Chapter 1: Linear Equations and Inequalities

- I can solve linear equations
- I can graph lines
- I can write an equation for a line

VOCABULARY

Expression	**Equation**
• contains operations • NO = sign	• contains an = sign • Has values/variables on both sides
Simplify	**Solve**
• make so there are no ( )/grouping symbols & no like terms	• find the value of the variable

Station1: Solving Equations and Inequalities

Solve the equation. Set up an equation if one is not given.

1) $\left(\frac{2}{3}x-7=5\right)^{3}$

$2x-21=15$

$2x=36$

$\boxed{x=12}$

2) $4(2x-9)+5x=-3(10-x)$

$8x-36+5x=-30+3x$

$13x-36=-30+3x$

$-3x \quad +36$

$\frac{10x}{10}=\frac{6}{10}$

$\boxed{x=3/5 \text{ or } 0.6}$

LCD = 24

3) $\left(\frac{2}{3}q-\frac{1}{12}=q+\frac{1}{8}\right)^{24}$

$16q-2=24q+3$

$-8q=5$

$\frac{-8q}{-8}=\frac{5}{-8}$

$\boxed{q=-\frac{5}{8}}$

4) **The bill for the repair of your bicycle was $180. The cost of parts was $105. The cost of labor was $25 per hour. How many hours did the repair work take?**

$105+25h=180$

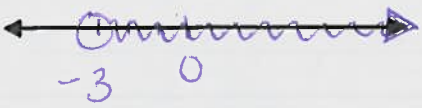
$25h=75$

$h=3$

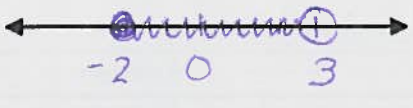
$\boxed{3 \text{ hours}}$

Graph the inequality.

5) $x > -3$



6) $-2 \le x < 3$



7) $x < -1$ or $x \ge 1$

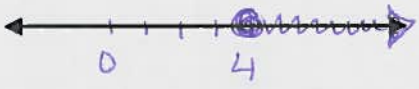
Solve the inequality. Graph the solution.

8) $4x+3 \le 6x-5$

$-2x \le -8$

$\frac{-2x}{-2} \le \frac{-8}{-2}$

$x \ge 4$

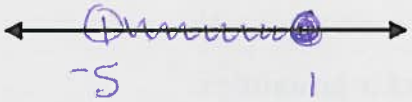


9) $-10 < 3x+5 \le 8$

$-5 \quad -5 \quad -5$

$\frac{-15}{3} < \frac{3x}{3} \le \frac{3}{3}$

$-5 < x \le 1$



10) $2x-1 \le 7$ or $4x+3 \ge 7$

$2x \le 8 \quad 4x \ge 4$

$x \le 4$ or $x \ge 1$

All Real

Special Cases...

11) $-3(x+2) = 5x+7-8x$

$-3x-6 = -3x+7$

$0 = 13$ or $-6 = 7$

False

$\emptyset$ no solution

12) $4x-2(x+1) > 2(x-5)$

$4x-2x-2 > 2x-5$

$2x-2 > 2x-5$

$0 > -3$ or $-2 > -5$

True

All Real

If the variable cancels and the statement is...	TRUE	FALSE
We say the answer is...	All Real Numbers	No Solution
On the number line We shade...	Everything	Nothing

Station2: Graphing Lines

Write a description or steps for "how to" graph in the box. Your "how to" may differ from your neighbors' and that's okay! Then graph the lines to the write. #3 & 4 can share a coordinate plane.

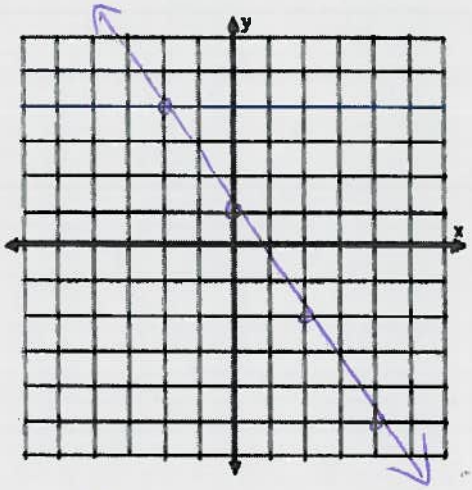
Slope- Intercept Form: y = mx + b

Plot b on the y-axis ↕

From b count the rise/run

- if + slope ↑/→
- if − slope ↓/→

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



Standard Form: Ax + By = C

Find x + y intercepts.

- Plug in for x or y
- Solve for other variable

Solve eq. for y

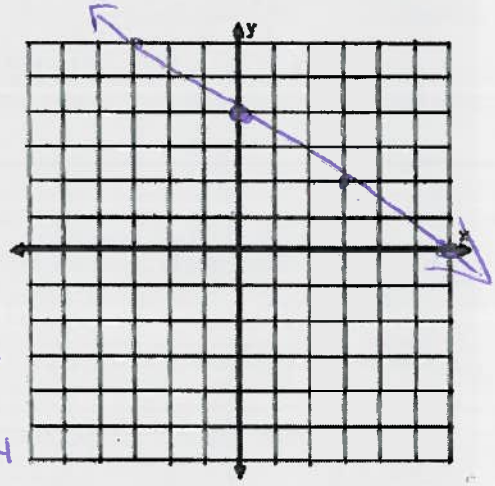
- graph $y = mx + b$

2) $2x + 3y = 12$

x-int:
$2x = 12$
$x = 6$

y-int:
$3y = 12$
$y = 4$

$3y = -2x + 12$
$y = -\frac{2}{3}x + 4$



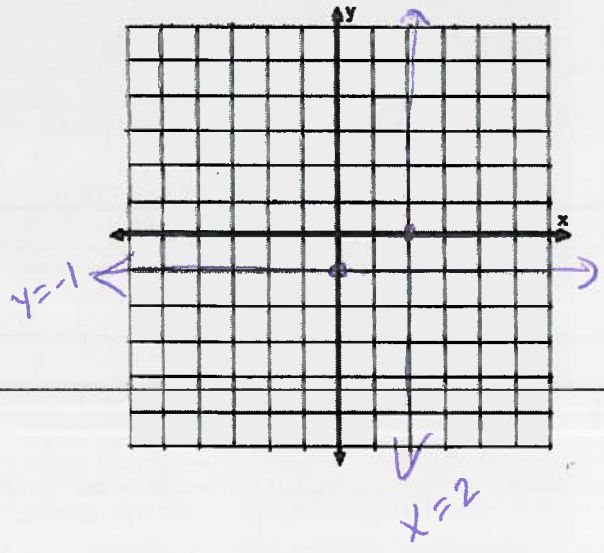
Horizontal & Vertical: y = # or x = #

1. Solve for the single variable.
2. Then use HOY-VUX
   a. Plot the intercept
   b. Draw the line.

Horizontal	Vertical
O slope (zero)	Undefined slope
Y = y-intercept	**X** = x-intercept

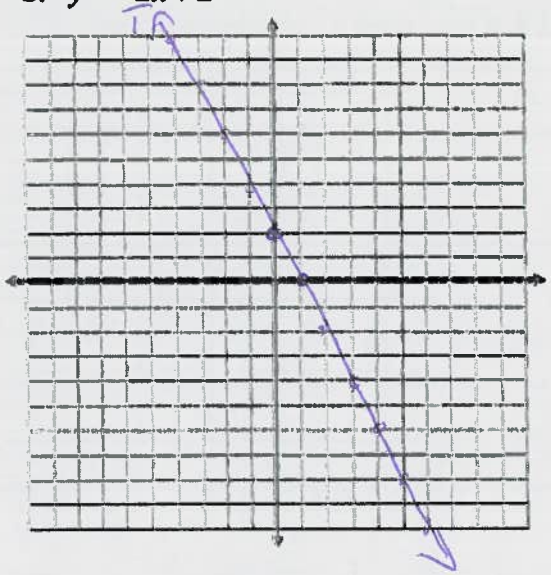
3) $y = -1$

4) $x = 2$

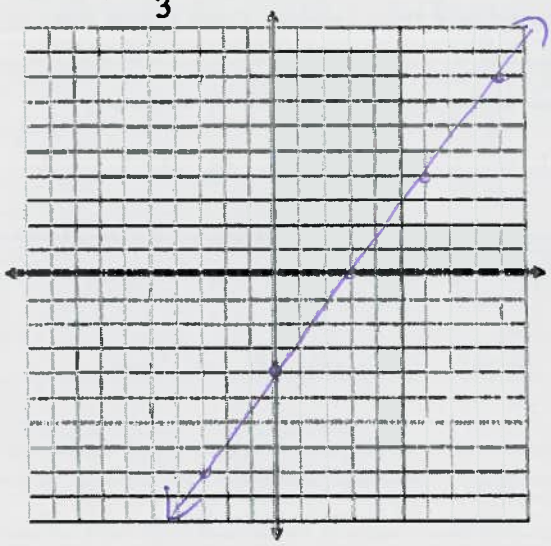


Graph the lines.

5. $y = -2x + 2$



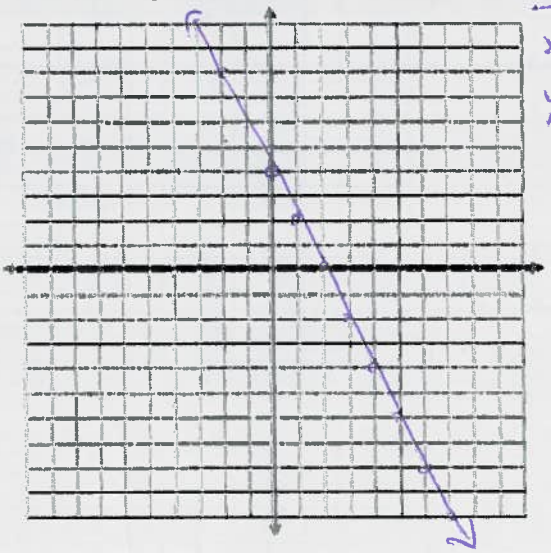
6. $y = \frac{4}{3}x - 4$



7. $4x + 2y = 8$ → $2y = -4x + 8$ → $y = -2x + 4$

x-int : 2

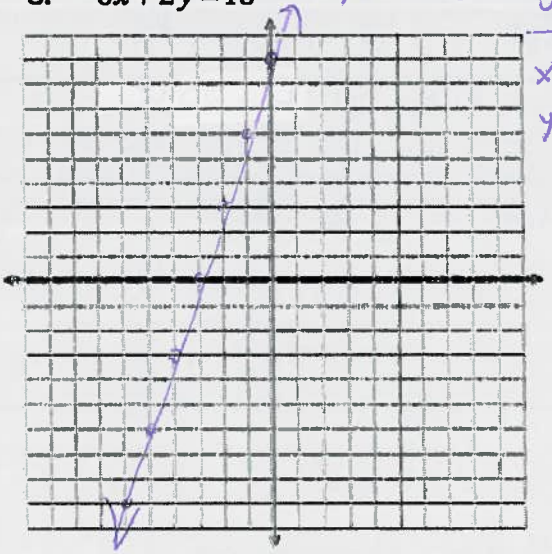
y-int : 4



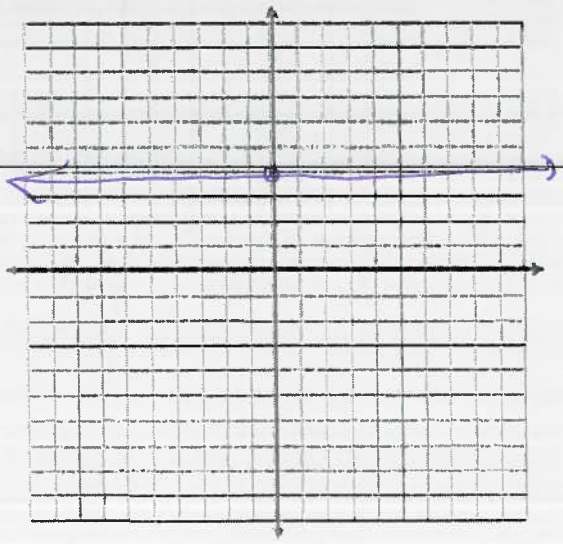
8. $-6x + 2y = 18$ → $2y = 6x + 18$ → $y = 3x + 9$

x-int : -3

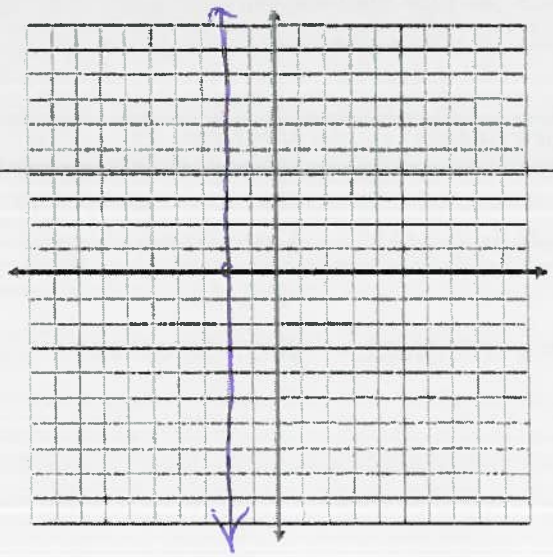
y-int : 9



9. $8y = 32$ → $y = 4$ "HOY"



10. $-30 = 15x$ → $-2 = x$ "VUX"



Station3: Writing Equations of Lines in Slope-Intercept Form

Label what each variable represents:

$$y = mx + b$$

- y: y-value of a point (x, y)
- m: slope
- x: x-value of a point (x, y)
- b: y-intercept $(0, b)$

Slope:

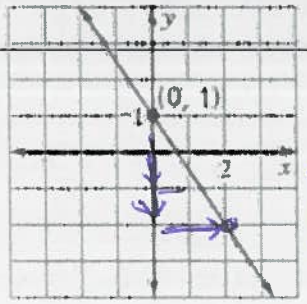
Slope Formula	m = $\frac{y_2 - y_1}{x_2 - x_1}$ $\frac{\Delta y}{\Delta x}$ $\frac{\text{rise}}{\text{run}}$	**Ex:** (4,3) (-5,6) m = 3/-9 = -1/3
Parallel	Slopes are the SAME	**Ex:** y = 2x + 5 and 4x – 2y = 8
Perpendicular	Slopes are OPPOSITE (change sign +/-) and RECIPROCAL (Flip fraction)	**Ex:** y = 5x – 2 and y = -1/5x + 3

Special Lines: Horizontal & Vertical

What type of line?	**H**orizontal	**V**ertical
What's the slope of the line?	**O** = slope	Undefined slope
What's the equation of the line?	**Y** = #	**X** = #

Find the slope-intercept equation of the line using the given information. If the slope-intercept equation cannot be given, give the alternative equation. (Hint: this is a special case)

1.



$b = 1$

$m = -\frac{3}{2}$

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

2. Through (3,-2) with slope of -5

$-2 = -5(3) + b$

$-2 = -15 + b$

$13 = b$

$y = -5x + 13$

3. Through (2,3) and parallel to y = -x + 3

$m = -1$

$3 = -1(2) + b$

$3 = -2 + b$

$5 = b$

$y = x + 5$

4. Through (2,3) and perpendicular to y = 2x + 7

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

$3 = -\frac{1}{2}(2) + b$

$3 = -1 + b$

$4 = b$

$y = -\frac{1}{2}x + 4$

5. Through (-3,5) and (-4,7)

$m = \frac{7-5}{-4+3} = \frac{2}{-1} = -2$

$5 = -2(-3) + b$ or $7 = -2(-4) + b$

$5 = 6 + b$ or $7 = 8 + b$

$-1 = b$ $\quad -1 = b$

$y = -2x - 1$

6. Through (-2,4) and (3,-1)

$m = \frac{-1-4}{3+2} = \frac{-5}{5} = -1$

$4 = -1(-2) + b$ or $-1 = -1(3) + b$

$4 = 2 + b$ or $-1 = -3 + b$

$2 = b$ $\quad 2 = b$

$y = -x + 2$

7. Through (10,-2) and perpendicular to 5x – 3y = 7

$m = -\frac{3}{5}$

$\frac{-3y}{-3} = \frac{-5x}{-3} + \frac{7}{-3}$

$y = \frac{5}{3}x - \frac{7}{3}$

$-2 = -\frac{3}{5}(10) + b$

$-2 = -6 + b$

$4 = b$

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

8. Through (-6,5) and perpendicular to y = 7

horizontal

vertical

$x = -6$

9. In a chemistry experiment you record the temperature of a compound to be -5° F one minute after you begin the experiment. Six minutes after you begin the experiment, the temperature is 20°F.

Use x = minutes, y = temp

(1,-5)

(6,20)

$m = \frac{20+5}{6-1} = \frac{25}{5} = 5$

$-5 = 5(1) + b$ or $20 = 5(6) + b$

$-5 = 5 + b$ $\quad 20 = 30 + b$

$-10 = b$ $\quad -10 = b$

$y = 5x - 10$

10. You have $6 to spend on drinks and a salad at the school cafeteria. The drinks cost $1.25 each and the salad cost $0.20 per ounce. (Hint: Begin with STANDAR FORM Ax + By = C)

Use x = # of drinks, y = ounces of salad

$1.25x + .20y = 6$

$\frac{.20y}{.2} = \frac{-1.25x}{.2} + \frac{6}{.2}$

$y = -6.25x + 30$

Station4: Writing Equations of Lines in POINT-SLOPE Form

Label what each variable represents:

$$y - y_1 = m(x - x_1)$$

y-value of point | slope | x-value of point

STEPS:
1. **Find the slope**
2. **Choose a point**
   Plug in the point and the slope
3. **Solve for y (slope-intercept answers)**

WHY??? Why do we need to know another form?

A. Quicker → Saves a step
B. Minimizes Error → No need to go back and plug numbers into final equation
C. Upper Level Math → MUCH faster because you can leave it! (Don't always need y = mx +b)

Ex1: Using point-slope, find the slope-intercept equation of a line through (7,-4) with slope -2.

$y + 4 = -2(x - 7)$

$y + 4 = -2x + 14$

$\boxed{y = -2x + 10}$

Ex2: Using point-slope, fine the slope-intercept equation of a line through (-8,7) and (-10,4).

$m = \frac{4-7}{-10+8} = \frac{-3}{-2} = \frac{3}{2}$

$y - 7 = \frac{3}{2}(x + 8)$

$y - 7 = \frac{3}{2}x + 12$

$\boxed{y = \frac{3}{2}x + 19}$

Quick Check: ~~Redo Ex2 using the OTHER point. You should get the same answer!~~

$y - 4 = \frac{3}{2}(x + 10)$

$y - 4 = \frac{3}{2}x + 15$

$\boxed{y = \frac{3}{2}x + 19}$

Do & Discuss: Using Point-Slope, find the slope-intercept equation of the line described.
These problems should look familiar from Station3, so check your answers!

1. Through (3,-2) with slope of -5

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

$y+2=-5x+15$

$\boxed{y=-5x+13}$

2. Through (2,3) and parallel to $y=-x+3$

$m=-1$

$y-3=-1(x-2)$

$y-3=-1x+2$

$\boxed{y=-x+5}$

3. Through (2,3) and perpendicular to $y=2x+7$

$m=-1/2$

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

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

$\boxed{y=-\frac{1}{2}x+4}$

4. Through (-3,5) and (-4,7)

$m=\frac{7-5}{-4+3}=\frac{2}{-1}=-2$

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

$y-5=-2x-6$

$\boxed{y=-2x-1}$

5. Through (-2,4) and (3,-1)

$m=\frac{-1-4}{3+2}=\frac{-5}{5}=-1$

$y-4=-1(x+2)$

$y-4=-1x-2$

$\boxed{y=-x+2}$

6. Through (10,-2) and perpendicular to $5x-3y=7$ $m=-5/-3=5/3$

$\perp m=-\frac{3}{5}$

$y+2=-\frac{3}{5}(x-10)$

$y+2=-\frac{3}{5}x+6$

$\boxed{y=-\frac{3}{5}x+4}$

Extra Point-Slope Resources:

- See Section 2.4 in the classroom textbook
- Video on point-slope: https://www.khanacademy.org/math/algebra/two-var-linear-equations-and-intro-to-functions/point-slope/v/idea-behind-point-slope-form *(a,b) is the same as* (x_1,y_1)
- Extra Practice online: https://www.khanacademy.org/math/algebra/two-var-linear-equations-and-intro-to-functions/point-slope/e/converting_between_point_slope_and_slope_intercept