

Secondary One Mathematics: An Integrated Approach

Module 1 Getting Ready

By

The Mathematics Vision Project:

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www.mathematicsvisionproject.org

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Module 1 – Getting Ready

Classroom Task: Checkerboard Borders - A Develop Understanding Task

Defining quantities and interpreting expressions (N.Q.2, A.SSE.1)

Ready, Set, Go Homework: Getting Ready 1.1

Classroom Task: Building More Checkerboard Borders – A Develop Understanding Task

Defining quantities and interpreting expressions (N.Q.2, A.SSE.1)

Ready, Set, Go Homework: Getting Ready 1.2

Classroom Task: Serving Up Symbols – A Develop Understanding Task

Interpreting expressions and using units to understand problems (A.SSE.1, N.Q.1)

Ready, Set, Go Homework: Getting Ready 1.3

Classroom Task: Examining Units – A Solidify Understanding Task

Using units as a way to understand problems (N.Q.1)

Ready, Set, Go Homework: Getting Ready 1.4

Classroom Task: Cafeteria Actions and Reactions – A Develop Understanding Task

Explaining each step in the process of solving an equation (A.REI.1)

Ready, Set, Go Homework: Getting Ready 1.5

Classroom Task: Elvira’s Equations – A Solidify Understanding Task

Rearranging formulas to solve for a variable (A.REI.3, A.CED.4)

Ready, Set, Go Homework: Getting Ready 1.6

Classroom Task: Solving Equations, Literally – A Practice Understanding Task

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Ready, Set, Go Homework: Getting Ready 1.7

Classroom Task: Cafeteria Conundrums – A Develop Understanding Task

Writing inequalities to fit a context (A.REI.1, A.REI.3)

Ready, Set, Go Homework: Getting Ready 1.8

Classroom Task: Greater Than? – A Solidify Understanding Task

Reasoning about inequalities and the properties of inequalities (A.REI.1, A.REI.3)

Ready, Set, Go Homework: Getting Ready 1.9

Classroom Task: Taking Sides – A Practice Understanding Task

Solving linear inequalities and representing the solution (A.REI.1, A.REI.3)

Ready, Set, Go Homework: Getting Ready 1.10



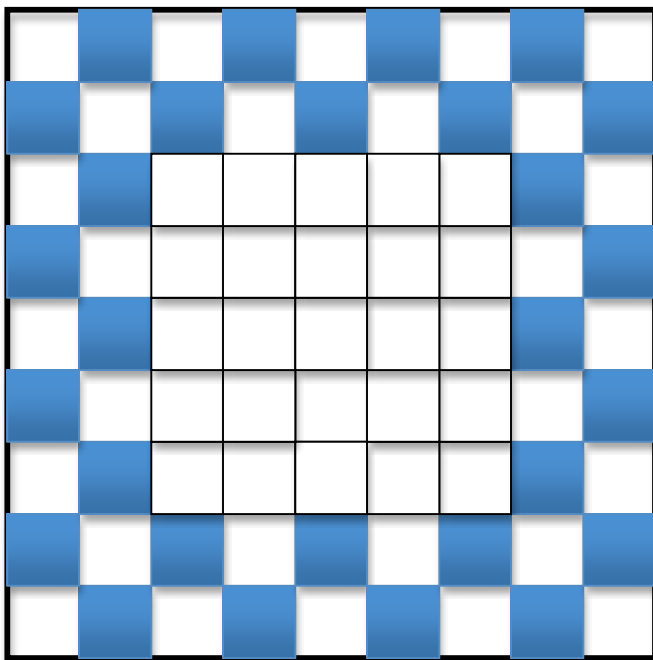
1.1 Checkerboard Borders

A Develop Understanding Task

In preparation for back to school, the school administration has planned to replace the tile in the cafeteria. They would like to have a checkerboard pattern of tiles two rows wide as a surround for the tables and serving carts.

Below is an example of the border that the administration is thinking of using to surround a square 5 x 5 set of tiles.

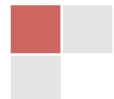
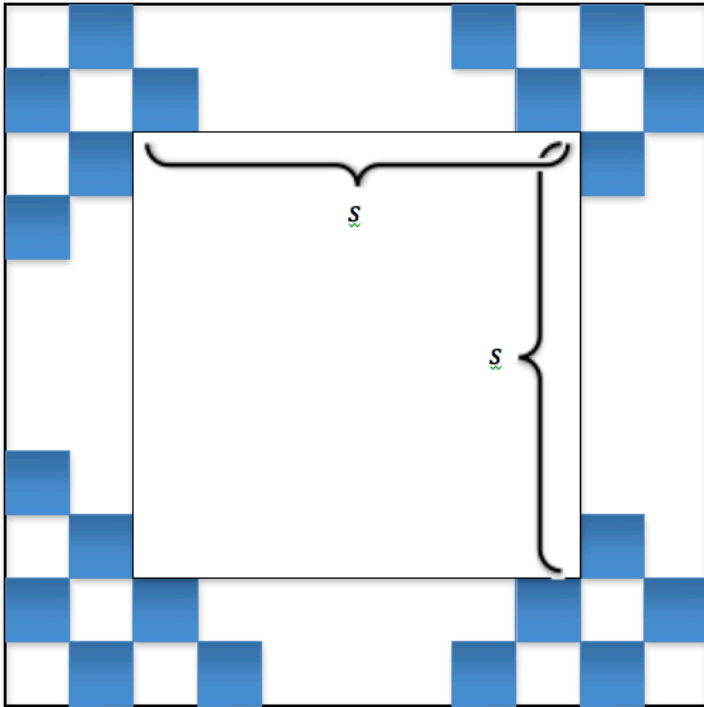
- A. Find the number of colored tiles in the checkerboard border. Track your thinking and find a way of calculating the number of colored tiles in the border that is quick and efficient. Be prepared to share your strategy and justify your work.



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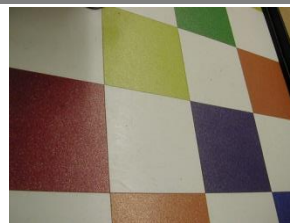
- B. The contractor that was hired to lay the tile in the cafeteria is trying to generalize a way to calculate the number of colored tiles needed for a checkerboard border surrounding a square of tiles with dimensions $s \times s$. Find an expression for the number of colored border tiles needed for any $s \times s$ square center.



Name: _____

Getting Ready | 1.1

Ready, Set, Go!



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Ready

Topic: Solve one variable equations

Find the value of x that makes each equation true.

1. $6x = 18$

2. $3x - 10 = 2$

3. $8x - 10 = x + 11$

4. $5x - 7 = 7x - 17$

5. $3x + 9 = 44 - 2x$

6. $3x + 6 = x + 2$

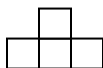
Set

Topic: Create and solve equations in one variable.

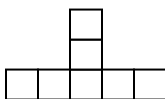
Use the pictures below to answer questions 7 – 12.



Step 1



Step 2



Step 3

7. Each square represents one tile, how many total tiles are in Step 5? Step 6?
8. What might you do to determine the number of tiles in Step 25?
9. Write a rule to predict the total number of tiles for any step. Show how your rule relates to the pattern.
10. Try to think of a different rule that you can use to predict the total number of tiles for any step. Show how your rule relates to the pattern.
11. Andrew also solved this problem and came up with following equation: $s = 1 + 3(n-1)$. How does each piece of his expression show up in the pattern?
12. Tami came up with the equation $s = 3n - 2$. How does each piece of her expression show up in the pattern?

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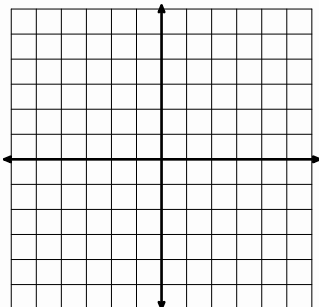


Go

Topic: Graph linear equations

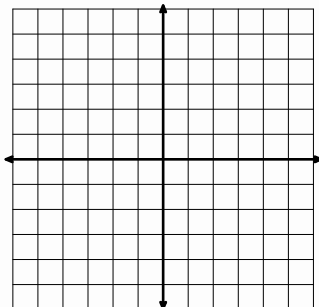
For the following problems two points and a slope are given. Use the graph to plot these points, draw the line, and *clearly* label the slope on the graph.

13. $(2, -1)$ and $(4, 2)$



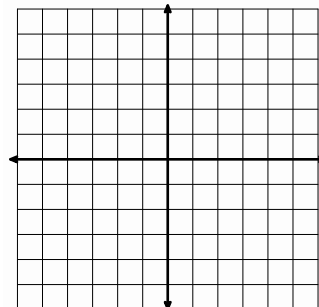
Slope: $m = \frac{3}{2}$

14. $(-2, 1)$ and $(2, 5)$



Slope: $m = 1$

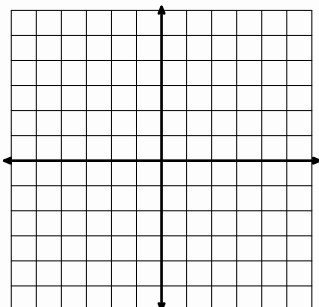
15. $(0, 0)$ and $(3, 6)$



Slope: $m = 2$

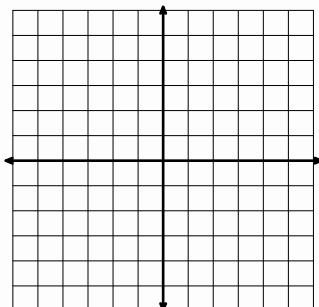
For the following problems, two points are given. Use the graph to plot these points *and* find the slope.

16. $(-3, 0)$ and $(0, 5)$



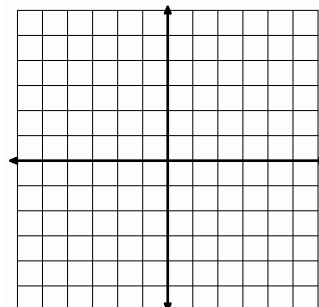
Slope: $m =$

17. $(-2, -1)$ and $(-4, 4)$



Slope: $m =$

18. $(0, 3)$ and $(1, 6)$



Slope: $m =$

Need Help? Check out these related videos:

<http://www.khanacademy.org/math/algebra/solving-linear-equations/v/solving-equations-1>

<http://www.khanacademy.org/math/algebra/linear-equations-and-inequalities/v/graphing-a-line-in-slope-intercept-form>

<http://www.youtube.com/watch?v=WXzpisUh0AU>

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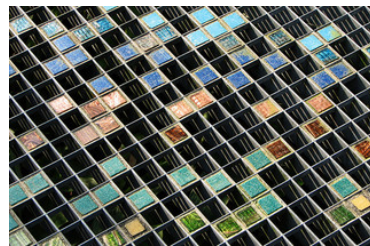
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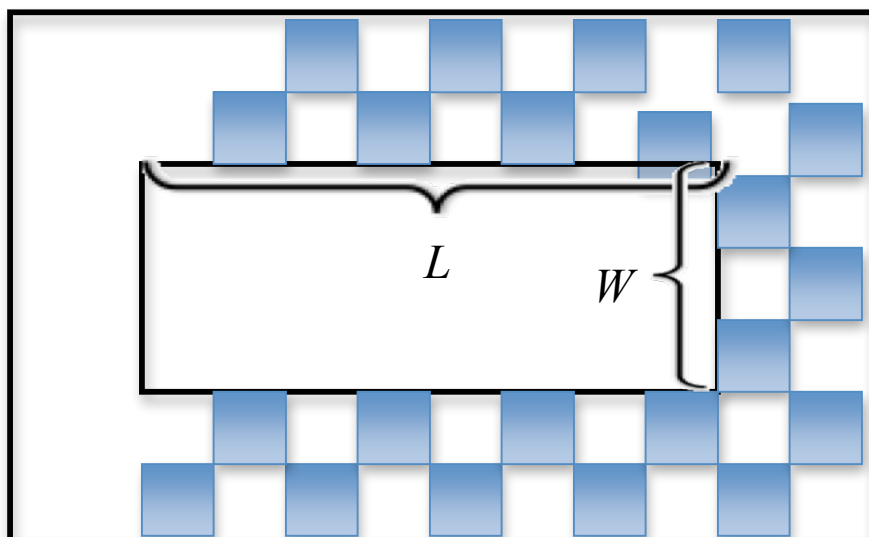
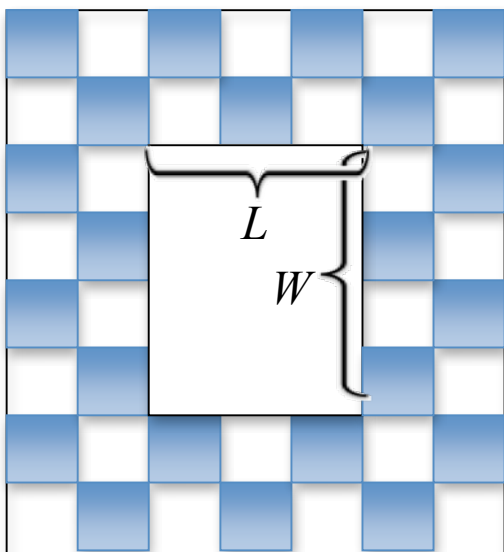
1.2 Building More Checkerboard Borders

A Develop Understanding Task



As the tile workers started to look more deeply into their work they found it necessary to develop a way to quickly calculate the number of colored border tiles for not just square arrangements but also for checkerboard borders to surround any $L \times W$ rectangular tile center.

Find an expression to calculate the number of colored tiles in the two row checkerboard border for any rectangle. Be prepared to share your strategy and justify your work. Create models to assist you in your work.



Name: _____

Getting Ready | 1.2

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Ready

Solve the following equations for the unknown variable.

1. $4(x + 3) = 1$

2. $q - 13 = -13$

3. $21s = 3$

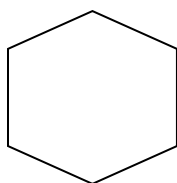
4. $\frac{7f}{11} = \frac{7}{11}$

5. $5q - 7 = \frac{2}{3}$

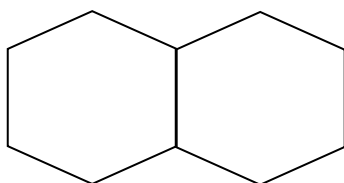
6. $5x - (3x + 2) = 1$

Set

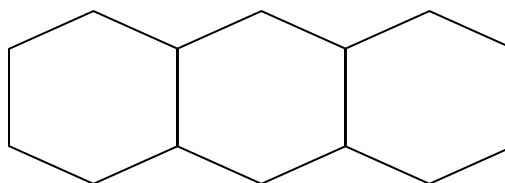
For the growing pattern below, each line segment is one unit in length.



Step 1



Step 2



Step 3

7. How much total **perimeter** in Step 5? Step 6? (Remember to focus on the perimeter.)
8. How can you determine the amount of perimeter in Step 25?
9. Write a rule to predict the total amount of perimeter for any step. Show how your rule relates to the pattern.
10. Marsha also solved this problem and came up with following expression: $1 + 5n - (n-1)$. How does each piece of her expression show up in the pattern?
11. Tyler came up with the expression $6n - 2(n-1)$. How does each piece of his expression show up in the pattern?

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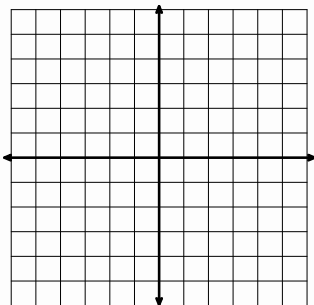
Name: _____

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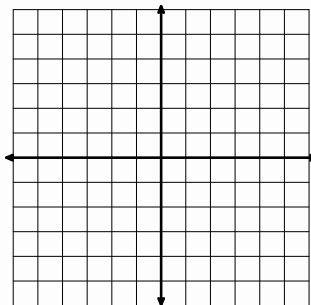
Go

For problems 12 and 13, the y-intercept and the slope of a line are given. Graph the line on the coordinate axes, clearly labeling the slope and y-intercept.

12. $(0, 2); m = \frac{3}{4}$



13. $(0, -3); m = 4$



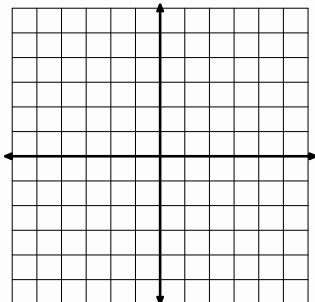
The equations below are represented in the above graphs. Explain how the slope and y-intercept show up in both the graph and algebraic representations.

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

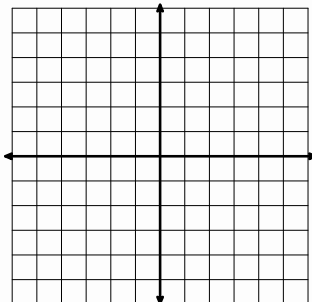
$$y = 4x - 3$$

For problems 14-16, graph the following equations on the provided coordinate axes.

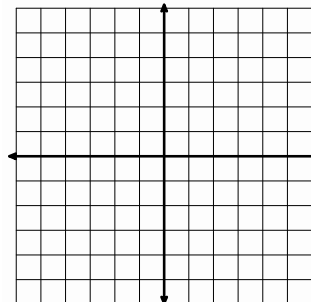
14. $y = 2x - 1$



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



16. $y = -3x + 5$



Need Help? Check out these related videos:

<http://www.khanacademy.org/math/algebra/solving-linear-equations/v/solving-equations-1>

<http://www.khanacademy.org/math/algebra/linear-equations-and-inequalities/v/graphing-a-line-in-slope-intercept-form>

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1.3 Serving Up Symbols

A Develop Understanding Task

As you look around your school cafeteria, you may see many things that could be counted or measured. To increase the efficiency of the cafeteria, the cafeteria manager, Elvira, decided to take a close look at the management of the cafeteria and think about all the components that affect the way the cafeteria runs. To make it easy, she assigned symbols for each count or measurement that she wanted to consider, and made the following table:



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Symbol	Meaning (description of what the symbol means in context)	Units (what is counted or measured)
<i>S</i>	Number of students that buy lunch in the cafeteria each day	<i>students</i> or <i>students/day</i>
<i>S_M</i>	Number of students who have passed through a line in <i>M</i> minutes	
<i>C</i>	Number of classes per lunch period	
<i>P</i>	Number of lunch periods per day	
<i>B</i>	Number of boys that buy lunch each day	<i>boys</i> or <i>students</i> or <i>boys/day</i>
<i>G</i>	Number of girls that buy lunch each day	
<i>F</i>	Number of food servers in the cafeteria	
<i>T</i>	Total number of food items in one lunch (Each entrée, side dish, or beverage counts as 1 item.)	
<i>M</i>	Number of minutes passed since the beginning of the lunch period	
<i>N_e</i>	Number of entrees in each lunch	
<i>N_s</i>	Number of side dishes in each lunch	
<i>N_b</i>	Number of beverages in each lunch	
<i>C_e</i>	Cost of each entrée	
<i>C_s</i>	Cost of each side dish	
<i>C_b</i>	Cost of each beverage	
<i>L</i>	Number of lines in the cafeteria	
<i>W</i>	The number of food servers per line	
<i>i</i>	Average number of food items that a server can serve each minute (Each entrée, side dish, or beverage counts as 1 item.)	
<i>H</i>	Number of hours each food server works each day	
<i>P_L</i>	Price per lunch	



Using the given symbols, it is possible to write many different algebraic expressions.

- Using these symbols, what would the expression $\frac{G+B}{C \times P}$ mean?
- Using these symbols, what would the expression $S + F + L$ mean?

Elvira hopes to use the symbols in the chart to come up with some meaningful expressions that will allow her to analyze her cafeteria. Your job is to help her by writing as many expressions as you can and describe what they mean. Put each of your expressions in the following chart, adding lines if you need to:

Expression	Description

Write an expression for the average number of lunches served in a line each day.

Write an expression for the total price of the items served in a line.



Name:

Getting Ready | 1.3

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Ready

Topic: Evaluating Expressions

Evaluate the following expressions for $a = -3$, $b = 2$, $c = 5$, and $d = -4$.

1. $2a + 3b$

2. $4c + d$

3. $5ac - 2b$

4. $\frac{2a}{c-d}$

5. $\frac{3b}{d}$

6. $\frac{a-4b}{3c+2d}$

The equation $c = 2000 + 3r$ represents the cost in dollars (c) of producing remote controls (r).

7. What is the cost of producing 1000 remote controls?

8. What is the cost of producing 2000 remote controls?

9. What is the cost of producing 2500 remote controls?

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Name:

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Set*Solve each equation, justifying each step you use.*

10.

$3x = 15$	Justification

11.

$x - 10 = 2$	Justification

12.

$-16 = x + 11$	Justification

13.

$6 - x = 10$	Justification

14.

$6x + 3 = 15$	Justification

15.

$3x - 10 = 2$	Justification



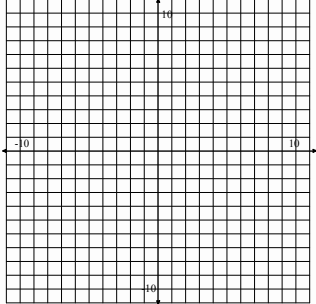
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Getting Ready | 1.3

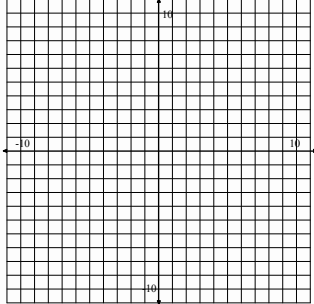
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Graph the following equations on the provided coordinate grids.

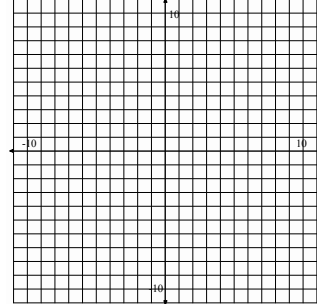
16. $y = -\frac{3}{5}x + 7$



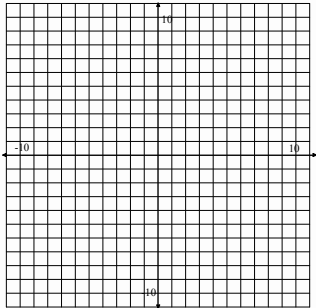
17. $y = -2x + 1$



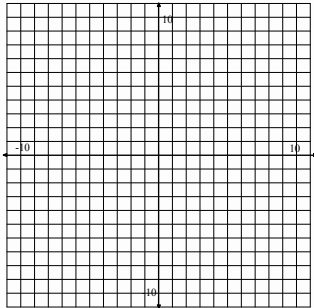
18. $y = \frac{5}{8}x + 1$



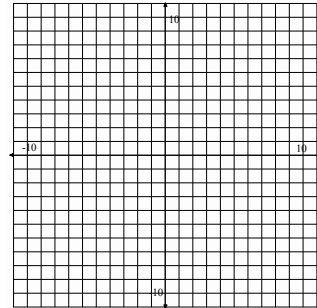
19. $y = \frac{6}{7}x$



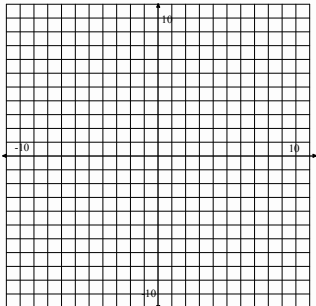
20. $y = x - 3$



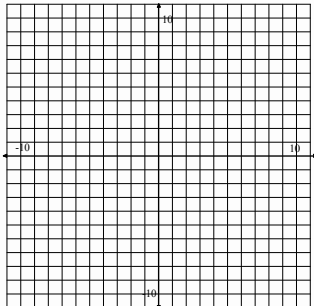
21. $y = 4x$



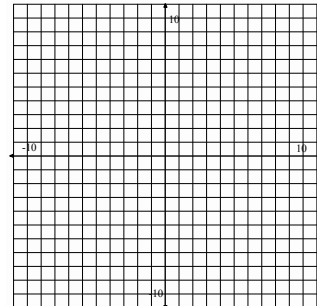
22. $y = -x - 6$



23. $y = 3x + 2$



24. $y = x$



Need Help? Check out these related videos:

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<http://www.khanacademy.org/math/algebra/linear-equations-and-inequalities/v/graphing-a-line-in-slope-intercept-form>

<http://www.youtube.com/watch?v=WXzpisUh0AU>



1.4 Examining Units

A Solidify Understanding Task

(Note: This task refers to the same set of variables as used in *Serving Up Symbols*)



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Units in Addition and Subtraction

1. Why can you add $N_e + N_s + N_b$ and you can add $B + G$, but you can't add $M + W$?
2. We measure real-world quantities in units like feet, gallons, students and miles/hour (miles per hour).
 - a. What units might you use to measure N_e , N_s and N_b ?
What about the sum $N_e + N_s + N_b$?
 - b. What units might you use to measure B ? G ?
What about the sum $B + G$?
 - c. What units might you use to measure M ? W ?
What about the sum $M + W$?
3. State a rule about how you might use units to help you think about what types of quantities can be added. How would you use or modify your rule to fit subtraction?

Units in Multiplication, scenario 1

1. Why can you multiply $N_e \times C_e$ and you can multiply $L \times W$, but you can't multiply $G \times C$?
2. Units in multiplication often involve rates like miles/gallon (miles per gallon), feet/second (feet per second), or students/table (students per table).
 - a. What units might you use to measure N_e ? C_e ?
What about the product $N_e \times C_e$?
 - b. What units might you use to measure L ? W ?
What about the product $L \times W$?
 - c. What units might you use to measure G ? C ?
What about the product $G \times C$?
3. State a rule about how you might use units to help you think about what types of quantities can be multiplied.



Units in Multiplication, scenario 2

1. Let ℓ represent the length of the cafeteria in feet and w represent its width in feet. What does $\ell + w + \ell + w$ represent? What about $\ell \times w$?
2. Why can we add $\ell + w$ and multiply $\ell \times w$? What is it about these variables that allow them to be added or multiplied?
3. How might you modify your rule for using units to guide your thinking when multiplying?

Units in Division, scenario 1

1. What are the units for the **dividend** (what you are dividing up), the **divisor** (what you are dividing by) and the **quotient** (the result of the division) in the following expressions:

a. $\frac{S}{P}$

b. $\frac{F}{L}$

c. $\frac{S}{F}$

d. $\frac{S_M}{M}$

2. State a rule about the units in division problems like those represented above.

Units in Division, scenario 2

1. What are the units for the dividend (what you are dividing up), the divisor (what you are dividing by) and the quotient (the result of the division) in the following expressions:

a. $\frac{F}{W}$

b. $\frac{P_L}{T}$

2. State a rule about the units in division problems like those represented above.



Name: _____

Getting Ready **4****Ready, Set, Go!**

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Ready

Topic: Solve and justify one variable equations

Solve each equation, justifying each step you use.

1. $8x - 10 = x + 11$	Justification	2. $5p - 2 = 32$	Justification
3. $10(y + 5) = 10$	Justification	4. $3x + 9 = 44 - 2x$	Justification



Set

Topic: Understanding variables

Use the task **Serving Up Symbols** to complete the table below.

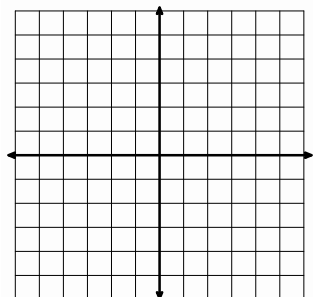
Expression	Description
$\frac{C}{L}$	
$\frac{C}{W}$	
$\frac{F}{L}$	
	Total beverages served in the cafeteria per day
	Average number of food items per week
	The average number of food items served per minute

Go

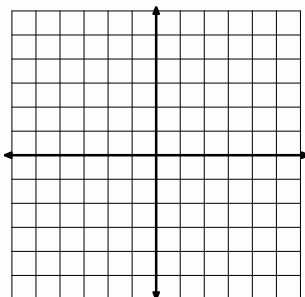
Topic: Graph linear equations

Graph each equation.

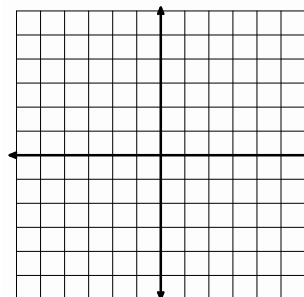
6. $y = 3x + 1$



7. $y = -2x + 3$

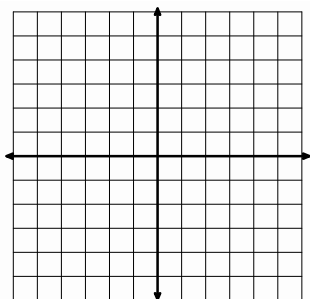


8. $y = \frac{1}{2}x - 5$

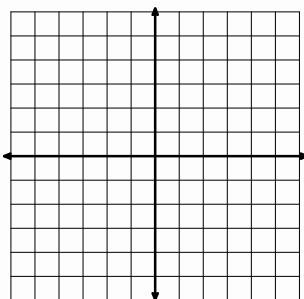


Getting Ready | 4

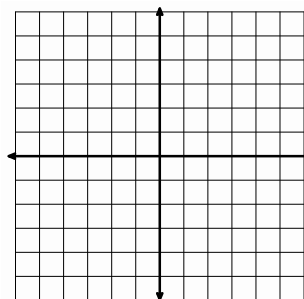
9. $y = -\frac{2}{3}x + 2$



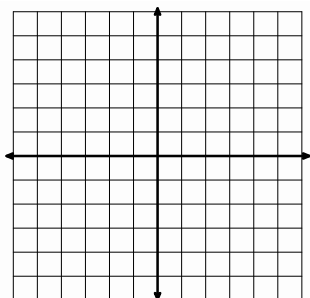
10. $y = 2x - 1$



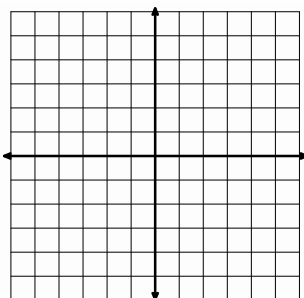
11. $y = -\frac{1}{2}x + 4$



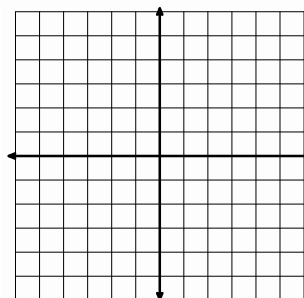
12. $y = 4x + 2$



13. $y = 2x$



14. $y = -3x + 5$



Need help? Check out these related videos:

<http://www.khanacademy.org/math/algebra/solving-linear-equations/v/solving-equations-1>

<http://www.khanacademy.org/math/algebra/linear-equations-and-inequalitie/v/graphing-a-line-in-slope-intercept-form>

<http://www.youtube.com/watch?v=WXzpisUh0AU>

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1.5 Cafeteria Actions and Reactions

A Develop Understanding Task

Elvira, the cafeteria manager, has just received a shipment of new trays with the school logo prominently displayed in the middle of the tray. After unloading 4 cartons of trays in the pizza line, she realizes that students are arriving for lunch and she will have to wait until lunch is over before unloading the remaining cartons. The new trays are very popular and in just a couple of minutes 24 students have passed through the pizza line and are showing off the school logo on the trays. At this time, Elvira decides to divide the remaining trays in the pizza line into 3 equal groups so she can also place some in the salad line and the sandwich line, hoping to attract students to the other lines. After doing so, she realizes that each of the three serving lines has only 12 of the new trays.



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“That’s not many trays for each line. I wonder how many trays there were in each of the cartons I unloaded?”

1. Can you help the cafeteria manager answer her question using the data in the story about each of the actions she took? Explain how you arrive at your solution.

Elvira is interested in collecting data about how many students use each of the tables during each lunch period. She has recorded some data on Post-It Notes to analyze later. Here are the notes she has recorded:

- Some students are sitting at the front table. (I got distracted by an incident in the back of the lunchroom, and forgot to record how many students.)
- Each of the students at the front table has been joined by a friend, doubling the number of students at the table.
- Four more students have just taken seats with the students at the front table.
- The students at the front table separated into three equal-sized groups and then two groups left, leaving only one-third of the students at the table.
- As the lunch period ends, there are still 12 students seated at the front table.

Elvira is wondering how many students were sitting at the front table when she wrote her first note. Unfortunately, she is not sure what order the middle three Post-It Notes were recorded in since they got stuck together in random order. She is wondering if it matters.

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2. Does it matter which order the notes were recorded in? Determine how many students were originally sitting at the front table based on the sequence of notes that appears above. Then rearrange the middle three notes in a different order and determine what the new order implies about the number of students seated at the front table at the beginning.
3. Here are three different equations that could be written based on a particular sequence of notes. Examine each equation, and then list the order of the five notes that is represented by each equation. Find the solution for each equation.

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

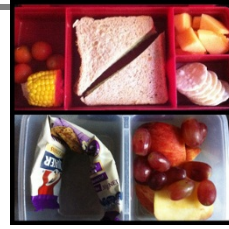
- $2\left(\frac{x}{3} + 4\right) = 12$

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



Name: _____

Getting Ready | 5



Ready, Set, Go!

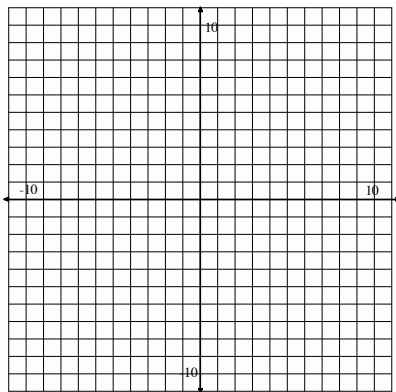
Ready

Topic: Solutions to an equation

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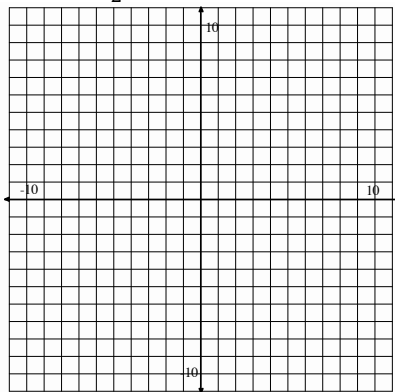
Graph the following equations using the coordinate graph, and then say if the given point is a solution to the equation.

1. $y = 5x - 2$



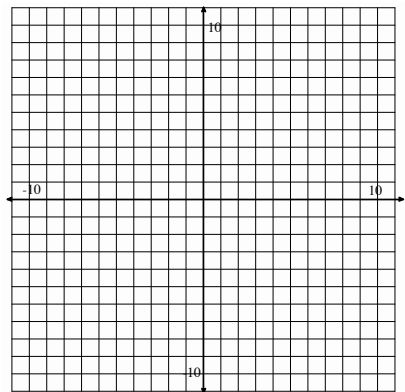
Point: (1, 3) Yes / No

2. $y = -\frac{1}{2}x + 8$



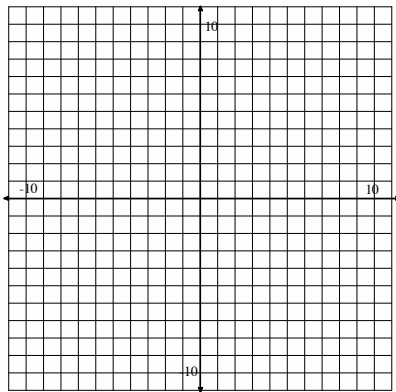
Point: (0, 4) Yes / No

3. $y = x + 4$



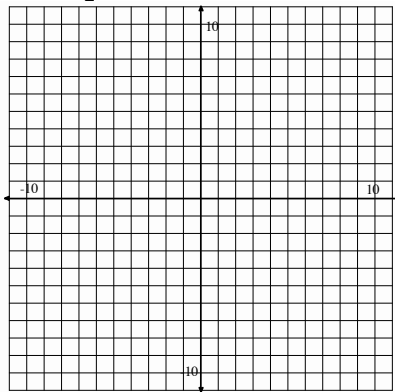
Point: (-2, 2) Yes / No

4. $y = x + 2$



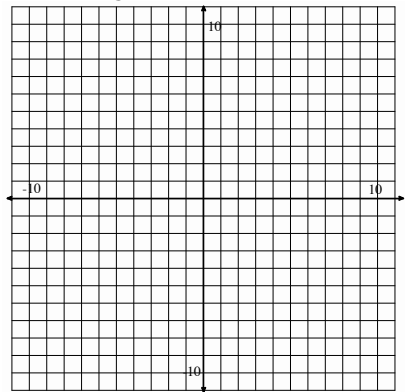
Point: (1, 3) Yes / No

5. $y = \frac{5}{2}x - 7$



Point: (2, -2) Yes / No

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



Point: (4, -6) Yes / No



Set

7. The solution to an equation is $n = -5$. The equation has parentheses on at least one side of the equation and has variables on both sides of the equation. What could the equation be?

8. Create a two-step equation that is true by expanding the given solution using properties of equality. Draw a model to represent your expanded equation.

a. $x = 3$

$m = -2$

$a = 0$

9. Without solving, determine if the two expressions are equivalent. Explain your reasoning.

a. $14 - (3a + 2) = 14 - 3a - 2$

b. $4a - 10 = 2(2a - 5)$

10. Without solving, determine if these two equations have the same solution.

$3(x - 5) = 35$ and $3x - 5 = 35$. Why or why not?

11. Which of the following expressions are equivalent?

$\frac{4t-10}{2}$

$\frac{4t}{2} - 10$

$2t - 10$

$4t - 5$



Go

Check whether the given number is a solution to the corresponding equation.

12. $a = -3$; $4a + 3 = -9$

13. $x = \frac{4}{3}$; $\frac{3}{4}x + \frac{1}{2} = \frac{3}{2}$

14. $y = 2$; $2.5y - 10.0 = -0.5$

15. $z = -5$; $2(5 - 2z) = 20 - 2(z - 1)$

Need Help? Check out these related videos:

<http://www.khanacademy.org/math/algebra/solving-linear-equations/v/solving-equations-1>

<http://www.khanacademy.org/math/algebra/linear-equations-and-inequalitie/v/graphing-a-line-in-slope-intercept-form>

<http://www.youtube.com/watch?v=WXzpisUh0AU>

<http://patrickjmt.com/an-intro-to-solving-linear-equations-what-does-it-mean-to-be-a-solution/>

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1.6 Elvira's Equations

A Solidify Understanding Task

(Note: This task refers to the same set of variables as used in *Serving Up Symbols*)



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Elvira, the cafeteria manager, has written the following equation to describe a cafeteria relationship that seems meaningful to her. She has introduced a new variable A to describe this relationship.

$$A = \frac{S}{CP}$$

1. What does A represent in terms of the school and the cafeteria?
2. Using what you know about manipulating equations, solve this equation for S . Your solution will be of the form $S = \text{an expression written in terms of the variables } A, C \text{ and } P$.
3. Does your expression for S make sense in terms of the meanings of the other variables? Explain why or why not.
4. Now solve the above equation for C and explain why the solution makes sense in terms of the variables.



Here is another one of Elvira's equations.

$$T_s = \frac{S(N_e + N_s + N_b)}{i}$$

5. What does T_s represent in terms of the school and the cafeteria?

(Hint: Elvira was really clever here. She recognized that the expression $N_e + N_s + N_b$ counted the number of *items/lunch*. She also noticed that since S represented the number of students that eat lunch each day, S also counted the number of *lunches* served. Using these new units, what would the product $S(N_e + N_s + N_b)$ mean? What would the quotient named T_s mean?)

6. Using what you know about manipulating equations, solve this equation for S .

7. Does your expression for S make sense in terms of the meanings of the other variables? Explain why or why not.

8. Now solve the above equation for N_e and explain why the solution makes sense in terms of the variables.



Name: _____

Getting Ready | 6

Ready, Set, Go!

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Ready

Topic: Solve literal equations

Solve each equation for x . Justify each step.

1. $ax = d$

2. $b + cx = d$

3. $ab + cx = d$

Set

Topic: Solve literal equations or writing linear equations in slope-intercept form

Rearrange the following equations to solve for y (slope-intercept form).

4. $4x + y = 3$

5. $2y = 6x + 9$

6. $5x - 2y = 10$

7. $3x + 6y = 25$

8. $x - 8y = 12$

9. $3x - 7y = 20$

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Go

Topic: Create and solve equations for real world problems

Create an equation that describes each of the situations below, then solve.

10. The cost of a birthday party at Classic Boon is \$200 plus \$4 per person. The cost for Fletcher's party came to \$324. How many people came to his party?

11. A cell phone company charges \$55 per month for unlimited minutes plus \$0.25 per text sent. If the charges to Dayne's cell phone for last month came to \$100, how many texts did Aly send?

12. Aly has baked an apple pie and wants to sell it in her bakery. She is going to cut it into 12 slices and sell them individually. She wants to sell it for three times the cost of making it. The ingredients cost \$8.50, and she allowed \$1.25 to cover the cost of electricity to bake it. Find the values for each of the following questions:

- a) What is the amount Aly will charge for each slice of pie?
- b) What is the total amount she will gross if she sells the entire pie?
- c) What will be the profit if she sells the entire pie?

Need Help? Check out these related videos:

Solve and justify two step equations using properties of equality <http://www.youtube.com/watch?v=WXzpisUh0AU>

Rearrange equations to highlight a variable: solve literal equations

<http://www.khanacademy.org/math/algebra/solving-linear-equations/v/example-of-solving-for-a-variable>

1.7 Solving Equations, Literally

A Practice Understanding Task



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Solve each of the following equations for x :

1. $\frac{3x+2}{5} = 7$

2. $\frac{3x+2y}{5} = 7$

3. $\frac{4x}{3} - 5 = 11$

4. $\frac{4x}{3} - 5y = 11$

5. $\frac{2}{5}(x+3) = 6$

6. $\frac{2}{5}(x+y) = 6$

7. $2(3x+4) = 4x+12$

8. $2(3x+4y) = 4x+12y$

Write a verbal description for each step of the equation solving process used to solve the following equations for x . Your description should include statements about how you know what to do next. For example, you might write, "First I _____, because _____."

9. $\frac{ax+b}{c} - d = e$

10. $r \cdot \sqrt{\frac{mx}{n}} + s = t$



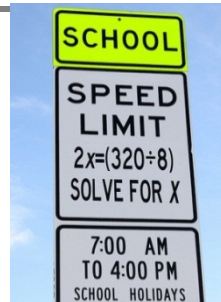
Name:

Getting Ready | 1.7

Ready, Set, Go!

Ready

Topic: Inequalities



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Use the inequality $4 < 6$ to complete each row in the table.

Apply each operation to the original inequality $4 < 6$	Result	Is the inequality true or false?
1. Add 4 to both sides		
2. Add -4 to both sides		
3. Subtract 10 from both sides		
4. Multiply both sides by 4		
5. Divide both sides by 2		
6. Multiply both sides by -3		
7. Divide both sides by -2		

In general, what operations, when performed on an inequality, *reverse* the inequality?

Set

Topic: Solve literal equations

Solve for the indicated variable.

8. Solve the following equation to isolate F : $C = \frac{5}{9}(F - 32)$

9. For $V = \frac{1}{3}\pi r^2 h$, rewrite the formula to isolate the variable h .

10. The area formula of a regular polygon is $A = \frac{1}{2}Pa$. The variable a represents the apothem and P represents the perimeter of the polygon. Rewrite the equation to highlight the value of the perimeter, P .

11. The equation $y = mx + b$ is the equation of a line. Isolate the variable m .

12. The equation $y = mx + b$ is the equation of a line. Isolate the variable x .

13. $Ax + By = C$ is the standard form for a line. Isolate the equation for x .

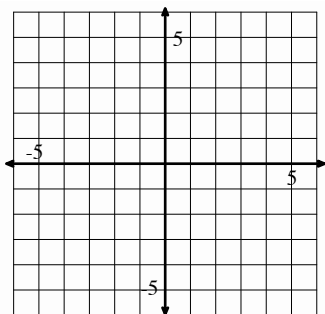
14. $Ax + By = C$ is the standard form for a line. Isolate the equation for y .

Go

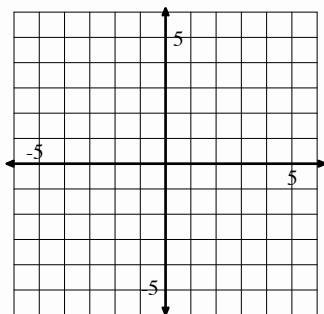
Topic: Solve systems of linear equations

Solve linear equations and pairs of simultaneous linear equations (simple, with a graph only) by graphing both lines and finding where they intersect. Justify the solution numerically.

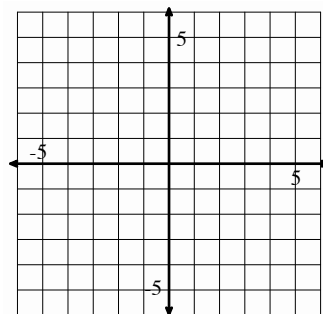
15. $y = x + 3$ and $y = -x + 3$



16. $y = 3x - 6$ and $y = -x + 6$



17. $2x = 4$ and $y = -3$



Need Help? Check out these related videos:

<http://www.khanacademy.org/math/algebra/solving-linear-inequalities/v/equations-and-inequalities>

<http://www.khanacademy.org/math/algebra/solving-linear-equations/v/solving-for-a-variable>

<http://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/v/solving-linear-systems-by-graphing>

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1.8 Cafeteria Conundrums

A Solidify Understanding Task

Between serving and preparing delicious school lunches, our cafeteria manager, Elvira, is busy analyzing the business of running the cafeteria. We previously saw the symbols for some of the things that she measured. Now she plans to use those symbols. Help Elvira to consider the pressing questions of the lunch room.



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Symbol	Meaning
S	Number of students that buy lunch in the cafeteria each day
S_m	Number of students who have passed through a line in m minutes
C	Number of classes per lunch period
P	Number of lunch periods per day
B	Number of boys that buy lunch each day
G	Number of girls that buy lunch each day
F	Number of food servers in the cafeteria
T	Total number of food items in one lunch (Each entrée, side dish, or beverage counts as 1 item.)
M	Number of minutes passed since the beginning of the lunch period
N_e	Number of entrees in each lunch
N_s	Number of side dishes in each lunch
N_b	Number of beverages in each lunch
C_e	Cost of each entrée
C_s	Cost of each side dish
C_b	Cost of each beverage
L	Number of lines in the cafeteria
W	The number of food workers (servers) per line
i	Average number of food items that a worker can serve each minute (Each entrée, side dish, or beverage counts as 1 item.)
H	Number of hours each food worker works each day
P_L	Price per lunch



Write equations or inequalities to express some of the conditions that Elvira sees in the cafeteria.

1. Each lunch can have no more than 4 side dishes.
2. More boys eat school lunch than girls.
3. There can be no more than 7 food items in each lunch.
4. In each lunch, there are 3 more side dishes than entrees and twice as many beverages as entrees. Write an inequality in **one variable** that shows that the total number of food items in a lunch cannot be more than 7.
5. The cost of food in the lunch is the total of the cost of the entrée, the side dishes, and the beverages. Write an inequality that shows that the cost of the food in the lunch must be less than \$1.50.
6. To meet district guidelines, the total price of a lunch must be more than \$2.25, but less than \$3.50.
7. Elvira knows that the number of lines that she can open in the cafeteria depends on how many food servers she has in the cafeteria each day and how many workers are needed in each line. Write an inequality that shows this relationship.
8. Food workers are paid \$11.50 per hour. Elvira can't spend more than \$500 per day on employees. Write an inequality that relates the number of food workers to the amount spent each day on employees.
9. Elvira knows that the money she gets from selling lunches has to be greater than her costs.
 - a. Write an expression for the cost of employees each day
 - b. Write an expression for the cost of food each day
 - c. Write an expression that shows that the total cost of food and employees each day must be less than the amount she brings in from selling lunches.



Name:

Getting Ready | 8

Ready, Set, Go!

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Ready

Topic: Solving equations

Jesse was asked to solve an algebra problem. She submitted the following solution

$$4(x + 3) = 1$$

$$4x + 3 = 1$$

$$4x = -2$$

$$x = -2$$

1. Is Jesse's solution correct?
2. If it is correct, justify each step of her solution.
3. If it is incorrect, correct her solution, and explain to Jesse what she did wrong.

Set

Topic: Creating and solving real world problems

4. Jade is stranded downtown with only \$10 to get home. Taxis cost \$0.75 per mile, but there is an additional \$2.35 hire charge. Write a formula and use it to calculate how many miles she can travel with her money.
5. Jasmin's Dad is planning a surprise birthday party for her. He will hire a bouncy castle, and will provide party food for all the guests. The bouncy castle costs \$150 for the afternoon, and the food will cost \$3 per person. Andrew, Jasmin's Dad, has a budget of \$300. Write an equation and use it to determine the maximum number of guests he can invite.



6. Jane is baking cookies for a large party. She has a recipe that will make one batch of two dozen cookies, and she decides to make five batches. To make five batches, she finds that she will need 12.5 cups of flour and 15 eggs. Write an equation to describe each of the following situations. Then solve the problem.
- How many cookies will she make in all?
 - How many cups of flour go into one batch?
 - How many eggs go into one batch?
 - If Jane only has a dozen eggs on hand, how many more does she need to make five batches?
 - If she doesn't go out to get more eggs, how many batches can she make? How many cookies will that be?

Go

Topic: Solve systems of equations

Solve the following systems of equations by graphing. You may use a graphing calculator.

7. Mary's car has broken down and it will cost her \$1200 to get it fixed—or, for \$4500, she can buy a new, more efficient car instead. Her present car uses about \$2000 worth of gas per year, while gas for the new car would cost about \$1500 per year. After how many years would the total cost of fixing the car equal the total cost of replacing it?
8. Juan is considering two cell phone plans. The first company charges \$120 for the phone and \$30 per month for the calling plan that Juan wants. The second company charges \$40 for the same phone but charges \$45 per month for the calling plan that Juan wants. After how many months would the total cost of the two plans be the same?
9. A tortoise and hare decide to race 30 feet. The hare, being much faster, decides to give the tortoise a 20 foot head start. The tortoise runs at 0.5 feet/sec and the hare runs at 5.5 feet per second. How long until the hare catches the tortoise?

Need Help? Check out these related videos:

<http://www.youtube.com/watch?v=EWcllbr8Hqs&feature=related>

http://www.youtube.com/watch?v=ldYGiXSHa_Q

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1.9 Greater Than?

A Solidify Understanding Task

For each situation you are given a mathematical statement and two expressions beneath it.

1. Decide which of the two expressions is greater, if the expressions are equal, or if the relationship cannot be determined from the statement.
2. Write an equation or inequality that shows your answer.
3. Explain why your answer is correct.

Watch out—this gets tricky!

Example:

Statement: $x = 8$

Which is greater? $x + 5$ or $3x + 2$

Answer: $3x + 2 > x + 5$ because if $x = 8$, $3x + 2 = 26$, $x + 5 = 13$ and $26 > 13$.

Try it yourself:

1. Statement: $y < x$
Which is greater? $x - y$ or $y - x$
2. Statement: $2x - 3 > 7$
Which is greater? 5 or x
3. Statement: $10 - 2x < 6$
Which is greater? x or 2
4. Statement: $4x = 0$
Which is greater? 1 or x
5. Statement: $a > 0$, $b < 0$
Which is greater? ab or $\frac{a}{b}$

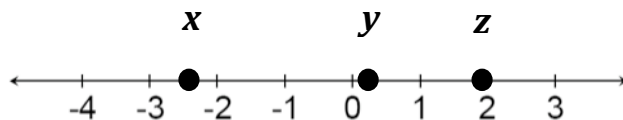


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6. Statement: n is an integer
Which is greater? n or $-n$

7. Statement:
Which is greater? 1 or yz



8. Statement: Use the number line in #7 and $x < w < y$
Which is greater? w or $-y$

9. Statement: $0 < x < 10$ and $0 < y < 12$
Which is greater? x or y

10. Statement: $3^{n+2} = 27$
Which is greater? n or 3

11. Statement: $5 > 4$
Which is greater? $5x$ or $4x$

12. Statement $x > y$
Which is greater? $x + a$ or $y + a$

13. Statement: $5 > 4$
Which is greater? $\frac{5}{x}$ or $\frac{4}{x}$

14. Statement: $x > y$ and $a > b$
Which is greater? $x - a$ or $y - b$

15. Statement: $x > 0, y > 0, \frac{x}{y} > 2$
Which is greater? $2y$ or x



Name: _____

Getting Ready | 1.9

Ready, Set, Go!

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Ready

Topic: Solve inequalities, create and solve equations.

Solve the following inequalities for x.

1. $2x - 9 < 3$

2. $4x - 3 < 13$

3. $6x - 4 < 26$

4. $3x - 5 \geq 10$

Create and solve the equations for the following problems.

5. Virginia's Painting Service charges \$10 per job and \$0.20 per square foot. If Virginia earns \$50 for painting one job, how many square feet did she paint at the job?

6. Renting the ice-skating rink for Dayne's birthday party costs \$200 plus \$4 per person. If the cost was \$324, how many people were at Dayne's birthday party?

Set

Topic: Solve inequalities

Solve each inequality. Write the solution as an inequality.

7. $x + 15 < 12$

8. $x - 4 \geq 13$

9. $9x > -\frac{3}{4}$

10. $3x - 7 \geq 3(x - 7)$

11. $x - 12 \geq 80$

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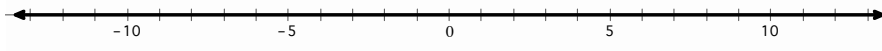
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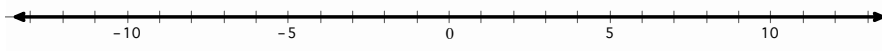


Solve each inequality and graph the solution on the number line.

12. $x - 2 \leq 1$

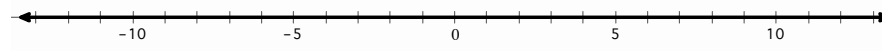


13. $x - 8 > -20$

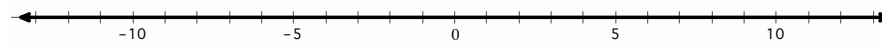


Solve each inequality. Write the solution as an inequality and graph it.

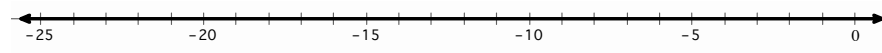
14. $3x \leq 6$



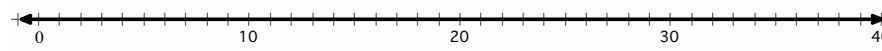
15. $\frac{x}{5} > -\frac{3}{10}$



16. $-10x > 150$



17. $\frac{x}{7} \geq -5$



Solve each multi-step inequality.

18. $x - 5 > 2x + 3$

19. $\frac{3(x-4)}{12} \leq \frac{2x}{3}$

20. $2(x - 3) \leq 3x - 2$



Go

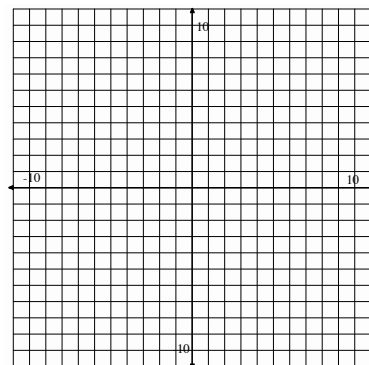
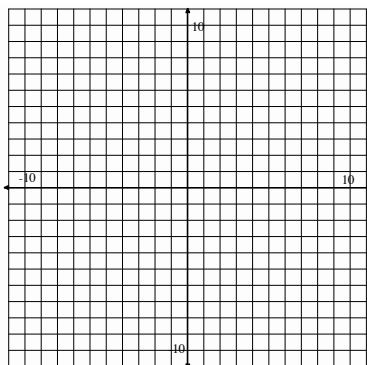
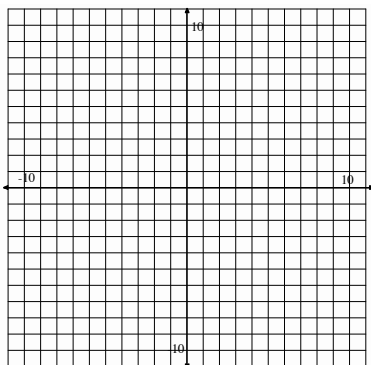
Topic: Solve systems of linear equations

Solve linear equations and pairs of simultaneous linear equations (simple, with a graph only). Justify the solution numerically.

$$21. \begin{cases} y = -x + 5 \\ -x + y = 1 \end{cases}$$

$$22. \begin{cases} x + 2y = 8 \\ 5x + 2y = 0 \end{cases}$$

$$23. \begin{cases} 3x + 2y = 12 \\ 4x - y = 5 \end{cases}$$



Need Help? Check out these related videos:

<http://www.khanacademy.org/math/algebra/solving-linear-inequalities/v/equations-and-inequalities>

<http://www.khanacademy.org/math/algebra/solving-linear-equations/v/solving-for-a-variable>

<http://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/v/solving-linear-systems-by-graphing>

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1.10 Taking Sides

A Practice Task

Joaquin and Serena work together productively in their math class. They both contribute their thinking and when they disagree, they both give their reasons and decide together who is right. In their math class right now, they are working on inequalities. Recently they had a discussion that went something like this:



Joaquin: The problem says that “6 less than a number is greater than 4.” I think that we should just follow the words and write $6 - x > 4$.

Serena: I don’t think that works because if x is 20 and you do 6 less than that you get $20 - 6 = 14$. I think we should write $x - 6 > 4$.

Joaquin: Oh, you’re right. Then it makes sense that the solution will be $x > 10$, which means we can choose any number greater than 10.

The situations below are a few more of the disagreements and questions that Joaquin and Serena have. Your job is to decide how to answer their questions, decide who is right, and give a mathematical explanation of your reasoning.

1. Joaquin and Serena are assigned to graph the inequality $x \geq -7$.
Joaquin thinks the graph should have an open dot -7 .
Serena thinks the graph should have a closed dot at -7 .
Explain who is correct and why.
2. Joaquin and Serena are looking at the problem $3x + 1 > 0$.
Serena says that the inequality is always true because multiplying a number by three and then adding one to it makes the number greater than zero.
Is she right? Explain why or why not.
3. The word problem that Joaquin and Serena are working on says, “4 greater than x ”.
Joaquin says that they should write: $4 > x$.
Serena says they should write: $x + 4$.
Explain who is correct and why.



4. Joaquin is thinking hard about equations and inequalities and comes up with this idea:
 If $45 + 47 = t$, then $t = 45 + 47$.
 So, if $45 + 47 < t$, then $t < 45 + 47$.
 Is he right? Explain why or why not.
5. Joaquin's question in #4 made Serena think about other similarities and differences in equations and inequalities. Serena wonders about the equation $-\frac{x}{3} = 4$ and the inequality $-\frac{x}{3} > 4$. Explain to Serena ways that solving these two problems are alike and ways that they are different. How are the solutions to the problems alike and different?
6. Joaquin solved $-15q \leq 135$ by adding 15 to each side of the inequality. Serena said that he was wrong. Who do you think is right and why?
- Joaquin's solution was $q \leq 150$. He checked his work by substituting 150 for q in the original inequality. Does this prove that Joaquin is right? Explain why or why not.
- Joaquin is still skeptical and believes that he is right. Find a number that satisfies his solution but does not satisfy the original inequality.
7. Serena is working is checking her work with Joaquin and finds that they disagree on a problem. Here's what Serena wrote:
- $$3x + 3 \leq -2x + 5$$
- $$3x \leq -2x + 2$$
- $$x \leq 2$$
- Is she right? Explain why or why not?
8. Joaquin and Serena are having trouble solving $-4(3m - 1) \geq 2(m + 3)$. Explain how they should solve the inequality, showing all the necessary steps and identifying the properties you would use.



9. Joaquin and Serena know that some equations are true for any value of the variable and some equations are never true, no matter what value is chosen for the variable. They are wondering about inequalities. What could you tell them about the following inequalities? Do they have solutions? What are they? How would you graph their solutions on a number line?
- a. $4s + 6 \geq 6 + 4s$
 - b. $3r + 5 > 3r - 2$
 - c. $4(n + 1) < 4n - 3$
10. The partners are given the literal inequality $ax + b > c$ to solve for x . Joaquin says that he will solve it just like an equation. Serena says that he needs to be careful because if a is a negative number, the solution will be different. What do you say? What are the solutions for the inequality?



Name:

Getting Ready | 10

Ready, Set, Go!

Ready

Topic: Solving equations and inequalities



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1. The local amusement park sells summer memberships for \$50 each. Normal admission to the park costs \$25; admission for members costs \$15.
 - a. If Darren wants to spend no more than \$100 on trips to the amusement park this summer, how many visits can he make if he buys a membership with part of that money?
 - b. How many visits can he make if he does not?
 - c. If he increases his budget to \$160, how many visits can he make as a member?
 - d. How many can he make as a non-member?

2. Jae just took a math test with 20 questions, each worth an equal number of points. The test is worth 100 points total.
 - a. Write an equation relating the number of questions Jae got right to the total score he will get on the test.
 - b. If a score of 70 points earns a grade of *C-*, how many questions would Jae need to get right to get a *C-* on the test?
 - c. If a score of 83 points earns a grade of *B*, how many questions would Jae need to get right to get a *B* on the test?
 - d. Suppose Jae got a score of 60% and then was allowed to retake the test. On the retake, he got all the questions right that he got right the first time, and also got half the questions right that he got wrong the first time. What percent did Jae get right on the retake?



Set

Topic: Solve and justify one variable inequalities

Solve each inequality, justifying each step you use.

3.

$x - 5 < 35$	Justification

4.

$x + 68 \geq 75$	Justification

5.

$2x - 4 \leq 10$	Justification

6.

$5 - 4x \leq 17$	Justification

7.

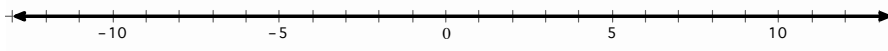
$\frac{x}{-3} > -\frac{10}{9}$	Justification

8.

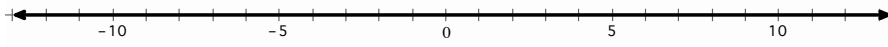
$2(x - 3) \leq 3x - 2$	Justification

Solve each inequality and graph the solution on the number line.

9. $x - 8 > -20$



10. $x + 11 > 13$



Solve each multi-step inequality.

11. $4x + 3 < -1$

12. $4 - 6x \leq 2(2x + 3)$

13. $5(4x + 3) \geq 9(x - 2) - x$

14. $\frac{2}{3}x - \frac{1}{2}(4x - 1) \geq x + 2(x - 3)$

Topic: Solve literal equations

15. Solve the following equation to isolate C : $F = \frac{9}{5}C + 32$

16. For $V = \frac{1}{3}\pi r^2 h$, rewrite the formula to isolate the variable r .

17. The area formula of a regular polygon is $A = \frac{1}{2}Pa$. The variable a represents the apothem and P represents the perimeter of the polygon. Rewrite the equation to highlight the value of the apothem, a .

18. The equation $y = mx + b$ is the equation of a line. Isolate the variable b

19. The equation for the circumference c of a circle with radius r is $c = 2\pi r$. Solve the equation for the radius, r .

20. The equation for the area of a circle A with diameter d is $A = \pi \frac{d^2}{4}$. Solve the equation to isolate the diameter, d .

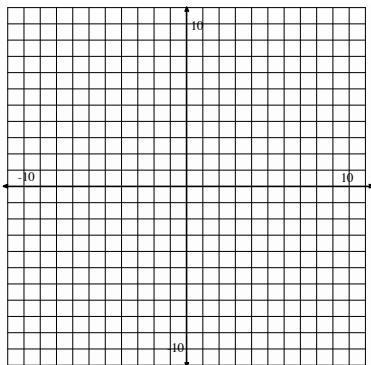


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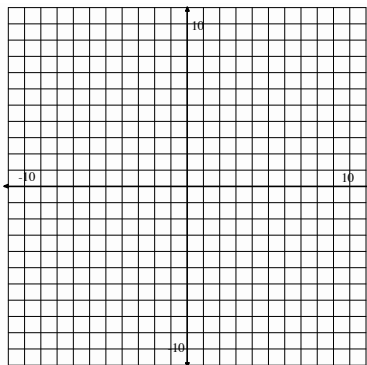
Topic: Solve systems of equations

Solve linear equations and pairs of simultaneous linear equations (simple, with a graph only). Justify the solution numerically.

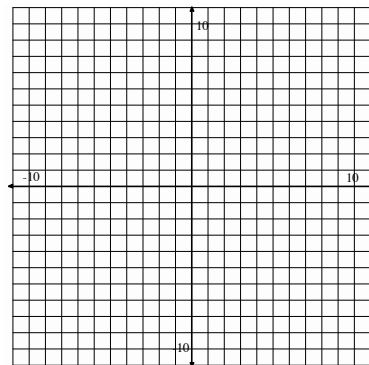
$$21. \begin{cases} y = 2x + 5 \\ -x + y = 1 \end{cases}$$



$$22. \begin{cases} 3x - 2y = 16 \\ x + 2y = 0 \end{cases}$$



$$23. \begin{cases} 3x + 2y = 11 \\ 4x - y = 10 \end{cases}$$



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