Lesson 33: From Equations to Inequalities

Student Outcomes

- Students understand that an inequality with numerical expressions is either true or false. It is true if the numbers calculated on each side of the inequality sign result in a correct statement and false otherwise.
- Students understand solving an inequality is answering the question of which values from a specified set, if any, make the inequality true.

Classwork

Example 1 (8 minutes)

Students will review their work from Lesson 23 and use this throughout the lesson.

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Example 1

What value(s) does the variable have to represent for the number sentence to be a true statement? What value(s) does the variable have to represent for the number sentence to be a false statement?

a. $y + 6 = 16$

The number sentence is true when y is 10. The sentence is false when y is any number other than 10.

b. $y + 6 > 16$

The number sentence is true when y is any number greater than 10. The sentence is false when y is 10 or any number less than 10.

c. $y + 6 \geq 16$

The number sentence is true when y is 10 or any number greater than 10. The sentence is false when y is a number less than 10.

d. $3g = 15$

The number sentence is true when g is 5. The number sentence is false when g is any number other than 5.

e. $3g < 15$

The number sentence is true when g is any number less than 5. The number sentence is false when g is 5 or any number greater than 5.

f. $3g \leq 15$

The number sentence is true when g is 5 or any number less than 5. The number sentence is false when g is any number greater than 5.

Example 2 (12 minutes)

Students move from naming the values that make the sentence true or false to using a set of numbers and determining whether or not the numbers in the set make the equation or inequality true or false.

Example 2

Which of the following numbers make the equation true? $\{0, 3, 5, 8, 10, 14\}$

a. $m + 4 = 12$

$m = 8$ *or* $\{8\}$

b. $m + 4 < 12$

$\{0, 3, 5\}$

- How does the answer to part (a) compare to the answer to part (b)?
  - *In part (a),* 8 *is the only number that will make the statement true. But in part (b), any number in the set that is less than* 8 *will make the statement true.*

c. $f - 4 = 2$

None of the numbers in the set will make a true sentence.

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d. $f - 4 > 2$

$\{8, 10, 14\}$

- Is there a number that we could include in the set so that part (c) will have a solution?
  - *Yes, the number* 6 *will make the equation in part (c) true.*
- Would 6 be part of the solution set in part (d)?
  - *No, the* 6 *would not make part (d) a true statement because* $6 - 4$ *is not greater than* 2*.*
- How could we change part (d) so that 6 would be part of the solution?
  - *Answers will vary; If the* $>$ *was changed to a* $\geq$*, we could include* 6 *in the solution set.*

e. $\frac{1}{2}h = 8$

None of the numbers in the set will make the statement true.

f. $\frac{1}{2}h \geq 8$

None of the numbers in the set will make the statement true.

- Which whole numbers, if any, make the inequality true?
  - *Answers will vary;* 16 *and any number greater than* 16 *will make the number sentence true.*

Exercises (16 minutes)

Students will practice either individually or in pairs.

Exercises

Choose the numbers that make the equation or inequality true from the following set of numbers: $\{0, 1, 5, 8, 11, 17\}$.

1. $m + 5 = 6$

   $m = 1$ *or* $\{1\}$

2. $m + 5 \leq 6$

   $\{0, 1\}$

3. $5h = 40$

   $h = 8$ *or* $\{8\}$

4. $5h > 40$

   $\{11, 17\}$

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

   There is no solution in the set.

6. $\frac{1}{2}y \leq 5$

   $\{0, 1, 5, 8\}$

7. $k - 3 = 20$

   There is no solution in the set.

8. $k - 3 > 20$

   There is no solution in the set.

Closing (3 minutes)

- In some of the equations and inequalities we worked within this lesson none of the numbers in the given set were solutions. What does this mean? Are there numbers that will make the statements true that are not in the set?
  - *None of the numbers in the set made a true statement. There are numbers that could make the statement true. For example, in Exercise 5, $y = 10$ would make a true statement.*
- Is it possible for every number in a set to make a true statement?
  - *Yes it is possible. For example, if the inequality says $x > 5$ and all the numbers in the set are greater than 5, then all the numbers in the set will make a true statement.*

- Consider the equation $y + 3 = 11$ and the inequality $y + 3 < 11$. How does the solution to the equation help you determine the solution set to the inequality?
  - *In the equation $y + 3 = 11$, $y = 8$ will make the statement true. In the inequality, we want $y + 3$ to be a value less than 11. So the numbers that will make it true must be less than 8.*

Exit Ticket (6 minutes)

Name _____ Date _____

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Exit Ticket

Choose the numbers that make the equation or inequality true from the following set of numbers: $\{3, 4, 7, 9, 12, 18, 32\}$.

1. $\frac{1}{3}f = 4$

2. $\frac{1}{3}f < 4$

3. $m + 7 = 20$

4. $m + 7 \geq 20$

Exit Ticket Sample Solutions

Choose the numbers that make the equation or inequality true from the following set of numbers: $\{3, 4, 7, 9, 12, 18, 32\}$.

1. $\frac{1}{3}f = 4$

   $f = 12$ or $\{12\}$

2. $\frac{1}{3}f < 4$

   $\{3, 4, 7, 9\}$

3. $m + 7 = 20$

   There is no number in the set that will make this equation true.

4. $m + 7 \geq 20$

   $\{18, 32\}$

Problem Set Sample Solutions

Choose the numbers that make the equation or inequality true from the following set of numbers: $\{0, 3, 4, 5, 9, 13, 18, 24\}$.

1. $h - 8 = 5$

   $h = 13$ or $\{13\}$

2. $h - 8 < 5$

   $\{0, 3, 4, 5, 9\}$

3. $4g = 36$

   $g = 9$ or $\{9\}$

4. $4g \geq 36$

   $\{9, 13, 18, 24\}$

5. $\frac{1}{4}y = 7$

   There is no number in the set that will make this equation true.

6. $\frac{1}{4}y > 7$

   There is no number in the set that will make this inequality true.

7. $m - 3 = 10$

   $m = 13$ or $\{13\}$

8. $m - 3 \leq 10$

   $\{0, 3, 4, 5, 9, 13\}$