = \frac{1}{4}(x-(-1))+1$

Line 21 - (2,5) and (3,2)

$m = \frac{2-5}{3-2} = \frac{-3}{1}$ * Decreasing

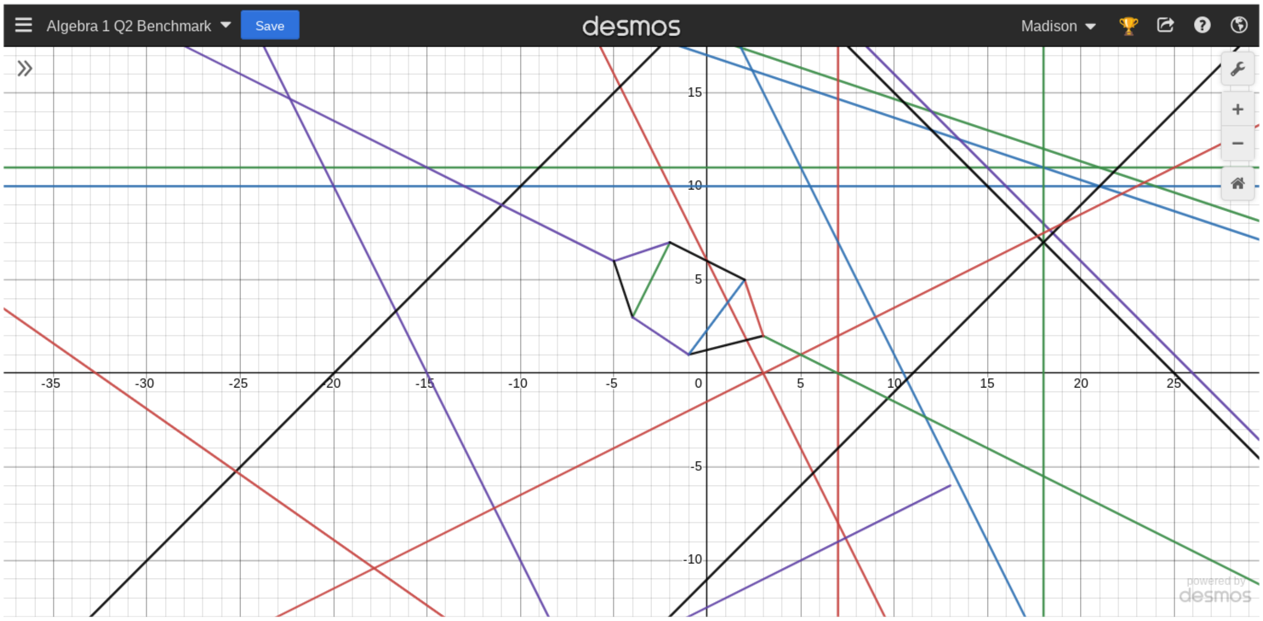
$m = -3$

$y = -3(x-2)+5$

Range = $\{2 < y < 5\}$

See next page

Now that you have the equations to our design, We're going to show you a picture of our artwork on Desmos Graph below.



Reflection

We believe our process was done in the best of our interest. We completed the project according to plan and on time. We also utilized every aspect of the project to our advantage. Communication and Scheduling became the learning core of this benchmark. While other benchmarks may have implemented these skills, this benchmark has taught us to use these skills even more. I learned that lines can be super complex, but also really simple at the same time. I deepened my understanding of slope, and grasped an idea of domain and range.

We mastered our ability to work in a group. We practiced communicating what we needed, what we felt like we could handle. By using our knowledge of point-slope form, and y-intercept form, we grew to be more comfortable calculating slope. We practiced dividing our time up evenly with the amount of work that we had personally. Overall, we learned that not all groups are the same, and some can be really beneficial. We had a really great time collaborating for this project.