Brain Game

3.4 Solving and Graphing Inequalities

MATERIALS • game cards

HOW TO PLAY

• Work with another student. Shuffle the cards you receive from your teacher. Then put them face down on your desk.
• Players will take turns flipping over three cards. If the cards are equivalent, they are a match. A match contains an inequality, the solution to the inequality, and the graph of the inequality, like the set below.

\[
\begin{align*}
  x + 4 &> -2 \\
  x &> -6 \\
  \cdot -7 -6 -5 -4 -3 -2 
\end{align*}
\]

• A player who makes a match keeps the cards and takes another turn. If the cards are not a match, the player turns the cards face down again and the next player takes a turn.
• The game is over when there are no cards left. The winner is the person with the most cards collected.

PRACTICE

Solve the inequality. Graph your solution.

1. \( x - 8 < -3 \)  
2. \( m + 6 \leq 4 \)  
3. \( t - 1 \geq -4 \)

4. \( 7 + x > 5 \)  
5. \( 4 < r - 3 \)  
6. \( x + 5 \leq 10 \)

7. \( -4 + n < 3.5 \)  
8. \( d + 5.75 \geq -6 \)  
9. \( 6.9 < y + 8.2 \)

10. How is solving an inequality using addition and subtraction like solving an equation using addition and subtraction? How is it different?
11. How do you know when to use an open circle or a closed circle when graphing an inequality?
<table>
<thead>
<tr>
<th>Game Cards</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x + 8 &gt; 3$</td>
<td>$x &gt; -5$</td>
</tr>
<tr>
<td>$x - 6 &gt; -3$</td>
<td>$x &gt; 3$</td>
</tr>
<tr>
<td>$x - 9 \geq -4$</td>
<td>$x \geq 5$</td>
</tr>
<tr>
<td>$x + 2 \leq -3$</td>
<td>$x \leq -5$</td>
</tr>
<tr>
<td>$4 + x \leq 2$</td>
<td>$x \leq -2$</td>
</tr>
<tr>
<td>$6 + x \geq 3$</td>
<td>$x \geq -3$</td>
</tr>
<tr>
<td>Inequality</td>
<td>Solution</td>
</tr>
<tr>
<td>------------------</td>
<td>----------</td>
</tr>
<tr>
<td>(-4 &gt; x + 2)</td>
<td>(x &lt; -6)</td>
</tr>
<tr>
<td>(8 \leq x + 6)</td>
<td>(x \geq 2)</td>
</tr>
<tr>
<td>(-4 \leq x - 5)</td>
<td>(x \geq 1)</td>
</tr>
<tr>
<td>(3 &gt; x + 4)</td>
<td>(x &lt; -1)</td>
</tr>
<tr>
<td>(x - 2.4 \leq 1.6)</td>
<td>(x \leq 4)</td>
</tr>
<tr>
<td>(x + 3.5 \geq -0.5)</td>
<td>(x \geq -4)</td>
</tr>
</tbody>
</table>
Answer Key

HOW TO PLAY

No answer key is provided. Each three-card set is matched horizontally on the original game sheets.

PRACTICE

1. \( x < 5; \)
2. \( m \leq -2; \)
3. \( t \geq -3; \)
4. \( x > -2; \)
5. \( r > 5; \)
6. \( x \leq 5; \)
7. \( n < 7.5; \)
8. \( d \geq -11.75; \)
9. \( y > -1.3; \)
10. Solving an inequality using addition and subtraction is the same as solving an equation using addition and subtraction. You use inverse operations to solve by adding (or subtracting) the same value from each side of the inequality or equation. It is different when you have a solution such as \( 4 < x \) and you need to rewrite it as \( x > 4 \). The inequality symbol and the values are reversed.
11. You use an open circle when graphing \( > \) or \( < \) inequalities. You use a closed circle when graphing \( \geq \) or \( \leq \) inequalities.
Teacher Notes

ACTIVITY PREPARATION AND MATERIALS

- Photocopy enough copies so that each pair has all 12 sets. Cut apart and store in sandwich bags or envelopes.
- If possible, photocopy the game cards on thicker or dark colored paper so students can not see through the cards when they are face down.
- Be sure to shuffle the cards before storing them in the baggie or envelope.
- If you want to focus solely on solving inequalities, eliminate the column of graphs.
- Decide on a method for determining who goes first. For example, you could have the person with the birthday closest to today go first or the oldest.

ACTIVITY MANAGEMENT

- If graphs of inequalities are new to your students, you may want to cover the material at the beginning of the lesson before starting this game.
- Pair students with a partner. Avoid groups of three if possible.
- Give students an extra piece of scrap paper so that computations can be checked as needed.
- Another way to play: Have students place about half of the cards face up on a desk. When a student finds a set, he or she says “I found a set” and points out the three cards. If the other player agrees that the cards match, the player who found them takes the cards and they are replaced from the remaining cards. Play can alternate (which will not result in a winner) or not (which will).
- **A-Level Alternatives** If students need practice recognizing graphs of inequalities you might choose to use only the solution and the graph cards. Also, you might want to replace the two inequalities which involve decimals and skip Exercises 7-9.
- **C-Level Alternatives** Replace some of the simpler inequalities with more complex ones that have the same solutions.
- **Common Error** Students sometimes forget to reverse the inequality symbol when they have solutions such as $4 > x$. Solution cards will always be written with the variable to the left of the inequality symbol.
Activity and Closure Questions

Ask these questions as a class.

Place these trios on the board or overhead and have students decide whether they form a set.

1. \( x + 4 \leq 6 \)  \( x = 2 \)

   \textbf{Answer:} They do not form a set.

2. \( x - 2 \geq -10 \)  \( x \geq -12 \)

   \textbf{Answer:} They do not form a set.

3. \( x - 3.2 < 1.8 \)  \( x < 5 \)

   \textbf{Answer:} They do form a set.

4. What steps were needed to solve the inequality?

   \textbf{Answer:} To solve the inequality, use inverse operations to solve for the variable.

5. How did you match the solution and the graph?

   \textbf{Answer:} You need to look for the correct endpoint, make sure that the shading is in the correct direction, and that the circle on the endpoint (open or closed) agrees with the inequality symbol in the solution.

\textbf{LESSON TRANSITION}

This is a post-lesson activity. It reinforces the skills of graphing and solving inequalities that students will be familiar with from Examples 2 and 3 of the lesson.