**Barron’s Let’s Review Regents – Algebra I**

# Chapter 7: Linear Inequalities

## 7.1 One-Variable Linear Inequalities

A linear equation line has just one solution, . This changes when the = is replaced with a > or a <. The inequality does not have 8 as a solution, but it does have many other solutions, including 9, 10, and 11. Solving one-variable linear inequalities is very similar to solving one-variable linear equations with one important exception – dealing with negative coefficients.

**When both sides of an inequality are divided by a negative number, the direction of the inequality sign must be reversed.** For example, it is true that  
 6 > 4. However, if both sides are divided by -2, the inequality would say -3 > -2, which is not true.

**Example 1**

What is the solution set to the inequality   
?

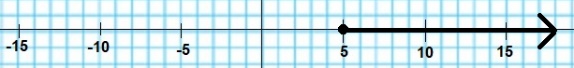
**Example 2**

What is the smallest integer that is a solution for x in the inequality   
Answer: 5

**Example 3**

If and x = -2, what is the greatest integer value for a stat satisfies this inequality?  
  
(1) -6

### Check Your Understanding of Section 7.1

1. Multiple-Choice
2. What is the solution set for   
   **(3)**
3. What is the solution set for ?  
   **(1)**
4. What is the solution set for ?  
   **(3)**
5. What is the solution set for ?  
   **(3)**
6. What is the smallest integer that satisfies the inequality ?  
   **(2) 4**
7. What is the smallest integer that satisfies the inequality ?  
   **(2) 3**
8. What is the greatest integer that satisfies the inequality ?  
   **(3) 6**
9. What is the greatest integer that satisfies the inequality ?  
   **(2) 7**
10. Which number satisfies the inequality   
    ?  
    **(4) -4**
11. What is the smallest number that satisfies the inequality ?  
    **(1) -15**
12. Show how you arrived at your answers.
13. Graph the solution set to the inequality   
     on a number line.  
    
14. Alejandra says that has the solution set . Lorenzo says that it has the solution set . Which student is correct and why?  
      
    **Lorenzo is correct.**  
    **When both sides of an inequality are divided by a negative number, the direction of the inequality sign must be reversed.**
15. Genevieve solves the inequality the following way:  
      
    Is this a valid way of finding the solution set? Explain why or why not.  
      
    **Her method produces the correct answer, but it is a long way to do it. Also, the steps involve the Addition Property of Equality. Whether this property can be extended to inequalities appears to work.**
16. What is the solution set of the inequality
17. Josephine has $60 and wants to go to a restaurant. The bill, including a 20% tip, must be no more than $60. The inequality for what the price of the meal without the tip is   
    . What is the solution set for this inequality?

## 7.2 Graphing Two-Variable Linear Inequalities

The graph of a linear equation, like , is a line. When the = is replaced by a or , the graph becomes a *half plane*. The process of creating the graph for the solution set to the inequality first requires graphing a line and then deciding which side of the line to shade.

**Graphing Inequalities Involving or Signs**

The equation :

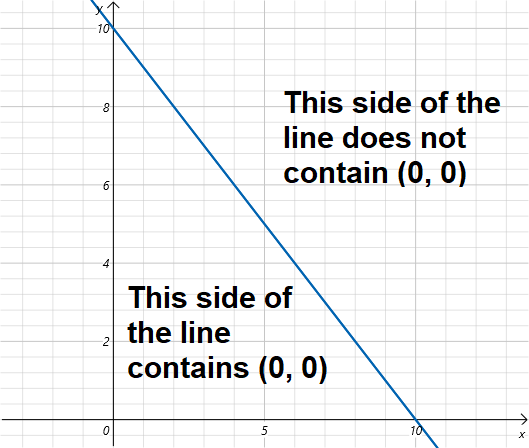
A graph of a line

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When the = sign is replaced with the symbol, it becomes the two-variable inequality .

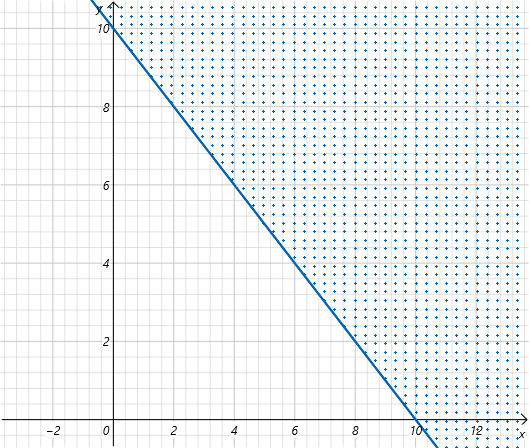
A math equation with black letters

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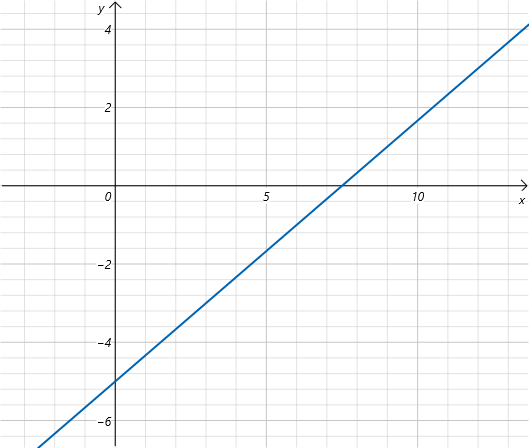
A math equation with a square and a square with black text

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**Example 1**

Graph the solution set to the inequality .

First, graph the line , which will be the boundary between the shaded and unshaded regions.  


Since (0, 0) is not on the line, test to see if (0, 0) satisfies the inequality.

Since 0 is greater than -5, (0, 0) is part of the solution set. Shade the side of the line that contains (0, 0).

A black and white math equation

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A graph paper with a point in the corner

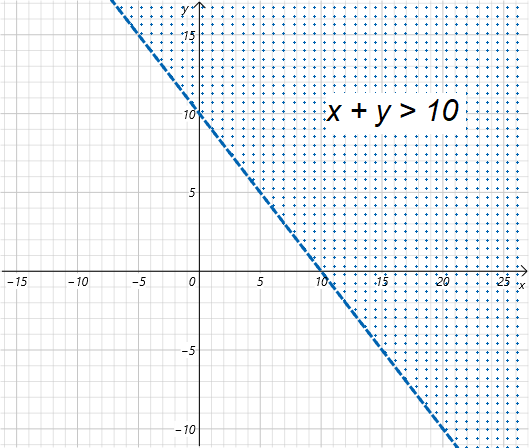
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**Graphing Inequalities Involving > or < Signs**

When the two-variable inequality contains a > or < sign, the only difference is that when the line is graphed it must be a dashed line. For the inequality , the ordered pair (2, 8) does not make it true since 2 + 8 is equal to 10, not greater than 10.  
A graph of x and y on a graph paper

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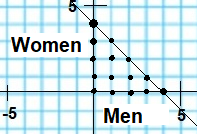
Check (0, 0) to determine whether to shade the side containing (0, 0) or the other side of the dashed line.  
Since this is not true, shade the side of the dashed line that does not contain (0, 0).



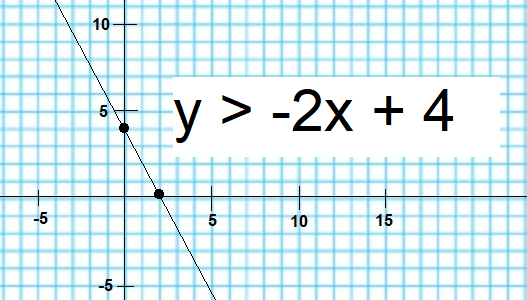
If the symbol in a two-variable inequality is a greater than sign (>) or a less than sign (<), the line separating the shaded half plane from the unshaded half plan will be dashed. If the symbol is a greater than or equal to sign () or a less than or equal to sign (), the line will be solid.

**Graphing Two-Variable Inequalities on the Graphing Calculator**

### Check Your Understanding of Section 7.2

1. Multiple-Choice
2. Which is the graph of y < x + 4.  
   **(4)**
3. Which is the graph of ?  
   **(1)**
4. This is the graph of which inequality?  
   **(2)**
5. Which is the graph of the inequality   
   ?  
   **(1)**
6. Which is the graph of ?  
   **(2)**
7. Which is the graph of ?  
   **(2)**
8. Which is a solution to the inequality  
   ?  
   **(2) (12, 8)**
9. Below is a graph of . Which is a point in the solution set?  
   **(4) (3, 5)**
10. All of these ordered pairs are part of the shaded region for the graph of   
     except  
    **(3) (5, 3)**
11. Which point would not be a good point for checking which side of the line to shade for inequality ?  
    **(2) (0, 4)**
12. Show how you arrived at your answers.
13. A small elevator has a capacity of 4 people. On the graph below, make points indicating valid combinations of men and women who could be in the elevator.  
    
14. What is the inequality that has this solution set?  
    Point 2: (2, 4)  
    Point 1: (0, 3)  
    Check with (0,0)
15. Ryan is graphing the solution set to the inequality . After drawing the line   
    , he tests the point (0,0) and finds that   
     is true. Does he now have enough information about which side of the line to shade? Explain.  
      
    No. (0, 0) is on the line. The procedure suggests or requires that a point is picked that is not on the line and this allows determining which section to shade. A better point would be (0, 1).
16. Graph the solution set for the inequality   
    . Dividing by -1 gives:  
    Points for:

|  |  |
| --- | --- |
| **x** | **y** |
| 0 | 4 |
| 2 | 0 |

Check for (0, 0)  
 is false.  
  
  
  
A screenshot of a math equation

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A graph of a function

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1. Juice costs $2 a point. Milk costs $3 a pint. If you have $12, make a graph that shows all possible combintaions of juice and milk you can purchase.  
   x = number of juice pints  
   y = number of milk pints

|  |  |
| --- | --- |
| x | y |
| 0 | 4 |
| 6 | 0 |

## 7.3 Graphing Systems of Linear Inequalities

Systems of two linear equations usually have one ordered pair that satisfies both equations. For systems of two lineary inequalities, there are many solutions. These solutions are most easily solved by graphing the two inequalities and finding the intersections of the two shaded regions. The solution will look like a rectangle.

Systems of Linear Inequalities

The sytem of equations

has the single solution (6, 4).

The system of inequalities

should be solved by graphing.

A screenshot of a math problem

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A graph of a triangle and a yellow triangle

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**Graphing Systems of Inequalities with the Graphing Calculator**

Consider:

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The point (4, 0) satisfies both inequalities. The point (0, 0) does not satisfy the second inequality.

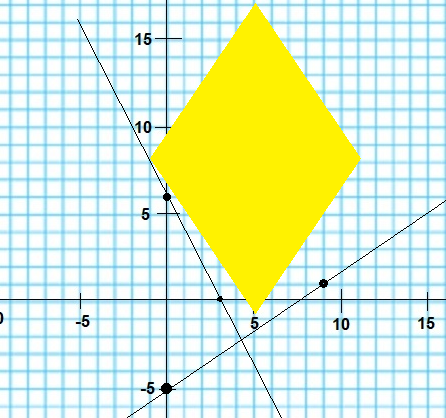
A graph of a line and a triangle

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### Check Your Understanding of Section 7.3

1. Multiple-Choice
2. (7, 1) is in the solution set for which system of inequalities?  
     
   **(1)**
3. Which graph shows the solution to the system of inequalities?

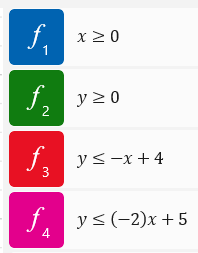
Point (3, 0) fails the second inequality.  
Point (3, 6) passes on both inequalities.  
**(2)**

1. Which system of inequalities does the following graph show the solution for?  
   Points (2, 0) and (4, 2) are both on the solid line. (That requires an equality – either or ). Point (0, 0) is in the solution set.  
     
   **(1)**
2. Which graph shows the solution to the system of inequalities?  
     
   Point (4, 0) does not satisfy either inequality.  
   Point (0, 6) satisfies both inequalities.  
     
   **(3)**
3. Which graph has the solution set shaded in for the following system of inequalities?  
     
   **(1)**
4. Which graph shows the solution set shaded in for the following system of inequalities?  
     
   both inequalities.  
     
   Point (-4, 0) does not satisfy the second inequality.  
     
   **(2)**
5. Which is the graph of this system of inequalities?  
     
   **(2)**
6. What system of inequalities does the graph below show the solution for?  
     
   (1), (2) Point (0, 0) does not satisfy the first inequality.  
   (3) Point (0, 0) satisfies both inequalities.  
   (4) Point (0, 0) does not satisfy the second inequality  
     
   **(3)**
7. An elevator can hold at most 10 people and at most 1,200 pounds. Children weigh an average of 60 pounds each, and adults weigh an average of 130 pounds each. If x is the number of children and y is the number of adults, which system of inequalities can be used to model all the allowable combinations of children and adults that can ride the elevator?  
     
   **(2)**
8. The graph below is the solution set to a system of inequalities where is one of the inequalities. What is the other inequality.  
     
   **(4)**
9. Show how you arrived at your answers.
10. On graph paper, make a graph of the solution to the system of inequalities.  
    6, 0) satisfies both inequalities.  
      
      
      
    A screenshot of a math problem

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A screenshot of a graph

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1. Find the system of inequalities for which this graph shows the solution.  
     
   Point 2: (2, 3), Point 1: (0, 2)
2. Johan goes to a store selling used books. He wants to buy at most 50 books and spend at most $90. Paperback books cost $0.75, and hardcover books cost $2.50. Create a system of linear inequalities that could be used to determine all the different combinations of paperback and hardcover books he can purchase.  
     
   x – number of paperback books  
   y – number of hardcover books
3. Movie tickets cost $8 for children and $12 for adults. A movie theatre has 300 seats. The theatre wants to collectd at least $3,200. What system of inequalities could be used to determine all the different combinations of children and adult tickets that would fit in the theatre and produce the money the theatre wants to collect?  
     
   c – number of children  
   a – number of adults
4. In economics, the feasible region for production can sometimes be modeled with a system of four inequalities. What would the graph of the solution below look like based on a problem from economics?  
     
     
   A yellow and red line on a graph paper

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