**9-5 Study Guide and Intervention**

***Solving Quadratic Equations by Using the Quadratic Formula***

**Quadratic Formula** To solve the standard form of the quadratic equation, *a*$x^{2}$ + *bx* + *c* = 0, use the **Quadratic Formula**.

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| **Quadratic Formula** | The solutions of *a*$x^{2}$ + *bx* + *c* = 0, where *a ≠* 0, are given by *x* = $\frac{-b \pm \sqrt{b^{2} - 4ac}}{2a}$. |

**Example 1: Solve** $x^{2}$ **+ 2*x* = 3 by using the
Quadratic Formula.**

Rewrite the equation in standard form.

 $x^{2}$ + 2*x* = 3 Original equation

$x^{2}$ + 2*x* – 3 = 3 – 3 Subtract 3 from each side.

$x^{2}$ + 2*x* – 3 = 0 Simplify.

Now let *a* = 1, *b* = 2, and *c* = –3 in the
Quadratic Formula.

*x* = $\frac{-b \pm \sqrt{b^{2} - 4ac}}{2a}$

 = $\frac{-2 \pm \sqrt{(2)^{2} - 4(1)(-3)}}{2(1)}$

 = $\frac{-2 \pm \sqrt{16}}{2}$

*x* = $\frac{-2 + 4}{2}$ or *x* = $\frac{-2 - 4}{2}$

 = 1 = –3

The solution set is {–3, 1}.

**Example 2: Solve** $x^{2}$ **– 6*x* – 2 = 0 by using the Quadratic Formula. Round to the nearest tenth
if necessary.**

For this equation *a* = 1, *b* = –6, and *c* = –2.

*x* = $\frac{-b \pm \sqrt{b^{2} - 4ac}}{2a}$

 = $\frac{6 \pm \sqrt{(-6)^{2} - 4(1)(-2)}}{2(1)}$

 = $\frac{6 + \sqrt{44}}{2}$

*x* = $\frac{6 + \sqrt{44}}{2}$ or *x* = $\frac{6 - \sqrt{44}}{2}$

x ≈ 6.3 ≈ –0.3

The solution set is {–0.3, 6.3}.

**Exercises**

**Solve each equation by using the Quadratic Formula. Round to the nearest tenth if necessary.**

 **1.** $x^{2}$ – 3*x* + 2 = 0 **2.** $x^{2}$ – 8*x* = –16

 **3.** 16$x^{2}$ – 8*x* = –1 **4.** $x^{2}$ + 5*x* = 6

 **5.** 3$x^{2}$ + 2*x* = 8 **6.** 8$x^{2}$ – 8*x* – 5 = 0

 **7.** –4$x^{2}$ + 19*x* = 21 **8.** 2$x^{2}$ + 6*x* = 5

 **9.** 48$x^{2}$ + 22*x* – 15 = 0 **10.** 8$x^{2}$ – 4*x* = 24

**11.** 2$x^{2}$ + 5*x* = 8 **12.** 8$x^{2}$ + 9*x* – 4 = 0

**13.** 2$x^{2}$ + 9*x* + 4 = 0 **14.** 8$x^{2}$ + 17*x* + 2 = 0

**9-5 Study Guide and Intervention** *(continued)*

***Solving Quadratic Equations by Using the Quadratic Formula***

**The Discriminant** In the Quadratic Formula, *x* = $\frac{-b \pm \sqrt{b^{2} - 4ac}}{2a}$, the expression under the radical sign, $b^{2}$ – 4*ac*, is called the **discriminant**. The discriminant can be used to determine the number of real solutions for a quadratic equation.

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| --- | --- |
| ***Case 1*:** $b^{2}$ – 4*ac* < 0 | no real solutions |
| ***Case 2*:** $b^{2}$ – 4*ac* = 0 | one real solution |
| ***Case 3*:** $b^{2}$ – 4*ac* > 0 | two real solutions |

**Example: State the value of the discriminant for each equation. Then determine the number of real solutions of the equation.**

**a. 12**$x^{2}$ **+ 5*x* = 4**

 Write the equation in standard form.

 12$x^{2}$ + 5*x* = 4 Original equation

12$x^{2}$ + 5*x* – 4 = 4 – 4 Subtract 4 from each side.

12$x^{2}$ + 5*x* – 4 = 0 Simplify.

Now find the discriminant.

$b^{2}$ – 4*ac* = $(5)^{2}$ – 4(12)(–4)

 = 217

Since the discriminant is positive, the equation has two real solutions.

**b. 2**$x^{2}$ **+ 3*x* = –4**

 2$x^{2}$ + 3*x* = –4 Original equation

2$x^{2}$ + 3*x* + 4 = –4 + 4 Add 4 to each side.

2$x^{2}$ + 3*x* + 4 = 0 Simplify.

Find the discriminant.

$b^{2}$ – 4*ac* = $(3)^{2}$ – 4(2)(4)

 = –23

Since the discriminant is negative, the equation has no real solutions.

**Exercises**

**State the value of the discriminant for each equation. Then determine the number of real solutions of the equation.**

 **1.** 3$x^{2}$ + 2*x* – 3 = 0 **2.** 3$x^{2}$ – 7*x* – 8 = 0 **3.** 2$x^{2}$ – 10*x* – 9 = 0

 **4.** 4$x^{2}$ = *x* + 4 **5.** 3$x^{2}$ – 13*x* = 10 **6.** 6$x^{2}$ – 10*x* + 10 = 0

 **7.** 2$x^{2}$ – 20 = –*x* **8.** 6$x^{2}$ = –11*x* – 40 **9.** 9 – 18*x* + 9$x^{2}$ = 0

**10.** 12$x^{2}$ + 9 = –6*x* **11.** 9$x^{2}$ = 81 **12.** 16$x^{2}$ + 16*x* + 4 = 0

**13.** 8$x^{2}$ + 9*x* = 2 **14.** 4$x^{2}$ – 4*x* + 4 = 3 **15.** 3$x^{2}$ – 18*x* = – 14