

# 4.8

## Use the Quadratic Formula and the Discriminant

- Goal** • Solve quadratic equations using the quadratic formula.

### Your Notes

#### VOCABULARY

Quadratic formula

Discriminant

#### THE QUADRATIC FORMULA

Let  $a$ ,  $b$ , and  $c$  be real numbers such that  $a \neq 0$ . The solutions of the quadratic equation  $ax^2 + bx + c$  are:

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

#### Example 1 Solve an equation with two real solutions

Solve  $x^2 + 7x = 6$ .

$$x^2 + 7x = 6$$

Original equation

$$x^2 + 7x - 6 = 0$$

Standard form

$$x = \frac{-7 \pm \sqrt{7^2 - 4(1)(-6)}}{2(1)}$$

Quadratic formula

$$x = \frac{-7 \pm \sqrt{49 - 4(-6)}}{2}$$

$a = 1$ ,  $b = 7$ ,  
 $c = -6$

$$x = \frac{-7 \pm \sqrt{49 + 24}}{2}$$

Simplify.

The solutions are  $x = \frac{-7 + \sqrt{73}}{2} \approx 0.8$  and  $x = \frac{-7 - \sqrt{73}}{2} \approx -7.8$ .

$$x = \frac{-7 + \sqrt{73}}{2} \approx 0.8$$

**Your Notes**

**Example 2** Solve an equation with one real solution

Solve  $2x^2 - 8x + 8 = 0$ .

**Solution**

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

Original equation

$x = \frac{\pm \sqrt{\quad - 4 \quad}}{2 \quad}$

$a = \quad, b = \quad,$   
 $c = \quad$

$x = \quad$

Simplify.

$x = \quad$

Simplify.

The solution is  $\quad$ .

**Example 3** Solve an equation with imaginary solutions

Solve  $-x^2 + 2x = 5$ .

**Solution**

$-x^2 + 2x = 5$

Original equation

$-x^2 + 2x \quad = 0$

Standard form

$x = \frac{\pm \sqrt{\quad - 4 \quad}}{2 \quad}$

$a = \quad, b = \quad,$   
 $c = \quad$

$x = \quad$

Simplify.

$x = \quad$

Rewrite using the  
imaginary unit  $i$ .

$x = \quad$

Simplify.

The solutions are  $\quad$  and  $\quad$ .

**Your Notes**

✔ **Checkpoint** Use the quadratic formula to solve the equation.

1. $2x^2 + 12x = -16$	2. $4x^2 - 13x = 7x - 25$
3. $3x^2 - 6x + 6 = 0$	4. $x^2 - 3x + 3 = 0$

**USING THE DISCRIMINANT OF  $ax^2 + bx + c = 0$**

When  $b^2 - 4ac > 0$ , the equation has \_\_\_\_\_  
\_\_\_\_\_. The graph has \_\_\_\_\_ x-intercepts.

When  $b^2 - 4ac = 0$ , the equation has \_\_\_\_\_  
\_\_\_\_\_. The graph has \_\_\_\_\_ x-intercept.

When  $b^2 - 4ac < 0$ , the equation has \_\_\_\_\_  
\_\_\_\_\_. The graph has \_\_\_\_\_ x-intercepts.

## Your Notes

### Example 4 Use the discriminant

Find the discriminant of the quadratic equation and give the number and type of solutions of the equation.

a.  $x^2 + 6x + 5 = 0$

b.  $x^2 + 6x + 9 = 0$

c.  $x^2 + 6x + 13 = 0$

Discriminant

$$b^2 - 4ac$$

Solution(s)

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

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

✔ **Checkpoint** Find the discriminant of the quadratic equation and give the number and type of solutions of the equation.

5.  $x^2 - 8x + 17 = 0$

6.  $x^2 + 4x + 3 = 0$

7.  $-x^2 + 2x - 1 = 0$

8.  $x^2 + 6x + 4 = 0$

## Homework