The Quadratic formula is a way to solve a quadratic function for the value of x. In order to solve an equation using the quadratic formula the equation must be set equal to zero. Sometimes a quadratic is not easy to factor or maybe you do not want to factor. The quadratic formula uses the numerical coefficients ‘a’, ‘b’, and ‘c’ from \( ax^2+bx+c \) to solve. The quadratic formula is:

\[
x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\]

To use the quadratic formula you substitute the a coefficient, b coefficient, and c coefficient and simplify. Look at this example:

Solve each equation with the quadratic formula

1. \( x^2+8x+7=0 \)
2. \( x^2-11x+10=0 \)
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>$x^2 + x - 90 = 0$</td>
</tr>
<tr>
<td>4.</td>
<td>$x^2 + 4x - 12 = 0$</td>
</tr>
<tr>
<td>5.</td>
<td>$x^2 - 10x + 9 = 0$</td>
</tr>
<tr>
<td>6.</td>
<td>$x^2 + 16x + 64 = 0$</td>
</tr>
<tr>
<td>7.</td>
<td>$x^2 + 2x - 24 = 0$</td>
</tr>
<tr>
<td>8.</td>
<td>$x^2 - 13x + 40 = 0$</td>
</tr>
<tr>
<td>9.</td>
<td>$x^2 + 11x + 18 = 0$</td>
</tr>
<tr>
<td>10.</td>
<td>$x^2 - x - 56 = 0$</td>
</tr>
</tbody>
</table>
Quadratic Formula Day 2

Let’s try when a is greater than 1

Solve each equation with the quadratic formula

1. \(2x^2+2x-12=0\)

2. \(2x^2+8x+6=0\)
3. \(2x^2 - 3x - 5 = 0\)  
4. \(3x^2 - 15x - 42 = 0\)  
5. \(2x^2 + 3x - 20 = 0\)

### Using the Discriminant Day 3

A positive discriminant indicates that the quadratic has two distinct real number solutions. A discriminant of zero indicates that the quadratic has a repeated real number solution. A negative discriminant indicates that neither of the solutions are real numbers. This is the discriminant: \(b^2 - 4ac\)

<table>
<thead>
<tr>
<th>If the discriminant is positive then there are two real roots</th>
<th>If the discriminant is zero then there are one real root (a double root)</th>
<th>If the discriminant is negative then there are two imaginary roots/no real roots</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="2 x-intercepts" /></td>
<td><img src="image2.png" alt="1 x-intercept" /></td>
<td><img src="image3.png" alt="0 x-intercepts" /></td>
</tr>
</tbody>
</table>
This has **two** solutions

\[ 3x^2 + 3x - 6 = 0 \]

\[
\begin{align*}
    b^2 - 4ac &= 3^2 - 4(3)(-6) \\
    &= 9 + 64 \\
    &= 72
\end{align*}
\]

Plug in \(a=3, \ b=3\), Multiply Add

This has **one** solution

\[ x^2 + 8x + 16 = 0 \]

\[
\begin{align*}
    b^2 - 4ac &= 8^2 - 4(1)(16) \\
    &= 64 - 64 \\
    &= 0
\end{align*}
\]

Plug in \(a=1, \ b=8\), Multiply Subtract

This has **no real solution**

\[ 2e^2 + 3e + 2 = 0 \]

\[
\begin{align*}
    b^2 - 4ac &= 3^2 - 4(2)(2) \\
    &= 9 - 16 \\
    &= -7
\end{align*}
\]

Plug in \(a=2, \ b=3\), Multiply Subtract

---

Find the discriminant of each quadratic equation then state the number of real and imaginary solutions.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Discriminant</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (6p^2 - 2p - 3 = 0)</td>
<td>(b^2 - 4ac)</td>
<td><strong>Two real</strong></td>
</tr>
<tr>
<td>2. (-2x^2 - x - 1 = 0)</td>
<td>(b^2 - 4ac)</td>
<td><strong>No real</strong></td>
</tr>
<tr>
<td>3. (-4m^2 - 4m + 5 = 0)</td>
<td>(b^2 - 4ac)</td>
<td><strong>Two real</strong></td>
</tr>
<tr>
<td>4. (5b + b - 2 = 0)</td>
<td>(b^2 - 4ac)</td>
<td><strong>Two real</strong></td>
</tr>
<tr>
<td>5. (r^2 + 5r + 2 = 0)</td>
<td>(b^2 - 4ac)</td>
<td><strong>Two real</strong></td>
</tr>
<tr>
<td>6. (2p^2 + 5p - 4 = 0)</td>
<td>(b^2 - 4ac)</td>
<td><strong>Two real</strong></td>
</tr>
</tbody>
</table>