Section 2.2a – Linear Equations

This booklet belongs to:______________________________Block: ______

Linear Equations

- A linear equation in Standard Form is an equation of the form $Ax + By = C$, where A, B, and C are constants and x and y are variables. All linear equations are functions except a vertical line.
- Another form is Slope-Intercept Form $y = mx + b$, where m is the slope and b is the y-intercept

Solutions to a Line

- Next is **figuring out if a point is on a line**. That is the same as saying: Is the **following point a solution** to the **equation of the line**.

  ✓ If the **point is a solution**, then when you plug the (x, y) into the given equation, it will **stay equal**, and the **point is on the line**

  ✓ If the **point is not a solution**, then when you plug the (x, y) into the given equation, it will **not stay equal**, and the **point is not** on the line

Example 1: Does the line $y = 2x + 5$ go through the point (1,8)?

Solution 1:

- Since $\boldsymbol{x}$ **is 1**, we **plug 1** in **for** $\boldsymbol{x}$ and since $\boldsymbol{y}$ **is 8**, we plug **8 in for** $\boldsymbol{y}$.
- Work through the equation and see if it stays equal.
- If **it does**, it's **a solution** (A point on the line)
- If **it doesn't**, it's **not a solution** (Not a point on the line)

$$y = 2x + 5$$

$$8 = 2(1) + 5$$

$$8 = 2 + 5$$

$$8 = 7$$

- 8 DOES NOT EQUAL 7

So that means that $(1, 8)$ is **NOT a solution** to $y = 2x + 5$

In other words, the point at $(1, 8)$ is **not on the line** with the equation $y = 2x + 5$

Example 2:

- Does the line $y = -\frac{2}{5}x + 6$ go through the point $(10, 2)$?

Solution 2:

Plug 2 in for y Plug 10 in for x

$$y = -\frac{2}{5}(10) + 6 \quad \rightarrow \quad 2 = -\frac{2}{5}(10) + 6$$

$$2 = -\frac{20}{5} + 6 \quad \rightarrow \quad 2 = -4 + 6 \quad \rightarrow \quad 2 = 2$$

$(10, 2)$ is a solution to the equation $y = -\frac{2}{5}x + 6$

Graphing Linear Equations in Slope-Intercept Form: $\boldsymbol{y = mx + b}$

1. Identify the $y - intercept$, plot that point.
2. Identify the Slope in the given equation and trace it to your next point, plot that
3. Repeat step #2
4. Connect the points to create your line.

$$\boldsymbol{m = Slope = \frac{Rise}{Run}} \qquad \boldsymbol{b = y}\textbf{-intercept}$$

OR

1. Select three values of x that are multiples of the denominator of the slope.
2. Solve for y in each case.
3. Plot three points from steps 1 and 2. Draw a straight line through the points

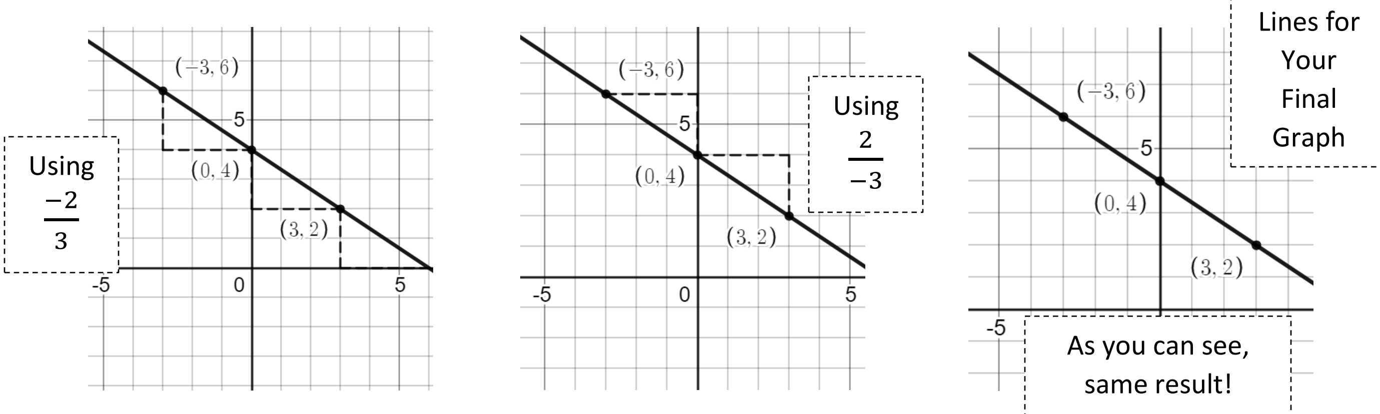
This step is more cumbersome given the Slope-Intercept Equation

Example 3: Graph $y = -\frac{2}{3}x + 4$ (Slope is the constant in front of the x)

Solution 3: This is why we love Slope-Intercept Form: Identify the y-intercept: $+\boldsymbol{4}$

Plot it.

Draw your slope using $\frac{rise}{run}$: Either $\boldsymbol{\frac{-2}{3}}$ or $\boldsymbol{\frac{2}{-3}}$ You'll end up with the same results!



Graphing Linear Equations in Standard Form: $\boldsymbol{Ax + By = C}$

1. To find the $\boldsymbol{y - intercept}$ (where the line crosses the $y - axis$), set $x = 0$ and solve for y.
   To find the $\boldsymbol{x - intercept}$ (where the line crosses the x-axis), set y = 0 and solve for x.
2. To get a third point, pick another value for x, and solve for y.
3. Plot the three points from steps 1 and 2 and draw a straight line through the points.

Example 4: Graph $3x + 2y = 6$

Solution 4: Three points picked: Solve for three missing values

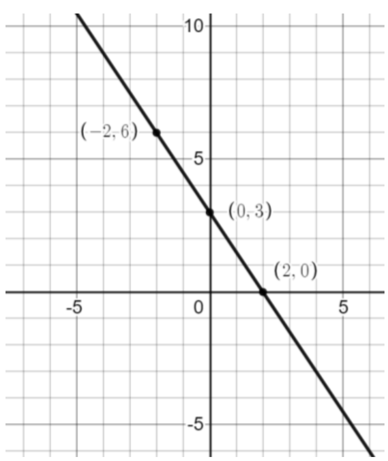
x	y
0	
	0
-2	

$3x + 2y = 6$	$3x + 2y = 6$	$3x + 2y = 6$
$3(0) + 2y = 6$	$3x + 2(0) = 6$	$3(-2) + 2y = 6$
$y = 3$	$x = 2$	$y = 6$

Therefore, the ordered pairs are:

x	y
0	3
2	0
-2	6

Plot these three points: $(0, 3), (2, 0), (-2, 6)$, and draw a straight line through the three points. **Extend the line in both directions.**



Summary of Ordered Pair $(\boldsymbol{x}, \boldsymbol{y})$

x	y
Domain	Range
Input	Output
Independent Variable	Dependent Variable

Example 5: Graph the following function: $3x - 4y = 6$

Solution 5:

- In this scenario we can use both of our equation to ensure we do not have to estimate points
- First let's see what the x-intercept and y-intercept are using our Standard Form Table of Values

x	y
0	$-\frac{3}{2}$
2	0

For the y-intercept

$$3x - 4y = 6$$
$$3(0) - 4y = 6$$
$$-4y = 6$$
$$y = -\frac{6}{4}$$
$$y = -\frac{3}{2}$$

For the x-intercept

$$3x - 4y = 6$$
$$3x - 4(0) = 6$$
$$3x = 6$$
$$x = 2$$

- As we can see, the x-intercept is an exact whole number, but the y-intercept would be an estimation
- Let's use our algebra to manipulate the equation from Standard Form to Slope-Intercept Form
- This way we will have an exact point and the we can simply map the slope from there.

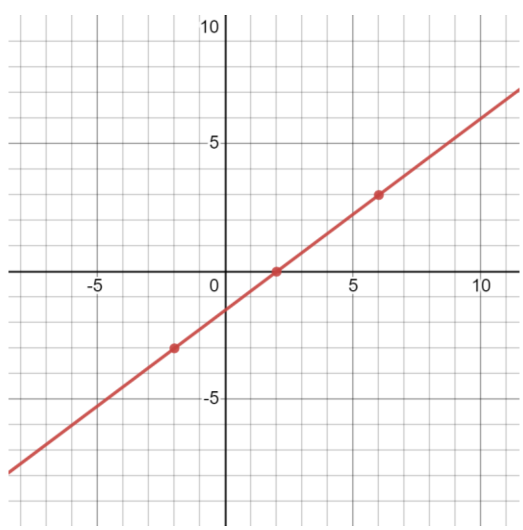
Algebra produces a Slope of: $\frac{3}{4}$

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

Now we have:

x-intercept: $(2, 0)$

slope: $\frac{3}{4}$



Using a combination of equations helps us find 'perfect' points and then using the slope to map the line.

Section 2.2a – Practice Questions

EMERGING LEVEL QUESTIONS

Determine whether the given ordered pair is a solution to the equation (a point on the line).

1. $(2,3)$; $3x - 5y = -9$

2. $(0,4)$; $y = -\frac{1}{3}x + 4$

3. $(1,-1)$; $3y = 5 - 2x$

4. $(6,8)$; $\frac{1}{3}x - \frac{1}{4}y = 4$

5. $(4,2)$; $x = 4$

6. $(-1,3)$; $y = -1$

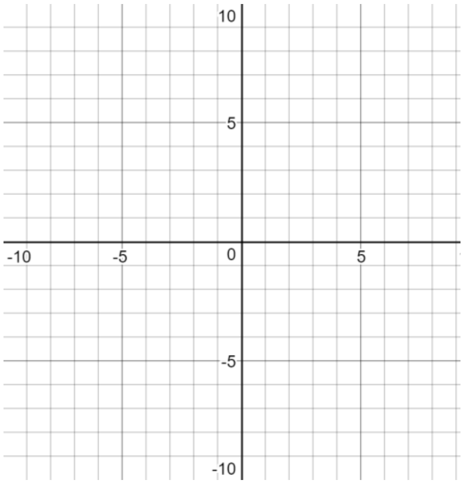
7. $(4,-3)$; $0.05x - 1.2y = 3.8$

8. $\left(\frac{2}{3}, -\frac{3}{4}\right)$; $60x - 36y = 13$

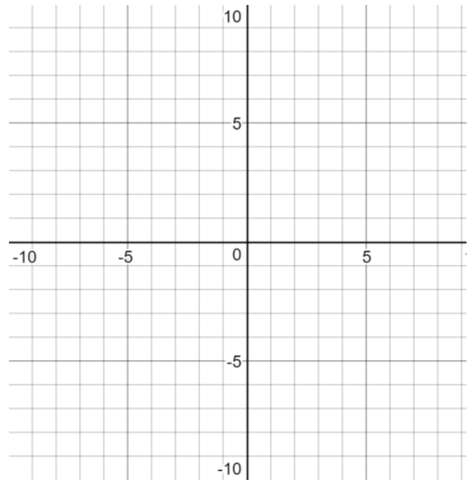
PROFICIENT LEVEL QUESTIONS

Graph the following Linear Equations

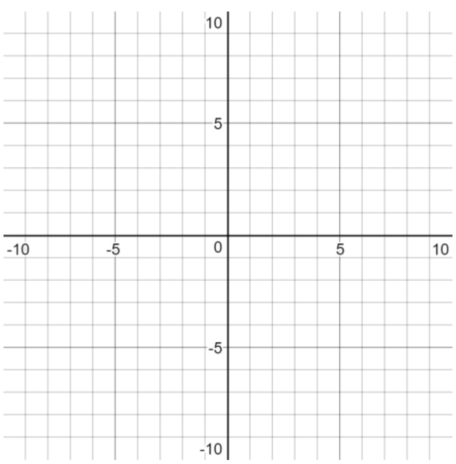
9. $2x + 3y = 6$



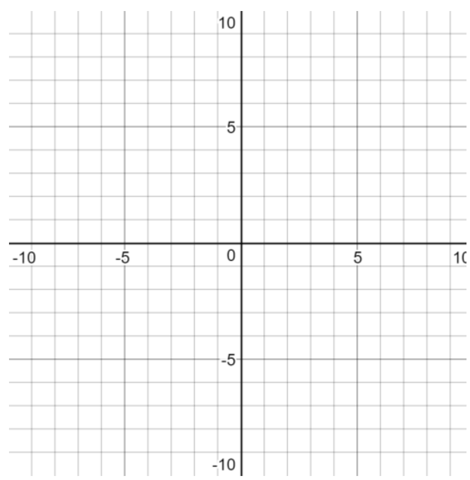
10. $2x + y = -4$



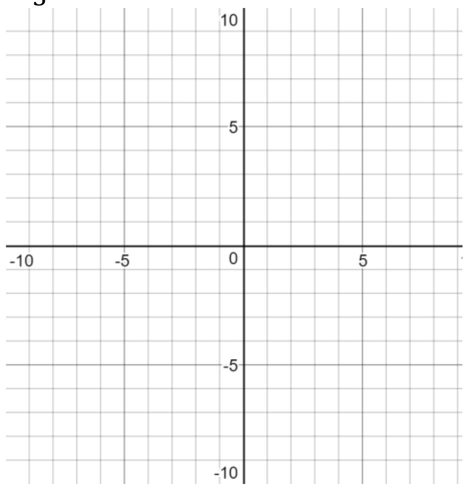
11. $2x - \frac{1}{2}y = 2$



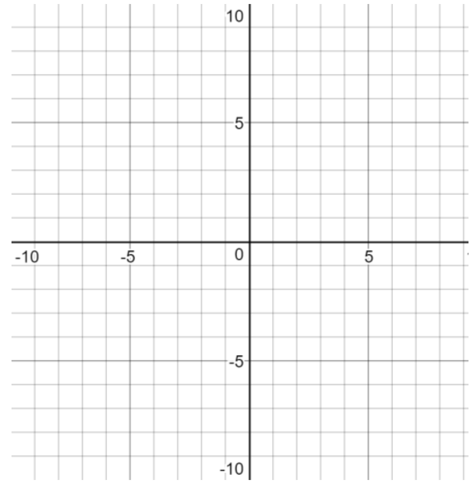
12. $3x + 2y = 5$



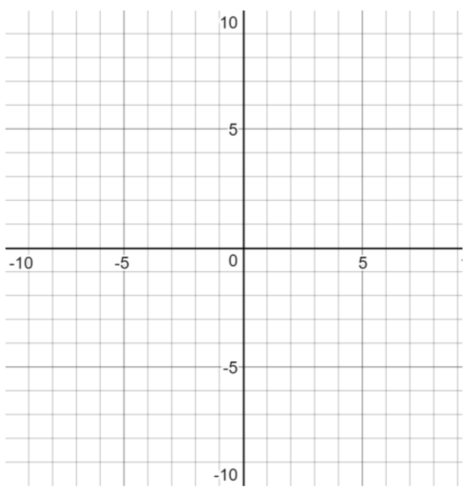
13. $\frac{2}{3}x - 0.4y = 2$



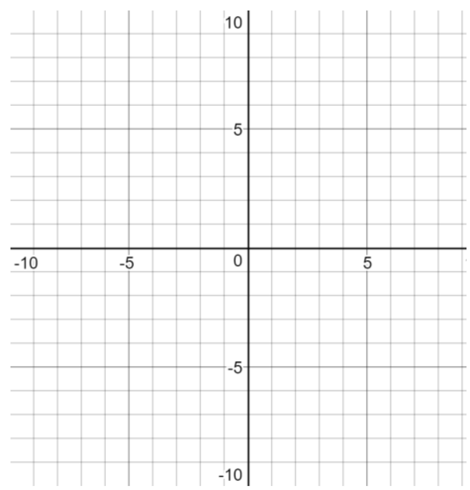
14. $y = -2x - 1$



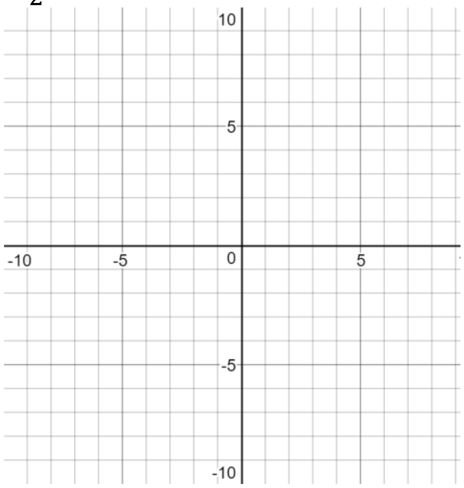
15. $y = -\frac{3}{4}x + 1$



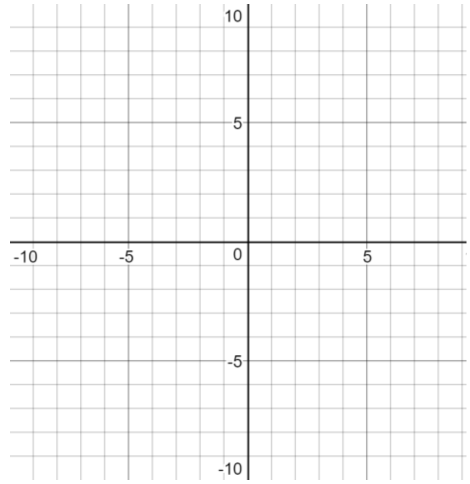
16. $y = \frac{2}{3}x - 2$



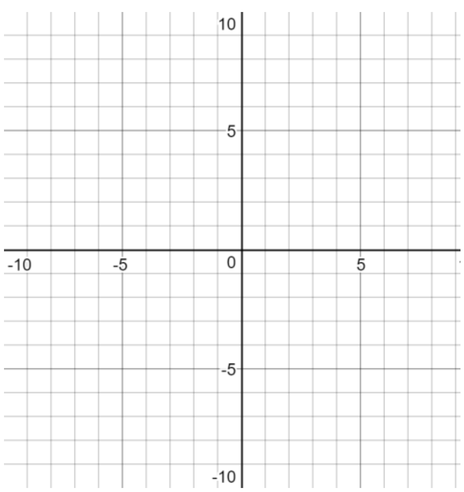
17. $\frac{1}{2}x + 0.6y = 3$



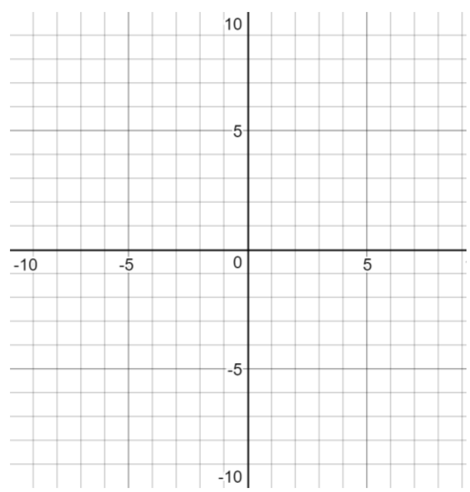
18. $-0.4x + \frac{1}{3}y = 1$



19. $x = 3$



20. $y = -2$



<u>Section 2.2a Answer Key available on the Website</u>

Extra Work Space