The Quadratic Formula can be used to solve any quadratic equation.

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

**Solve** \(2x^2 - 5x - 12 = 0\) **using the quadratic formula.**

**Step 1:** Identify \(a, b,\) and \(c.\)

\[ a = 2 \quad b = -5 \quad c = -12 \]

**Step 2:** Substitute into the quadratic formula.

\[ x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(-12)}}{2(2)} \]

**Step 3:** Simplify.

\[ x = \frac{5 \pm \sqrt{25 + 96}}{4} = \frac{5 \pm 11}{4} \]

**Step 4:** Write two equations and solve.

\[ x = 4 \quad \text{or} \quad x = -\frac{3}{2} \]

**Solve using the quadratic equation by filling in the blanks below.**

1. \(x^2 + 2x - 35 = 0\)
   
   \[ a = ____; \quad b = ____; \quad c = ____ \]
   
   \[ x = \frac{-2 \pm \sqrt{2^2 - 4(1)(-35)}}{2(1)} \]
   
   Simplify:
   
   \[ x = \frac{-2 \pm \sqrt{4 + 140}}{2} = \frac{-2 \pm 12}{2} \]
   
   \[ x = 5 \quad \text{or} \quad x = -7 \]

2. \(3x^2 + 7x + 2 = 0\)
   
   \[ a = ____; \quad b = ____; \quad c = ____ \]
   
   \[ x = \frac{-7 \pm \sqrt{7^2 - 4(3)(2)}}{2(3)} \]
   
   Simplify:
   
   \[ x = \frac{-7 \pm \sqrt{49 - 24}}{6} = \frac{-7 \pm 5}{6} \]
   
   \[ x = -\frac{1}{3} \quad \text{or} \quad x = -2 \]

3. \(x^2 + x - 20 = 0\)
   
   \[ a = ____; \quad b = ____; \quad c = ____ \]
   
   \[ x = \frac{-1 \pm \sqrt{1^2 - 4(1)(-20)}}{2(1)} \]
   
   Simplify:
   
   \[ x = \frac{-1 \pm \sqrt{1 + 80}}{2} = \frac{-1 \pm 9}{2} \]
   
   \[ x = 4 \quad \text{or} \quad x = -5 \]

4. \(2x^2 - 9x - 5 = 0\)
   
   \[ a = ____; \quad b = ____; \quad c = ____ \]
   
   \[ x = \frac{9 \pm \sqrt{9^2 - 4(2)(-5)}}{2(2)} \]
   
   Simplify:
   
   \[ x = \frac{9 \pm \sqrt{81 + 40}}{4} = \frac{9 \pm 9.5}{4} \]
   
   \[ x = \frac{18}{4} = 4.5 \quad \text{or} \quad x = -0.5 \]
Review for Mastery

**The Quadratic Formula and the Discriminant continued**

The discriminant of a quadratic equation is $b^2 - 4ac$. The discriminant will indicate the number of real solutions in a quadratic equation.

<table>
<thead>
<tr>
<th>$b^2 - 4ac$</th>
<th>Number of Real Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b^2 - 4ac &gt; 0$</td>
<td>2 real solutions</td>
</tr>
<tr>
<td>$b^2 - 4ac = 0$</td>
<td>1 real solution</td>
</tr>
<tr>
<td>$b^2 - 4ac &lt; 0$</td>
<td>0 real solutions</td>
</tr>
</tbody>
</table>

Find the number of real solutions of $4x^2 - 8x + 5 = 0$ using the discriminant.

$4x^2 - 8x + 5 = 0$

**Step 1:** Identify $a$, $b$, and $c$.

$a = 4$, $b = -8$, $c = 5$

**Step 2:** Substitute into $b^2 - 4ac$.

$(-8)^2 - 4(4)(5)$

**Step 3:** Simplify.

$64 - 80 = -16$

$b^2 - 4ac$ is negative. There are no real solutions.

Find the number of real solutions of $9x^2 - 49 = 0$ using the discriminant.

$9x^2 - 49 = 0$

**Step 1:** Identify $a$, $b$, and $c$.

$a = 4$, $b = 0$, $c = -49$

**Step 2:** Substitute into $b^2 - 4ac$.

$(0)^2 - 4(9)(-49)$

**Step 3:** Simplify.

$0 + 1764 = 1764$

$b^2 - 4ac$ is positive. There are two real solutions.

Find the number of real solutions of each equation using the discriminant by filling in the boxes below.

5. $4x^2 + 20x + 25 = 0$

$a = \_\_\_; b = \_\_\_; c = \_\_\_

$(\_\_)^2 - 4(\_\_)(\_\_)$

6. $15x^2 + 8x + -1 = 0$

$a = \_\_\_; b = \_\_\_; c = \_\_\_

$(\_\_)^2 - 4(\_\_)(\_\_)$

Find the number of real solutions of each equation using the discriminant.

7. $x^2 + 9x - 36 = 0$

8. $25x^2 + 4 = 0$
Review for Mastery
1. 1; 2; –35; 2; 2; 1; –35; 1; –7, 5
2. 3; 7; 2; 7; 7; 3; 2; 3; –1/3, –2
3. 1; 1; –20; 1; 1; –20; 1; –5; 4
4. 2; –9; –5; –9; –9; 2; –5; 2; –1/2; 5
5. 4; 20; 25; 20; 4; 25; 1 solution
6. 15; 8; –1; 8; 15; –1; 2 solutions
7. 2 solutions 8. no real solutions

Challenge
1. a = 2; b = –5; c = –8
2. a = 7; b = 0; c = –56
3. a = 12; b = –16; c = 0
4. a = 0; there is no x² – term
5. 2 6. 3
7. 1
8. answers may vary; answers may vary
9. answers may vary; answers may vary
10. answers may vary; answers may vary
11. x = 0 12. x = ±\sqrt{\frac{c}{a}}
13. x = \frac{b}{a} or x = 0
14. x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
15. the quadratic formula

Problem Solving
1. Yes; the discriminant (113) is positive.
2. 8x² + 27x + 22 = 80.5; x = 1.5
3. 30 ft by 45 ft
4. C
5. G 6. A

Reading Strategies
1. 0 2. 2; –5; 3
3. 2 4. x = 2 or x = 5
5. no real solution 6. x = –2 or x = \frac{5}{3}
7. x = 8

8-10NONLINEAR SYSTEMS

Practice A
1. (2, 2), (3, 7) 2. (1, 3), (2, 2)
3. (–3, 6), (2, 1) 4. no solution
5. (–1, –2), (2, 7) 6. (–5, 0), (6, 11)
7. (–1, 0), (3, 8) 8. (–2, –1), (–1, 0)
9. (–2, –1), (–3, 5) 10. (–1, –7), (2, –1)

Practice B
1. (–2, 4), (2, 0) 2. (–3, 0), (1, –4)
3. (2, –2), (1, 3) 4. no solution
5. (–2, 7), (1, 4) 6. (–4, 0), (5, 9)
7. (–2.5, 5.25), (2, 3) 8. (–2, 0), (–3, 2)
9. (–1, –2), (–1.5, –1) 10. (0, –4), (5, –19)

Practice C
1. (1, –1), (2, 3) 2. (–1, 11), (4, 6)
3. (2, –2), (1, 3) 4. no solution
5. (2, 3), (–2.5, 5.25) 6. (–3, 2), (–2, 0)
7. (1.5, 6), (0, 3) 8. (2, 9), (0.5, –3)
9. a = 3.93 s
   b. = 20.41 m

Review for Mastery
1. (0, –4), (1, 0) 2. (–1, 0), (1, 4)
3. (2, 2), (0, 4) 4. (–1, –4), (0, 2)

Challenge
1. (–1, 0), (3, 0) 2. (–1, 0), (3, 0)
3. (–2, 0) 4. no solution
5. (1, –2), (–4, –2) 6. (0, 0)
7. 0; 1; 2

Problem Solving
1. 1.875 s 2. 8.14 s
5. A 6. F

Reading Strategies
1. axis; symmetry; slope; y-intercept
2. (–1, –4), (3, 0)