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Intermediate II
Other Forms of Linearity (Chapter 3)

Note: All homework assignments are worth 10 points unless otherwise stated, and is due by the next class period. <u>No credit</u> will be given for anything turned in after the test.

Date	Objective	Assign. #	Assignments	HW Checked
	Point-Slope Form	WS 3.4h	Worksheet 3.4H: Point-Slope Form	
	8.EE.8c Intercepts	3.5	p. 213-216 (1-7, 9, 16-23)	
	8.EE.8c Writing Linear Equations	3.6	p. 225-228 (1-11, 14, 23-28)	
	Ch. 3.2 Quiz			
	Isolating the Variable and Changing Forms	WS 3.6i	Worksheet 3.6I: Isolating the Variable	
	8.EE.8a, b, c Solving Systems by Graphing	3.7j	Worksheet 3.7j: Graphing Systems of Equations	
	Writing Systems of Equations	WS 3.7k	Worksheet 3.7k: Writing Systems of Equations	
	8.EE.8b, c Solving Systems by Substitution	3.8*l*	Worksheet 3.8*l*: Solving Systems by Substitution	
	Review	3.R2	Worksheet 3.R2: Other Forms of Linearity Review	
	Other Forms of Linearity Test (Ch. 3)			

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Point-Slope Form | Chapter 4 Lesson H

You may have noticed that not all equations begin at the y-intercept. You can actually start at any point and move according to the slope.

A. In the following two problems, find the slope from the two points using the slope formula. Then choose one of the points to create a graph.

Ex: (1, 4) and (2, 6)

1. (2, 3) and (-1, 9)

2. (-2, 6) and (4, -8)

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Point-Slope Form | Chapter 4 Lesson H

Because we are no longer beginning at **b**, or the *y*-intercept, slope-intercept form (y=mx+b) is not the most effective representation of those lines.

There is another equation, called **point-slope form**, that shows the slope as well as a point where you can begin.

Point-Slope Form | Given that the slope is **m** like always, and that the point is **(x_1, y_1)**, the equation for point-slope form is:

$$y - \mathbf{y_1} = \mathbf{m}(x - \mathbf{x_1})$$

B. Given the following points and slope, fill out the point slope form. Rewrite the original equation each time.

Ex: Point: (2, 7) Slope: -3

1. Point: (1, -2) Slope: 3

2. Point: (-3, 2) Slope :2

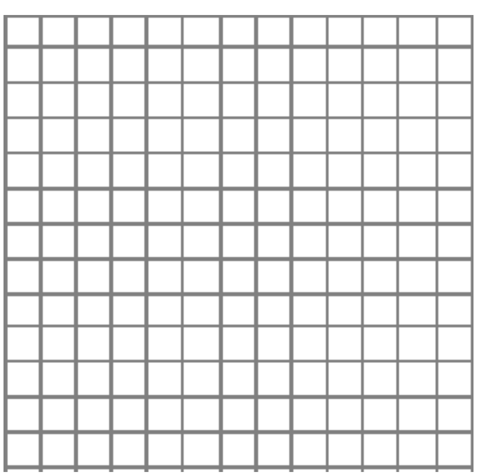
3. Point: (1, 0) Slope: ½

4. Points: (2, 3) and (3, 5)

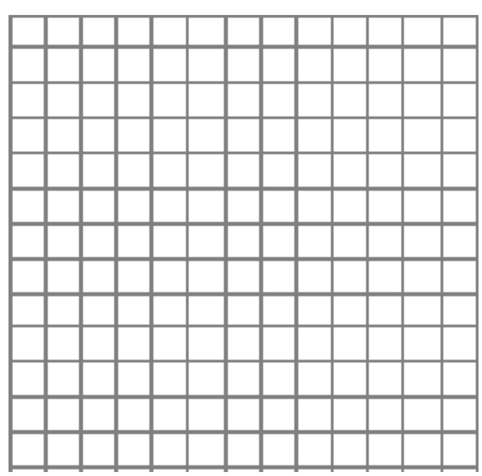
5. Points: (-1, 4) and (2, -5)

C. Graph the equations in point-slope form below:

1. $y - 7 = -3(x - 2)$



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



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From Slope-Intercept Form to Standard Form | Ch 3 Lesson 5

A. Review

What is the general Slope-Intercept Form? ______________________________

Find the slope and y-intercept of the following equations:

1. $y = 1.5x - 9$

2. $y = -\frac{1}{3}x + 5$

3. What is the definition of a *y*-intercept again? ______________________________
____

4. Based off of this, what do you think the definition of an *x*-intercept is?
____
____
____

Definition: The *x*-intercept of a line is the *x*-coordinate of the point where the graph crosses the *x*-axis.

Find the *x*-intercept of the following equations:

3. $y = 1.5x - 9$

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

B. The following form is called: **Standard Form:** $Ax + By = C$.

Mauldin Middle School wants to make $4,740 from yearbook sales. Print yearbooks *x* cost $60 each, and digital yearbooks *y* cost $15 each.

1. Write an equation to represent the situation above: ______________________________

2. How many digital yearbooks total could MMS sell?

3. How many print yearbooks total could MMS sell?

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From Slope-Intercept Form to Standard Form | Ch 3 Lesson 5

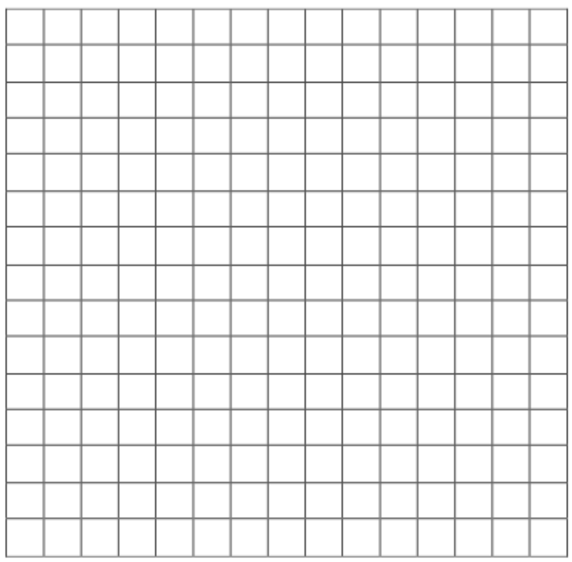
4. If MMS were to sell 79 print yearbooks, how many digital yearbooks would they need to sell?

5. If MMS were to sell 316 digital yearbooks, how many print yearbooks would they need to sell?

6. What does *x*=79 represent in context of a graph?

7. What does *y*=316 represent in context of a graph?

C. Use the *x*- and *y*- intercepts to graph the equation:



1. How can we see the yearbook sales on the graph above? Where can we see the sales of only paper yearbooks? Where can we see the sales of only digital yearbooks?

This is called *interpreting the intercepts.*

2. What does the point (68, 44) mean in context of the situation above?

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Write Linear Equations | Ch 3 Lesson 6

A. Review

1. What is **Slope-Intercept Form**?

2. What is **Point-Slope Form**?

3. What is **Standard Form**?

B. Write an equation in point-slope form and slope-intercept form for each line.

1. passes through (–5, 6), slope = 3

2. passes through (6, –6), slope = 5

Point- Slope Form:

Slope-Intercept Form:

3. passes through (0, 1) and (2, 5)

4. passes through (–5, 9) and (1, 3)

5. passes through (1, –1) and (2, 0)

6. passes through (–3, –5), slope = 2

8.EE.8c

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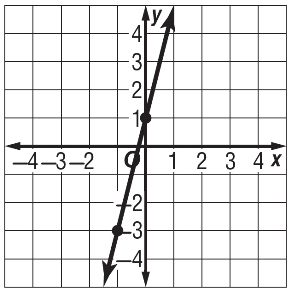
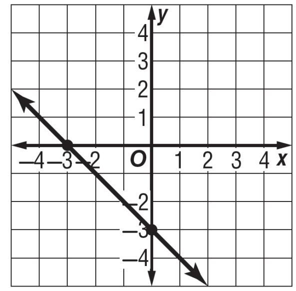
C. Write the point-slope form of an equation for each line graphed.

1.



2.



3. TEMPERATURE The table shows the temperature at certain hours. Assuming the temperature change is linear, write an equation in point-slope form to represent the temperature *y* at *x* hour.

Hour	Temperature (°F)
1	35
2	39

4. SPEED After 2 hours, a car travels 70 miles. After 2.25 hours in the same trip, the car travels 78.75 miles. Write an equation in point-slope form to represent the distance *y* of the car after *x* hours.

D. Convert the following from point-slope form to standard form.

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

3. $y - 7 = 3(x + 1)$

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

4. $y - 5 = -3(x + 4)$

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Isolating the Variable and Changing Forms | Ch. 3 Lesson I

In the past, we discussed how to graph systems of equations. There were three different linear forms that we looked at:

- Slope-Intercept Form

- Point-Slope Form

- Standard Form

All three of these linear equations have two things in common, an *x* and a *y*. Because of this, we can actually convert from one form to the other!

We're going to first talk about how to change all forms to **Slope-Intercept Form**. We do this by "isolating the variable". This means that we want to isolate, or separate, a specific variable.

A. Isolate the variable *y* in the following equations.

Example: $2x - y = 21$

1. $12x + 6y = 18$
2. $y - 6x = 13$
3. $22 = 2y + 6x + 2$
4. $y + 1.5 = \frac{3}{2}(x + 1)$
5. $y - 4 = 3(x - 8)$
6. $y + 3 = 2(x - 5)$
7. $y - 4 = \frac{1}{2}(x - 6)$
8. $3x + 4y = 12$

When you isolate for the variable *y*, you are writing the equation in what form?

B. Now isolate for the variable *x* in the following equations.

1. $12x + 6y = 18$
2. $3x + 4y = 12$
3. $3x - 5y = 15$
4. $x + 8y = 22$
5. $2x + 5 = x + 3y$
6. $7x - 16 = 3x + 4y$

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Isolating the Variable and Changing Forms | Ch. 3 Lesson I

C. Isolating a variable can be useful in multiple ways.

1. What is one reason that isolating a variable could help us?

2. What is another way? (You may have learned this from the class discussion.)

There are multiple forms of linear equations (slope-intercept, point-slope, and standard) because they each have different uses. We discussed these last time.

When could we use:

a) Slope-intercept form?

b) Point-slope form?

c) Standard Form?

Because the three forms have different purposes, it's good to have the skill of converting from one form to another. To do this, you must know what form you are starting with and what form you must end with.

Please note: Standard form is special. The coefficient of *x* cannot be less than 1 (meaning no negatives), and the coefficients of all the variables cannot have a common factor.

D. Convert the following from Slope-Intercept to Standard Form.

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

1. $y = 3x + 1$

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

3. $y = \frac{7}{3}x + \frac{4}{3}$

4. $y = 4x + \frac{9}{4}$

5. $y = -\frac{3}{8}x + \frac{1}{4}$

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

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Isolating the Variable and Changing Forms | Ch. 3 Lesson I

E. Isolate the variable of your choice (either *x* or *y*) in each of the following. Sometimes *y* will be easier than *x*, and sometimes *x* will be easier than *y*.

1. $x - 8y = 64$
2. $2x - 3y = -9$
3. $x + 5y = -15$
4. $x + 2y = -20$
5. $8x - 9y = -81$
6. $14x + 10y = 80$
7. $x + y = 4$
8. $5x - y = 15$
9. $\frac{3}{4}x + y = 4$
10. $12x - y = 24$
11. $7x - y = 9$
12. $x + y = 6$
13. $4x - 2y = 8$
14. $x + 3y = -27$
15. $8x - y = 18$
16. $9x + y = 27$
17. $x + y = 11$
18. $x + 12y = -120$
19. $56x - 8y = 64$
20. $2x + 3y = 6$

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Isolating the Variable and Changing Forms | Ch. 3 Lesson I

F. Being able to write multiple forms is also important. Below you will be given tables and graphs and must write at least two linear equations (either Slope-Intercept, Point-Slope, or Standard) for each problem.

1.

x	y
1	-5
3	-9
5	-13
7	-17

2.

x	y
-3	0
0	9
3	18
6	27

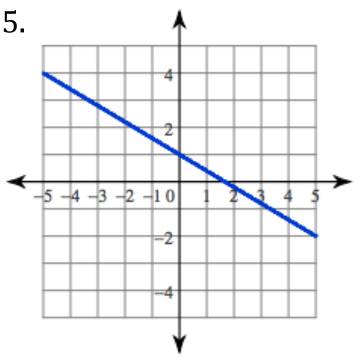
3.

x	y
-1	4
3	7
11	13
15	16

4.

x	y
-10	37
-5	22
0	7
5	-8

5.



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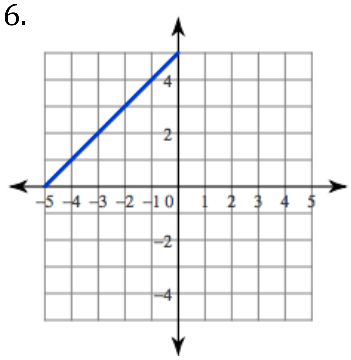

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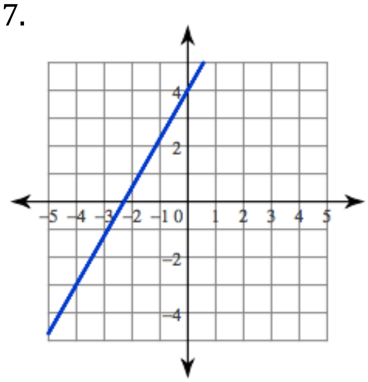

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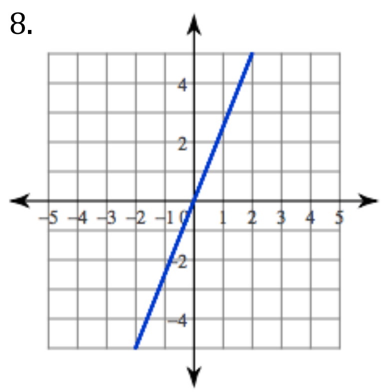

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Graphing Systems of Equations | Ch. 3 Lesson 7

Linear relationships are relationships with a ______________________________.

On a table, we can find this by:

Ex1:

On a graph, we can find this by:

Ex 2:

There are three different linear equations that we have learned this year. The three different forms are:

-
-
-

We can graph a line using any of the above types of equations. We'll describe and practice this below.

A. **Slope-Intercept Form**

1. What two pieces of information are given to us in **slope-intercept form**?

2. How do we use those two pieces of information to graph our relationship?

Practice below:

3. $y = 2x + 3$

4. $y = \frac{4}{5}x - 6$

5. $y = -3x + 7$

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Graphing Systems of Equations | Ch. 3 Lesson 7

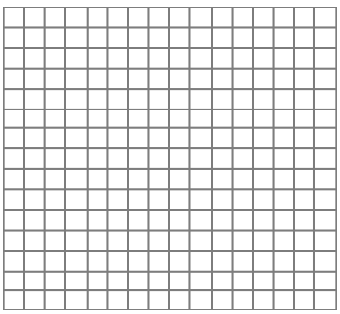
B. **Point-Slope Form**

1. What two pieces of information are given to us in **point-slope form**?

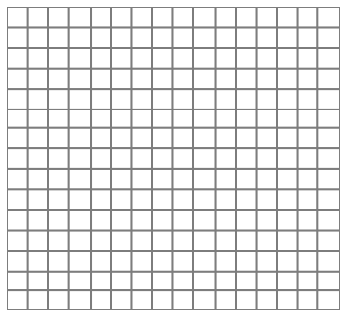
2. How do we use those two pieces of information to graph our relationship?

Practice below:

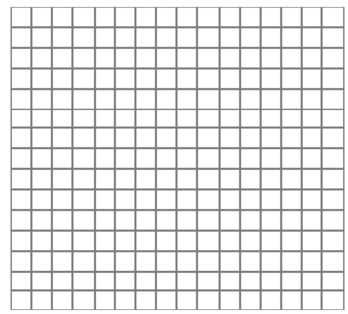
3. $y-4=2(x-3)$



4. $y+1=3(x-5)$



5. $y-6=-2(x+3)$



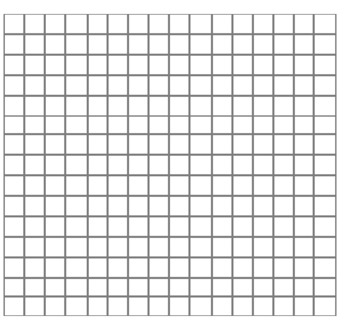
C. **Standard Form**

1. What two pieces of information are given to us in **standard form**?

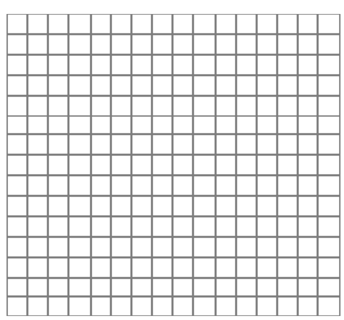
2. How do we use those two pieces of information to graph our relationship?

Practice below:

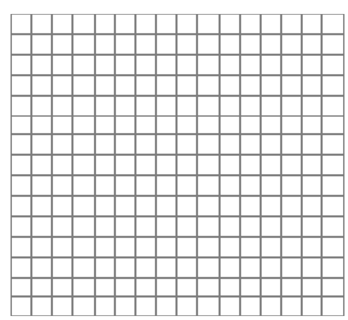
3. $2x+6y=18$



4. $-3x+4y=24$



5. $-2x-7y=21$



Recall: A system is a group of equations that have the same variables. Systems can be solved for a solution, which is the one point where both equations are true. On a graph, this can be see as where the two lines intersect.

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Graphing Systems of Equations | Ch. 3 Lesson 7

D. Solve the following systems of equations by graphing both equations. For each problem, you must check your solution by plugging it back in to both equations.

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

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

1. $y = 4x + 3$

   $y = -x - 2$

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

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

3. $y = 3x - 4$

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

4. $y = -2x + 2$

   $y = -2x - 2$

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

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

6. $y = \frac{1}{3}x - 3$

   $y = -x + 1$

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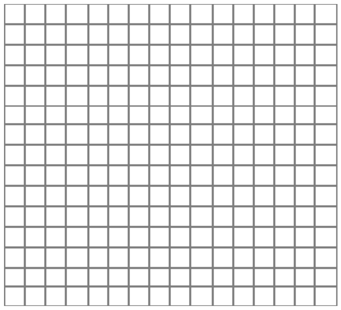
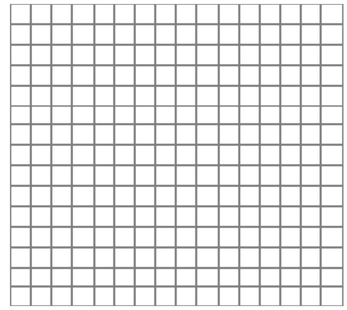
Graphing Systems of Equations | Ch. 3 Lesson 7

E. Systems can contain equations that are in different forms. Using the first couple pages as examples, graph the following pairs of equations to find the solution. Again, check your solution by plugging it back into the original equations.

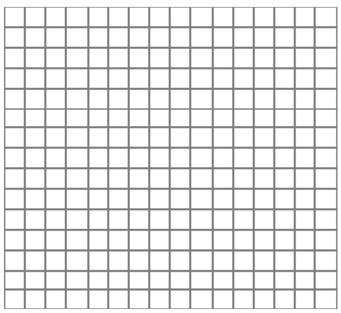
1. $y = -x + 2$
   $3x - 2x = 6$



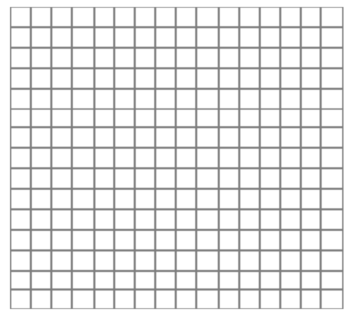
2. $y = 2x - 1$
   $4x - 2y = 2$



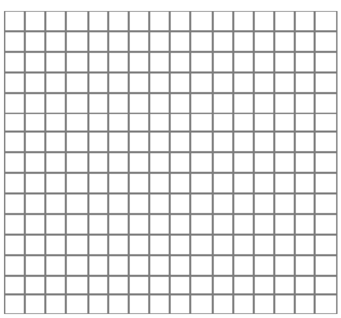
3. $y = 2x - 3$
   $y - 5 = 2(x - 2)$



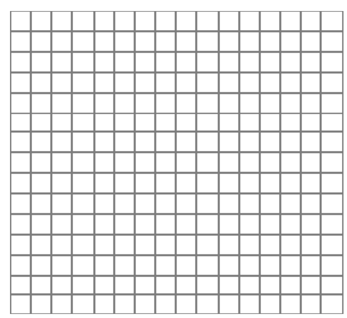
4. $y = 2x - 1$
   $4x - 2y = 2$



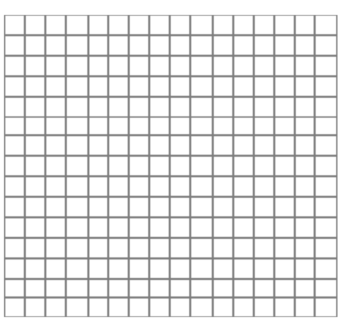
5. $y = -4x + 5$
   $y = 3x - 9$



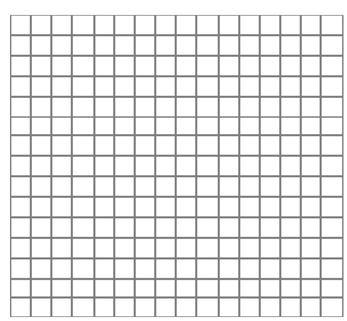
6. $2x + y = 0$
   $y = x + 6$



5. $3x - 2y = 4$
   $y = -2x + 5$



6. $3x - 2y = 6$
   $x - y = 2$



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Writing Systems of Equations | Ch. 3 Lesson K

A. Writing expressions and equations.
Reminder: Expressions and equations are mathematical sentences.

Write the following sentences as mathematical expressions.

1. Five more than a number.
2. Two-thirds of a variable.
3. Four less than two times a number.
4. Sixty percent of the total value.

Write the following sentences as mathematical equations. You can solve these.

5. Seven more than a number is fifty-two.
6. One-half of a number is four less than twenty.
7. The sum of forty-two and three is nine times a number.
8. Three times a number is the difference between fifteen and three.

B. Systems of equations can help us solve problems that have **two** questions (and therefore two answers). We write our own systems of equations by following the steps below:

1. What information does the problem give us?
2. What two pieces are unknown? **These become our variables.**
3. How can I organize the information into two equations? **This becomes our system.**

For today, we will work on simply setting up the systems. Next time we will discuss further ways to *solve* them.

Example: *Emma and Hannah are sisters. Together, their combined age is 35 years old. If Emma is 2/3 of the age of Hannah, how old is each sister?*

1. What information does the problem give us?
2. What two pieces are unknown?
3. How can I organize the information into two equations?

Name: ____ Date: ____________ Period: _____

Writing Systems of Equations | Ch. 3 Lesson K

C. We will start with simple systems. **Write a system for each of the problems below.** Make sure that you identify and label the variables before you write the system.

Remember, today's purpose is to write the systems, not to solve them. You don't need to solve the systems unless you have extra time.

1. Annalise has a lot of homework to catch up on. From English and Science combined, she has 15 assignments to complete. She has three more Science assignments than English. How many of each type of assignment does she have left to complete?
   a. What information does the problem give us?

   b. What two pieces are unknown?

   c. How can I organize the information into two equations?

2. Connor is thinking of a number. The sum of the two digits of this number is 7. The second digit is one more than twice the first digit. What is Connor's number?
   a. What information does the problem give us?

   b. What two pieces are unknown?

   c. How can I organize the information into two equations?

3. Dylan and Mark were playing basketball. Together, their combined points were 62. Mark scored five than three times the amount that Dylan scored. How many points did each boy make?
   a. What information does the problem give us?

   b. What two pieces are unknown?

   c. How can I organize the information into two equations?

4. Student Council is selling Spirit Supplies. The lanyards are $1.50 each and the water bottles are $4.00 each. On a certain day, 2200 purchases were made, and $5050 was collected. How many water bottles were sold, and how many lanyards were sold?
   a. What information does the problem give us?

   b. What two pieces are unknown?

   c. How can I organize the information into two equations?

Name: ____ Date: ____________ Period: _____

Writing Systems of Equations | Ch. 3 Lesson K

5. The 9th grades at AFJH and Mountain Ridge get to go to Lagoon. The 9th grade class at Mountain Ridge rented and filled 1 van and 6 buses with 372 students. American Fork rented and filled 4 vans and 12 buses with 780 students. Each van and each bus carried the same number of students. How many students can a van carry? How many students can a bus carry?
   a. What information does the problem give us?

   b. What two pieces are unknown?

   c. How can I organize the information into two equations?

6. The difference of two numbers is 3. Their sum is 13. What are the two numbers?
   a. What information does the problem give us?

   b. What two pieces are unknown?

   c. How can I organize the information into two equations?

7. Our school sold tickets to a fundraiser. On the first day of ticket sales the school sold 3 senior citizen tickets and 9 child tickets for a total of $75. The school took in $67 on the second day by selling 8 senior citizen tickets and 5 child tickets. What is the price of one senior citizen ticket and one child ticket?
   a. What information does the problem give us?

   b. What two pieces are unknown?

   c. How can I organize the information into two equations?

8. A boat traveled 336 miles downstream and back. The trip downstream took 12 hours. The trip back took 14 hours. What is the speed of the boat in still water? What is the s peed of the current?
   a. What information does the problem give us?

   b. What two pieces are unknown?

   c. How can I organize the information into two equations?

Name: ______________________________ Date: ____________ Period: _____

Writing Systems of Equations | Ch. 3 Lesson K

D. Write a system of equations for each of the following problems.

1. A test has twenty questions worth 100 points. The test consists of True/False questions worth 3 points each and multiple choice questions worth 11 points each. How many multiple choice questions are on the test?

2. Two small pitchers and one large pitcher can hold 8 cups of water. One large pitcher minus one small pitcher constitutes 2 cups of water. How many cups of water can each pitcher hold?

3. Margie is responsible for buying a week's supply of food and medication for the dogs and cats at a local shelter. The food and medication for each dog costs twice as much as those supplies for a cat. She needs to feed 164 cats and 24 dogs. Her budget is $4240. How much can Margie spend on each dog for food and medication?

4. Your sister and you go to Milo's Deli for lunch. A sandwich costs twice as much as a drink. You can buy 3 sandwiches and 2 drinks for $16. What is the cost of each?

5. The Madison Local High School marching band sold gift wrap to earn money for a band trip to Orlando, Florida .The gift wrap in solid colors sold for $4.00 per roll ,and the print gift wrap sold for $6.00 per roll .The total number of rolls sold was 480 ,and the total amount of money collected was $2340. How many rolls of each of each kind of gift wrap were sold?

6. John has 2 CD's and he is going to buy 4 per week. His friend Joan has 6 CD's and she is going to buy 2 per week. When will they have the same number of CD's? How many will they have?

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A. One way to solve a system of equations is by graphing. This is easiest when your systems are in Slope-Intercept Form or Standard Form. When solving by graphing, the solution to your system is shown as an __________________________ and is the point of intersection.

There are three possible answers to a system.
As we learned from graphs, lines can either cross once, never, or always. Draw a sketch of each of these examples below:

Crossing once:

Crossing never:

Crossing always:

B. Another way to solve systems is by substitution. Explain in your own words what substitution means in math:

Substitution can be simple or more complex. The purpose of substitution with systems is to allow us to create one equation with one variable.

Example: y=2x + 6
y= 10

1. $y = 5x + 4$
$y = 14$

2. $y = \frac{1}{2}x + 4$
$x = 10$

3. $y = 9x - 2$
$y = 5x$

4. $y = 2x - 6$
$y = 8x$

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C. Substitution can also be for entire expressions.

Example: $y = 2x + 3$
$y = 6x + 7$

1. $y = -2x - 16$
$y = -x - 9$

2. $y = 2x - 13$
$y = 17 - x$

3. $y = -x - 2$
$y = -5x + 26$

4. $y = 3x - 24$
$y = 4x - 32$

5. $y = -5x - 12$
$y = x + 6$

6. $y = -2x$
$y = -4x - 2$

7. $y = -3x + 22$
$y = x - 18$

8. $y = -3x + 0$
$y = -2x - 1$

D. Sometimes you may need to plug an expression into the middle of an equation.

Example: $x = -5y - 44$
$-3x + 4y = -39$

1. $y = 2x - 1$
$2x - 2y = 4$

2. $5x - 5y = 10$
$y = -2x + 28$

3. $3x + 2y = 10$
$y = x - 5$

4. $2x - 3y = 28$
$y = 3x - 28$

5. $-2x - 3y = -7$
$y = 6x - 11$

6. $5x - 5y = 10$
$y = -2x + 28$

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E. Sometimes, you may need to convert an equation or isolate a variable in order to substitute and solve the system.

Example: $-4x + y = 6$
$-5x - y = 21$

1. $-7x - 2y = -13$
$x - 2y = 11$

2. $-5x + y = -2$
$-3x + 6y = -12$

3. $x - 5y = -3$
$-8x + 3y = 24$

4. $x + 3y = 1$
$-3x - 3y = -15$

5. $-3x - 8y = 20$
$-5x + y = 19$

6. $6x + 6y = -6$
$5x + y = -13$

7. $2x + y = 20$
$6x - 5y = 12$

8. $-2x + 6y = 6$
$-7x + 8y = -5$

F. For each of the following problems, write and then solve your system.

1. Steve watched 6 times as many hours of television over the weekend as Tony. Together they watched a total of 14 hours of television. How many hours of television did each person watch over the weekend?

2. Elsa is a cross-country ski racer. On Saturday, she skied twice as many miles as she did on Sunday. Over the weekend she skied a total of 63 miles. How far did she ski on each day?

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G. 1-3 Solve each system of equations either by graphing or by substitution. Use whichever method you think best. Some systems you may need to write first.

1. $y = -x + 4$
   $y = 2x - 8$

2. $2y = x + 3$
   $y = -2x + 4$

3. The sum of Sam's age plus twice of Michael's age is 12. The difference between Sam's and Michael's age is 3. Write and solve a system to find both of their ages.

4. Which system has the solution (-3, -10)?

a) x + y = 7
x + y = 19

b) x – y = 7
3x – y = -19

c) x – y = 7
3x + y = -19

d) x + y = -7
3x – y = 19

5. Which system has NO solution?

a) 6x – 7y = 5
12x – 14y = 10

b) 6x – 7y = 5
12x – 14y = -10

c) 6x + 7y = 5
18x – 21y = 15

d) 6x + 7y = 5
12x + 14y = 10

6. Which system has infinitely many solutions?

a) 6x – 3y = 9
4x + 2y = 6

b) 6x – 3y = 6
4x – 2y = 9

c) 6x – 3y = 9
4x – 2y = 6

d) 6x + 3y = 9
4x + 2y = 3