Quadratic Inequalities
Worksheet to Accompany Videotape #11

Example: \( x^2 - 2x > 3 \)

Steps

1. Rewrite expression so the inequality is \( >0 \) or \( <0 \).
2. Factor.
3. Find all values of \( x \) for which entire expression = 0.
4. Locate these numbers on the number line.
5. These numbers divide line into 3 parts.
6. Select a number from each part and examine signs of factors when \( x \) has chosen value.

Example

1. \( x^2 - 2x-3 > 0 \)
2. \( (x-3)(x+1) > 0 \)
3. \( x = 3, \ x = -1 \)
4. \( x < -1, \ -1 < x < 3, \ x > 3 \)
5. \( x < -1, \ -1 < x < 3, \ x > 3 \)

6. Take the part \( x < -1 \). Select any number in this part, say \( x = -3 \). Then for \( (x+1) \), we have \(-3+1 = -2\) or a negative number. Therefore \( (x+1) \) is negative in this part. Continuing the procedure for each factor and for each part, we obtain:

   For \( (x-3) \)
   \[
   \begin{array}{c|c|c|c}
   \ \ \ & - & + & + \\
   \ \ \ & \ | & \ | & \ | \\
   \end{array}
   \]

   For \( (x+1) \)
   \[
   \begin{array}{c|c|c|c}
   \ \ \ & - & + & + \\
   \ \ \ & \ | & \ | & \ | \\
   \end{array}
   \]

7. These signs determine the sign of the whole expression.
8. Since, in this example, we want numbers that make whole expression >0, we can only select values of x from first and third parts of the number line.

8. Solution:

\[
\begin{array}{cccc}
\circ & \times & \bullet & \circ \\
(x-3) & - & - & + \\
(x+1) & - & + & + \\
-1 & \quad & 3 & \quad \\
\end{array}
\]

\{x | x < -1 \text{ or } x > 3\} \text{ Set notation}

\((-\infty, -1) \text{ or } (3, +\infty)\) \text{ Interval notation}

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**For you to try:**

1. \(x^2 - 4x + 3 < 0\)
2. \(2x^2 + 3x \leq 14\)
3. \(3x^2 - 4x \geq 4\)
4. \(x^2 - 8x - 20 \leq 0\)
5. \(x^2 - 2x < 8\)
6. \(x^2 - 5x + 6 > 0\)
7. \(x^2 + 5x \leq 36\)
8. \(4x^2 + 7x < 15\)
9. \(2x^2 + x > 3\)
10. \(2x^2 + 3x - 2 < 0\)

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**Answers:**

1. \(1 < x < 3\)
2. \(\frac{-7}{2} \leq x \leq 2\)
3. \(x \leq \frac{-2}{3} \text{ or } x \geq 2\)
4. \(-2 \leq x \leq 10\)
5. \(-2 < x < 4\)
6. \(x < 2 \text{ or } x > 3\)
7. \(-9 \leq x \leq 4\)
8. \(-3 < x < \frac{5}{4}\)
9. \(x < \frac{-3}{2} \text{ or } x > 1\)
10. \(-2 < x < \frac{1}{2}\)