1. Solve the inequality \( x^2 - x - 12 \leq 0 \).

Express your answer in interval notation.

2. Solve the inequality \(-2x^2 > -11x + 15\).

Express your answer in interval notation.

3. Solve the inequality \( 3x^2 + 6x > 45 \).

Express your answer in interval notation.
Solutions

1. First we compute the roots. This quadratic we can factor by inspection as \((x-4)(x+3)\) so the roots are \(-3\) and \(4\). Since the leading coefficient is positive, we get the following sign chart.

<table>
<thead>
<tr>
<th></th>
<th>+</th>
<th>−</th>
<th>+</th>
</tr>
</thead>
<tbody>
<tr>
<td>−3</td>
<td></td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

Given that we want to solve

\[x^2 - x - 12 \leq 0,\]

the solution is \([-3, 4]\).

2. This is equivalent to solving

\[0 > 2x^2 - 11x + 15.\]

First we find the roots. This time, let’s use quadratic formula. We have \(a = 2, b = -11, c = 15\). The discriminant is

\[d = b^2 - 4ac = (-11)^2 - 4(2)(15) = 1.\]

The roots are

\[-\frac{b \pm \sqrt{d}}{2a} = -\frac{(-11) \pm \sqrt{1}}{2(2)} = 3, \frac{5}{2}\]

Since the leading coefficient is positive, we get the following sign chart.

<table>
<thead>
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<th></th>
<th>+</th>
<th>−</th>
<th>+</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\frac{5}{2})</td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

This gives that the solution is \((\frac{5}{2}, 3)\).

3. Solving this inequality is equivalent to solving

\[3x^2 + 6x - 45 > 0,\]

which is equivalent (by dividing by 3) to solving

\[x^2 + 2x - 15 > 0.\]

We factor by inspection to get \((x + 5)(x - 3)\), which yields roots \(-5\) and \(3\). This gives the following sign chart.

<table>
<thead>
<tr>
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<th>+</th>
<th>−</th>
<th>+</th>
</tr>
</thead>
<tbody>
<tr>
<td>−5</td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

That gives the solution \((-\infty, -5) \cup (3, \infty)\).