

# **Lesson 14: Solving Inequalities**

## Classwork

#### **Exercise 1**

- 1. Consider the inequality  $x^2 + 4x \ge 5$ .
  - a. Sift through some possible values to assign to *x* that make this inequality a true statement. Find at least two positive values that work and at least two negative values that work.
  - b. Should your four values also be solutions to the inequality  $x(x + 4) \ge 5$ ? Explain why or why not. Are they?
  - c. Should your four values also be solutions to the inequality  $4x + x^2 \ge 5$ ? Explain why or why not. Are they?
  - d. Should your four values also be solutions to the inequality  $4x + x^2 6 \ge -1$ ? Explain why or why not. Are they?

e. Should your four values also be solutions to the inequality  $12x + 3x^2 \ge 15$ ? Explain why or why not. Are they?





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## Example 1

What is the solution set to the inequality 5q + 10 > 20? Express the solution set in words, in set notation, and graphically on the number line.

## Exercises 2–3

2. Find the solution set to each inequality. Express the solution in set notation and graphically on the number line.

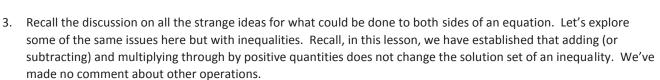
a.	$x + 4 \le 7$	b.	$\frac{m}{2} + 8 \neq 9$	c.	8y + 4 < 7y - 2
			3		

d. 
$$6(x-5) \ge 30$$
 e.  $4(x-3) > 2(x-2)$ 





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a. Squaring: Do  $B \le 6$  and  $B^2 \le 36$  have the same solution set? If not, give an example of a number that is in one solution set but not the other.

b. Multiplying through by a negative number: Do 5 - C > 2 and -5 + C > -2 have the same solution set? If not, give an example of a number that is in one solution set but not the other.

c. Bonzo's ignoring exponents: Do  $y^2 < 5^2$  and y < 5 have the same solution set?





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## Example 2

Jojo was asked to solve 6x + 12 < 3x + 6, for x. She answered as follows:

6x + 12 < 3x + 6

6(x+2) < 3(x+2) Apply the distributive property.

6 < 3 Multiply through by  $\frac{1}{x+2}$ .

a. Since the final line is a false statement, she deduced that there is no solution to this inequality (that the solution set is empty).

What is the solution set to 6x + 12 < 3x + 6?

b. Explain why Jojo came to an erroneous conclusion.

Example 3

Solve  $-q \ge -7$ , for q.









#### Exercises 4–7

- 4. Find the solution set to each inequality. Express the solution in set notation and graphically on the number line.
  - a. -2f < -16 b.  $-\frac{x}{12} \le \frac{1}{4}$
  - c.  $6-a \ge 15$  d. -3(2x+4) > 0

Recall the properties of inequality:

- Addition property of inequality:
   If A > B, then A + c > B + c for any real number c.
- Multiplication property of inequality:
   If A > B, then kA > kB for any positive real number k.
- 5. Use the properties of inequality to show that each of the following is true for any real numbers *p* and *q*.
  - a. If  $p \ge q$ , then  $-p \le -q$ . b. If p < q, then -5p > -5q.





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c. If  $p \le q$ , then  $-0.03p \ge -0.03q$ .

d. Based on the results from parts (a) through (c), how might we expand the multiplication property of inequality?

6. Solve -4 + 2t - 14 - 18t > -6 - 100t, for t in two different ways: first without ever multiplying through by a negative number and then by first multiplying through by  $-\frac{1}{2}$ .

7. Solve  $-\frac{x}{4} + 8 < \frac{1}{2}$ , for x in two different ways: first without ever multiplying through by a negative number and then by first multiplying through by -4.





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## **Problem Set**

- 1. Find the solution set to each inequality. Express the solution in set notation and graphically on the number line.
  - a. 2*x* < 10
  - b.  $-15x \ge -45$
  - c.  $\frac{2}{3}x \neq \frac{1}{2} + 2$
  - d.  $-5(x-1) \ge 10$
  - e. 13x < 9(1 x)
- 2. Find the mistake in the following set of steps in a student's attempt to solve  $5x + 2 \ge x + \frac{2}{5}$ , for x. What is the correct solution set?

$$5x + 2 \ge x + \frac{2}{5}$$
  

$$5\left(x + \frac{2}{5}\right) \ge x + \frac{2}{5} \quad \text{(factoring out 5 on the left side)}$$
  

$$5 \ge 1 \quad \text{(dividing by } \left(x + \frac{2}{5}\right)\text{)}$$

So, the solution set is the empty set.

- 3. Solve  $-\frac{x}{16} + 1 \ge -\frac{5x}{2}$ , for x without multiplying by a negative number. Then, solve by multiplying through by -16.
- 4. Lisa brought half of her savings to the bakery and bought 12 croissants for \$14.20. The amount of money she brings home with her is more than \$2.00. Use an inequality to find how much money she had in her savings before going to the bakery. (Write the inequality that represents the situation, and solve it.)





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