

Unit 6: Inequalities ~ Learning Guide

Name: _____

Instructions:

Using a pencil, complete the following questions as you work through the related lessons.

Show ALL work as is explained in the lessons. Do your best and ask your instructor if you don't understand any questions!

Lesson One

Solving Linear Inequalities

1. Describe each of the following inequality symbols.

a) $>$

b) $<$

c) $\geq$

d) $\leq$

2. Describe the following in words.

a) $-4 \geq x$

b) $18 > y \geq -5$

c) $-7 < x \leq -3$

3. Solve the following inequalities.

a) $x + 12 > 9$

b) $4x \leq 11$

c) $5x - 4 \geq 6$

d) $7 + 5x \geq x - 1$

4. Solve the following inequalities.

a) $2a + 1 \leq 3a - 4$

b) $10 - y \geq 8 - (-5y + 2)$

c) $\frac{x+2}{2} \geq \frac{3-x}{6}$

5. Solve the following inequalities.

a) $-2x + 5 < -7$

b) $-4x + 10 \geq -2$

c) $-2(x + 5) + 10 \leq x - 6$

6. a) Give an example of when we would collect **discrete** data (as oppose to **continuous** data)?

b) Give an example of when we would collect data **continuous** (as oppose to discrete data)?

7. Write the following using set notation and state whether it represents **discrete** or **continuous** data.

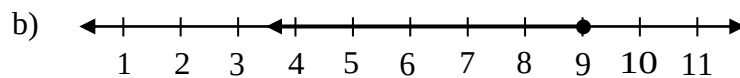
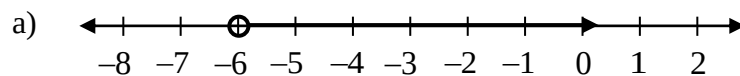
a) x is an element of the set of Integers such that x is less than or equal to 3.

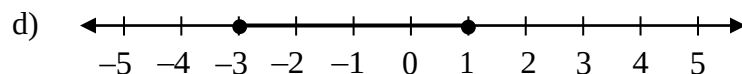
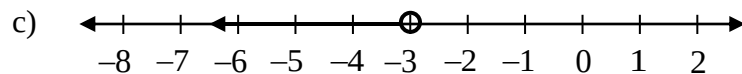
discrete or continuous

b) y is an element of the set of Real numbers such that y is greater than 5.

discrete or continuous

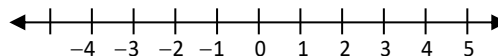
8. Write a word statement AND an algebraic statement to represent each inequality.



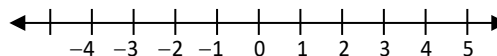


9. Solve the following inequalities and then graph on the number line.

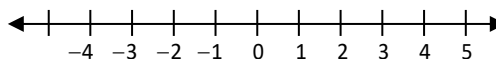
a) $6 + 3(x + 2) > -x + 16$



b) $\frac{2(x-3)}{5} + \frac{1}{10} < \frac{3(3-2x)}{2}$



c) $-5[2 - (1 + a)] \geq 25 + 7(2a - 3)$



Lesson Two

Solving Quadratic Inequalities

1. a) What do we call the *critical points* that get plotted on the number line when solving a quadratic inequality?

b) Give an example of an inequality where we would use **solid** dots.

c) How many **intervals** do they divide the number line into?

d) How do **test values** help us find our solution?

2. Solve each of the following quadratics using a number line.

a) $x^2 + 4x - 5 < 0$

b) $x^2 - x - 6 \geq 0$

c) $5x^2 + 5x - 30 > 0$

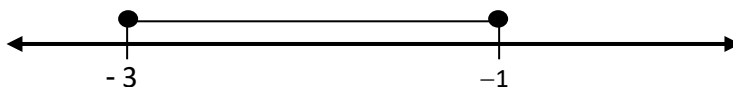
d) $(x - 3)^2 + 5 > 0$

e) $2x^2 - 3x - 3 \leq 0$

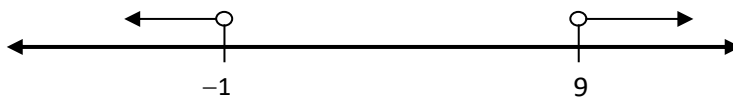
f) $\frac{x^2}{3} + \frac{x}{4} < \frac{1}{12}$

3. Write a quadratic inequality statement that represents each of the following solutions.

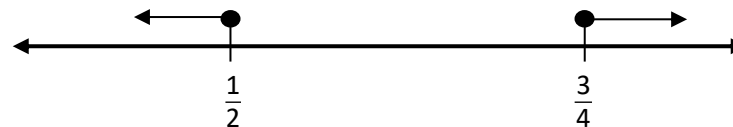
a)



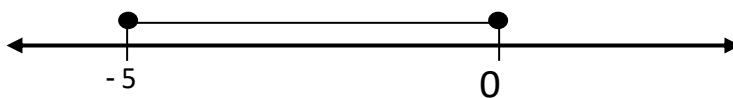
b)



c)



d)



Lesson Three

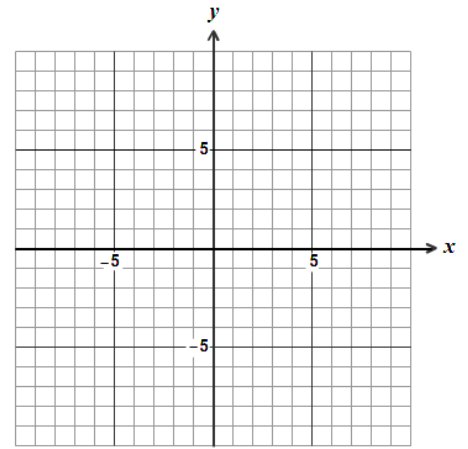
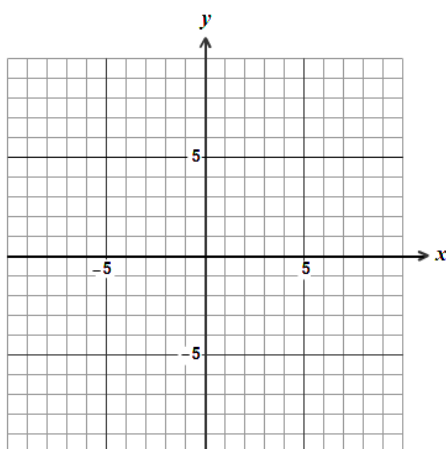
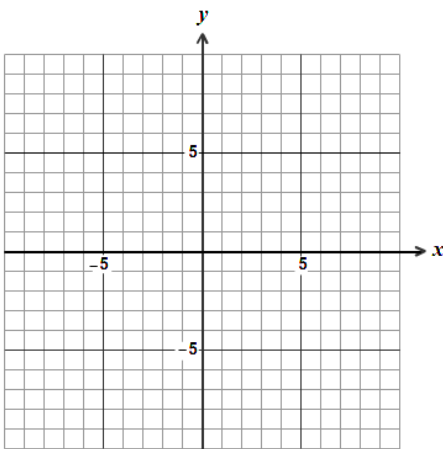
Solving Inequalities by Graphing

1. Graph each inequality on a grid. Use the y-intercept and the slope to find two points.

a) $y < -x + 3$

b) $3y \geq 4x + 6$

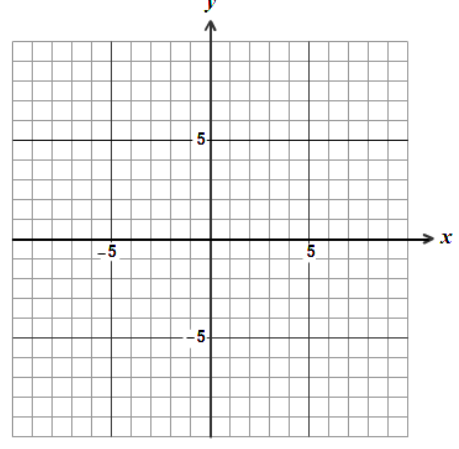
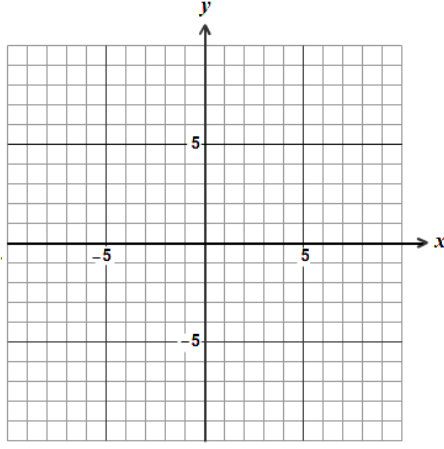
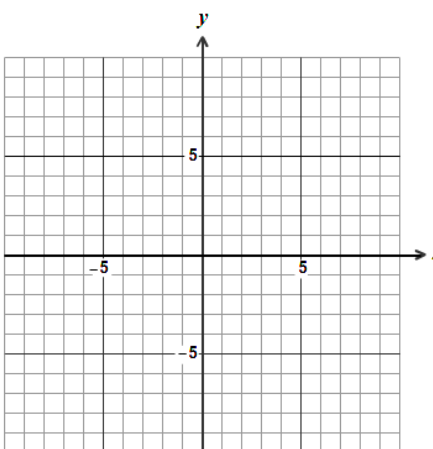
c) $3x - 2y - 8 \leq 0$



d) $\frac{x}{4} - \frac{y}{5} > \frac{1}{5}$

e) $x - y \geq 4$ if $x > 0$ and $y \leq -2$

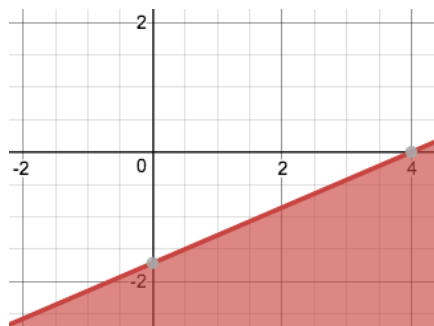
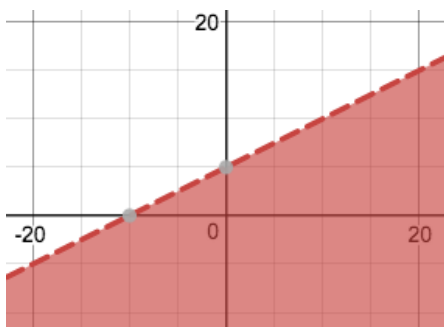
f) $y > -\frac{1}{2}x + 2$ if $x > 1$ and $y > 1$



2. Write a **linear** inequality statement for each of the following graphs.

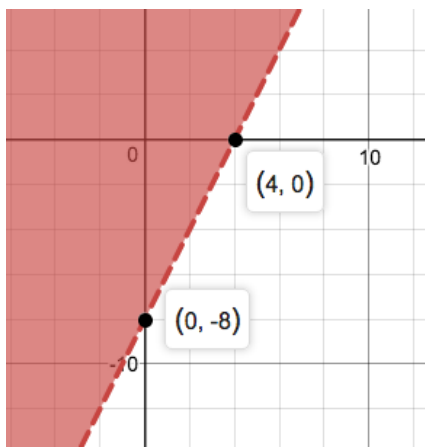
a) Equation of boundary line: $y = \frac{x}{2} + 5$

b) $3x - 7y = 12$

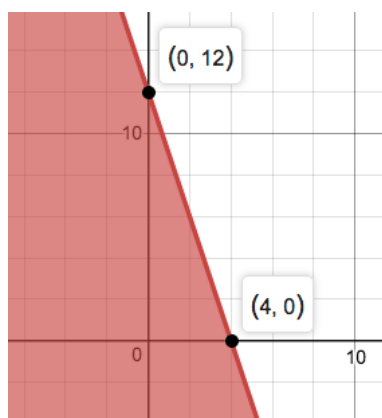


3. Write an inequality statement that represents the graph.

a)

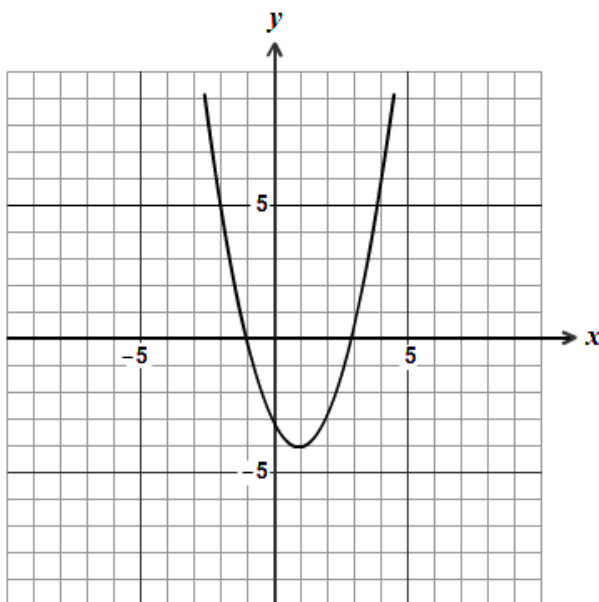


b)

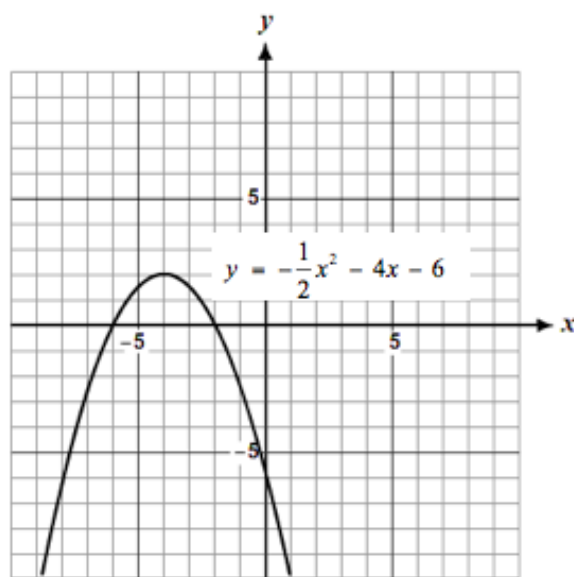


4. When you are solving quadratic equations in two variables by graphing, the origin (0,0) is a good test point. Why is that?

5. Given the graph of a quadratic function write the solution for the following quadratic inequality $x^2 - 2x - 3 \geq 0$. Use the graph of the **quadratic function** to answer the quadratic inequality.

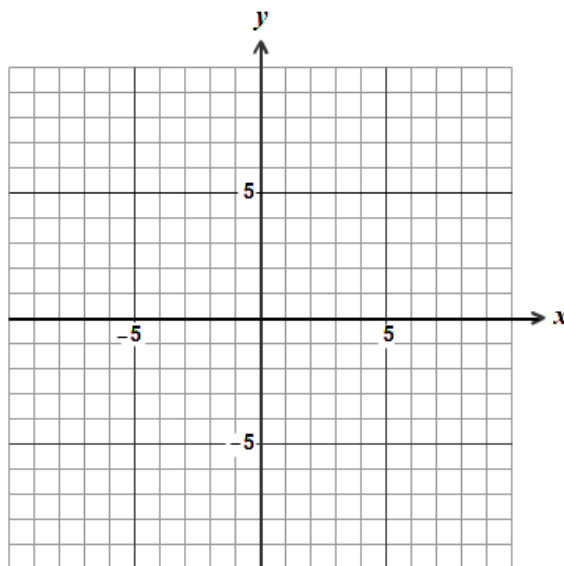


6. Given the graph of a quadratic function write the solution for the following quadratic inequality $-\frac{1}{2}x^2 - 4x - 6 > 0$. Use the graph of the **quadratic function** to answer the quadratic inequality.

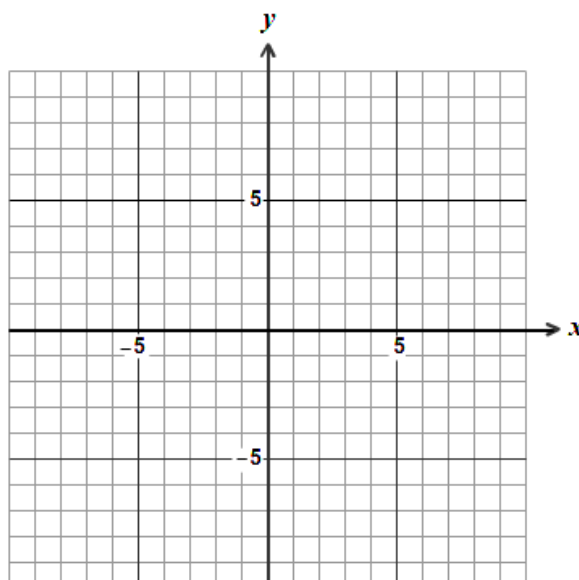


7. Solve the following quadratic inequalities in two variables by graphing.

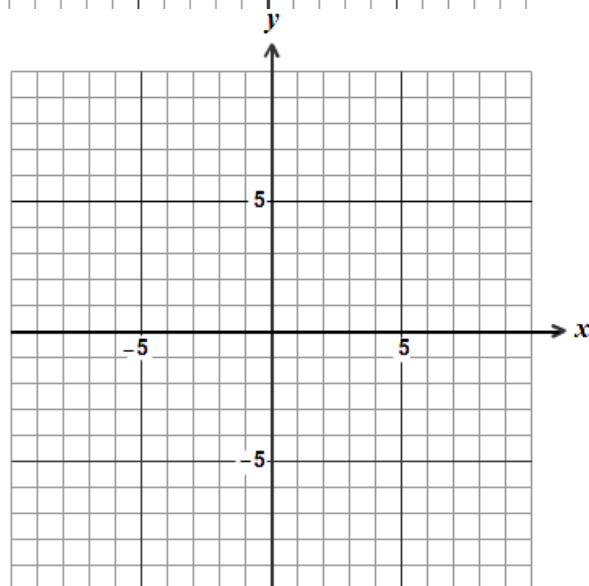
a) $y > 4(x - 5)^2 - 5$



b) $y \leq -2x^2 + 16x - 24$



c) $y > \frac{1}{3}(x - 1)^2 - 3$



8. Is the point $(-1, 20)$ is a solution for $y \leq \frac{1}{2}(x - 5)^2 + 2$? Show work to support your answer for full marks.

Lesson Four

Sign Analysis

1. Solve each quadratic inequality using sign analysis. **Show all work for full marks.**

a) $(x - 3)(x + 4) \geq 0$

b) $(x - 7)(x - 2) \leq 0$

c) $x^2 - 2x - 8 \geq 0$

d) $x^2 + 4x + 3 \geq 0$

e) $x^2 + 2x - 15 \leq 0$

f) $x^2 - 6x + 8 > 0$

g) $-12x^2 + 5x + 3 > 0$

h) $-2x^2 + 10 < 8x$

i) $2x^2 - 7x + 3 > 0$

j) $x^4 - 10x^2 + 9 \geq 0$

2. Solve each rational inequality using sign analysis.

a) $\frac{(x-3)(x+4)}{x-1} \leq 0$

b) $\frac{x+3}{(x-1)(x-4)} \geq 0$

c) $\frac{x+6}{x^2+6x+8} \geq 0$

d) $\frac{4}{x+2} > 2$

e) $\frac{x+3}{x^2-5x+6} \leq 0$

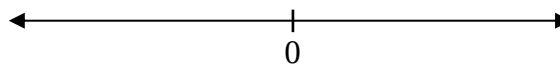
f) $\frac{x^2-9}{x+5} < 0$

g) $\frac{3}{x-4} \leq -1$

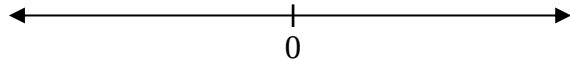
h) $\frac{3x+1}{x-1} \geq 2$

3. Solve the following inequalities using sign analysis. **Show all work for full marks.**

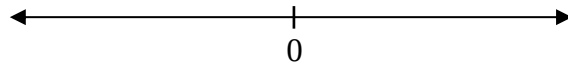
a) $-6x^2 - 7x + 3 \leq 0$



b) $\frac{4x-3}{x+2} \geq 3$



c) $\frac{x+4}{x^2-7x+6} \leq 0$



ANSWERS

Lesson One Solving Linear Inequalities

1. a) greater than b) less than c) greater than or equal d) less than or equal
2. a) x is less than or equal to -4 b) y is less than 18 and greater than or equal to -5 c) x is greater than -7 and less than or equal to -3
3. a) $x > -3$ b) $x \leq -\frac{11}{4}$ c) $x \geq 2$ d) $x \geq -2$ 4. a) $a \geq 5$ b) $y \leq \frac{2}{3}$ c) $x \geq -\frac{3}{4}$
5. a) $x > 6$ b) $x \leq 3$ c) $x \geq 2$ 6. a) When we are keeping track of separate or distinct parts, like number of correct answers on a quiz. b) When we are keeping track of data that could have ANY value, such as the temperature of a cooling solution. 7. a) $\{x \mid x \leq 3, x \in \mathbb{I}\}$ discrete b) $\{y \mid y \cdot 5, y \in \mathbb{R}\}$ continuous. 8. a) All values greater than -6, $x > -6$ b) All values less than or equal to 9, $x \leq 9$ c) All values less than -3, $x < -3$ d) The value is greater than or equal -3 and less than or equal to 1. $-3 \leq x \leq 1$.

9.a) $x > 1$

A number line from -5 to 5 with tick marks at every integer. An open circle is placed at 1, and the line is shaded to the right with an arrow.

b) $x < \frac{28}{17}$

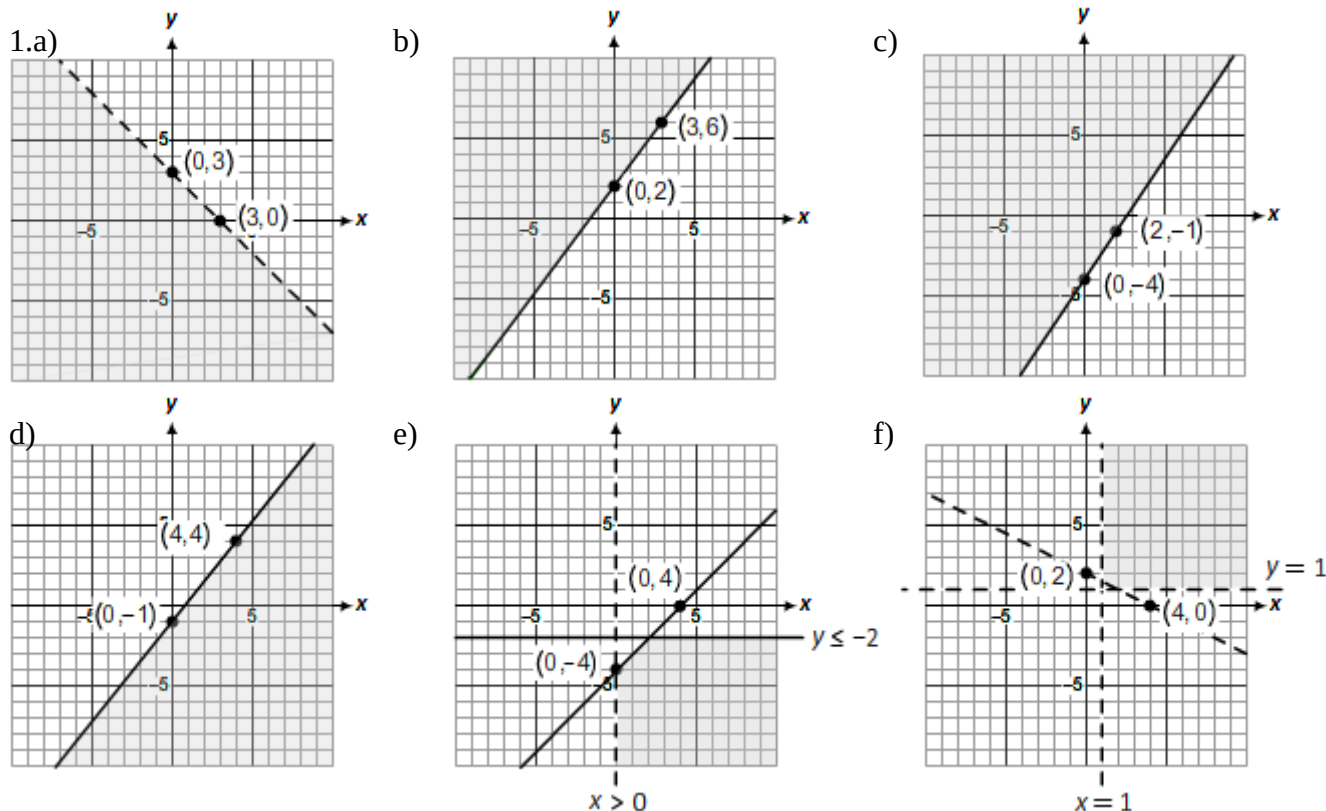
A number line from -5 to 5 with tick marks at every integer. An open circle is placed at 1, and the line is shaded to the left with an arrow.

c) $a \leq -1$

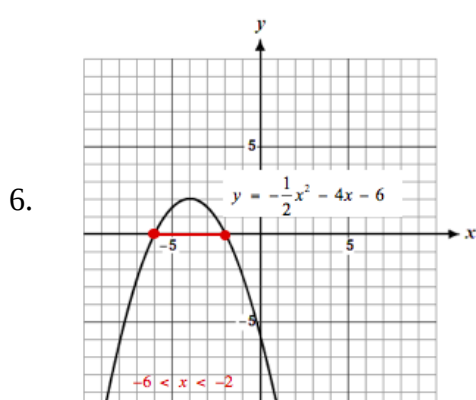
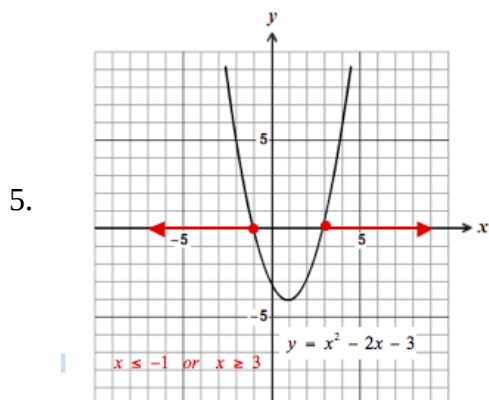
A number line from -4 to 5 with tick marks at every integer. A closed circle is placed at -1, and the line is shaded to the left with an arrow.

Lesson Two Solving Quadratic Inequalities

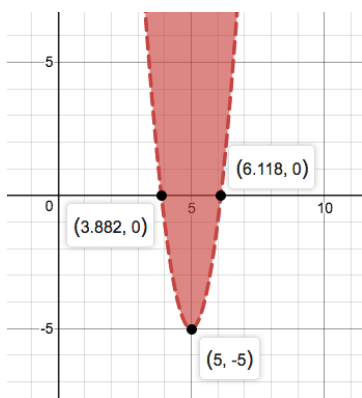
1. a) zeros b) Any inequality that includes the equal sign. c) 3 d) They help us to know whether they are part of the solution or not thereby letting us know if that interval is part of the solution. 2. a) $5 < x < 1, x \in \mathbb{R}$ b) $x \leq -2$ or $x \geq 3, x \in \mathbb{R}$ c) $x < -3$ or $x > 2, x \in \mathbb{R}$ d) no solution e) $\frac{3-\sqrt{33}}{4} \leq x \leq \frac{3+\sqrt{33}}{4}, x \in \mathbb{R}$ f) $-1 < x < \frac{1}{4}, x \in \mathbb{R}$
3. a) $x^2 + 4x + 3 \leq 0$ b) $x^2 - 8x - 9 > 0$ c) $8x^2 - 10x + 3 \geq 0$ d) $5x^2 - 5x \leq 0$

Lesson Three Solving Inequalities by Graphing

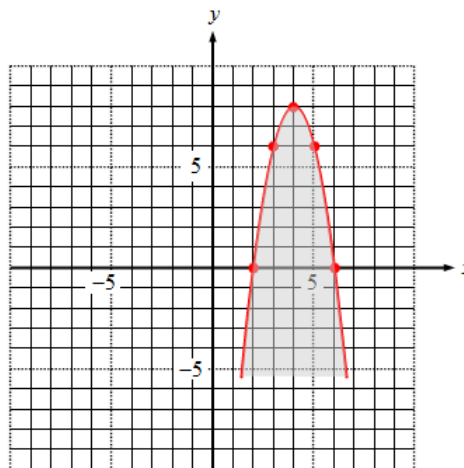
2. a) $y < \frac{x}{2} + 5$ b) $3x - 7y \geq 12$ 3. a) $y > 2x - 8$ b) $y \leq -3x + 12$
4. It simplifies the equation the quickest.



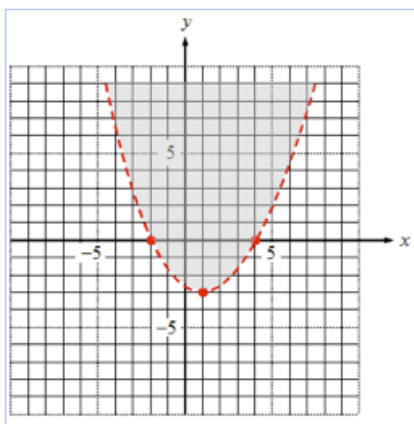
7. a)



b)



c)



8. yes

Lesson Four Sign Analysis

1. a) $(-\infty, -4] \cup [3, \infty)$ b) $[2, 7]$ c) $(-\infty, -2] \cup [4, \infty)$ d) $[-3, -1]$ e) $[-5, 3]$ f) $(-\infty, 2) \cup (4, \infty)$

g) $\left(-\frac{3}{4}, \frac{1}{3}\right)$ h) $(-\infty, -5) \cup (1, \infty)$ i) $\left(-\infty, \frac{1}{2}\right) \cup (3, \infty)$ j) $(-\infty, -3] \cup [-1, 1] \cup [3, \infty)$

2. a) $(-\infty, -4] \cup (1, 3]$ b) $[-3, 1) \cup (4, \infty)$ c) $[-6, -4) \cup (-2, \infty)$ d) $(-2, 0)$ e) $(-\infty, -3] \cup (2, 3)$

f) $(-\infty, -5) \cup [-3, 3]$ g) $[1, 4)$ h) $(-\infty, -3] \cup (1, \infty)$

3. a) $\left(-\infty, -\frac{3}{2}\right] \cup \left[\frac{1}{3}, \infty\right)$ b) $(-\infty, -2) \cup [9, \infty)$ c) $(-\infty, -4] \cup (1, 6)$