

## §1.2 Quadratic Equations

**Quadratic Equation:** an equation which can be written in the form  $ax^2 + bx + c = 0$  where  $a, b, c$  are real numbers and  $a \neq 0$ . This is also called standard form.

### 1) Solving by Factoring

Zero-Factor Property - If  $a$  and  $b$  are complex numbers with  $ab = 0$ , then  $a = 0$  or  $b = 0$  or both.

Square Root Property - If  $x^2 = k$ , then  $x = \pm\sqrt{k}$ .

example: Solve by factoring

a)  $x^2 + 6x = 0$

b)  $2x^2 = x + 3$

c)  $x^2 = 5$

d)  $(x - 2)^2 = 16$

## 2) Solving by Completing the Square

Start	Add	Result
$x^2 + 4x$	4	$x^2 + 4x + 4 = (x + 2)^2$
$x^2 + 12x$	36	$x^2 + 12x + 36 = (x + 6)^2$
$x^2 - 6x$	9	$x^2 - 6x + 9 = (x - 3)^2$
$x^2 + x$	$\frac{1}{4}$	$x^2 + x + \frac{1}{4} = \left(x + \frac{1}{2}\right)^2$

Start	Add	Result
$x^2 + mx$	$\left(\frac{m}{2}\right)^2$	$x^2 + mx + \left(\frac{m}{2}\right)^2 = \left(x + \frac{m}{2}\right)^2$

### Examples: Complete the Table

Start	Add	Result	Factored Form
$y^2 + 8y$			
$x^2 + 12x$			
$a^2 - 20a$			
$p^2 - 5p$			

example: Solve(by completing the square)

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

### 3) Solving Using the Quadratic Formula

The solutions of  $ax^2 + bx + c = 0$  are

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

Note: The fraction bar in the quadratic formula extends under the  $-b$  term in the numerator.

example: Solve(by quadratic formula)

$$3x^2 - 5x + 1 = 0$$