

## 2-3 Factoring Review

- Objectives:**
1. Factor out the greatest common factor.
  2. Factoring quadratic expressions in standard form
  3. Finding the zeroes of a polynomial

Multiply  $(x-2)(x+3)$

$$x^2 + 3x - 2x - 6$$

$x^2 + x - 6$

The image shows a handwritten example of multiplying two binomials. At the top, the expression  $(x-2)(x+3)$  is written. The terms are circled:  $x$  and  $x$  are circled in blue,  $-2$  and  $3$  are circled in green. A red arc connects  $x$  and  $3$ , and a green arc connects  $-2$  and  $x$ . Below this, the expanded form  $x^2 + 3x - 2x - 6$  is written. A purple bracket underlines the middle terms  $+3x - 2x$ . A blue arrow points from the  $x^2$  term in the expansion down to the  $x^2$  term in the simplified expression  $x^2 + x - 6$ , which is enclosed in a black box.

To factor an expression containing two or more terms, factor out the *greatest common factor* (GCF)

Factor each quadratic expression.

a.  $5x^2 + 4x$   
 $\overbrace{5} \cdot \overbrace{x} \cdot x + \overbrace{4} \cdot \overbrace{x}$

GCF:  $x$

$$x(5x + 4)$$

$$5x^2 + 4x$$

b.  $3ax^2 - 6a^2x$

$$\overbrace{3a} \cdot \overbrace{x} \cdot x - \overbrace{2} \cdot \overbrace{3a} \cdot \overbrace{x}$$

GCF:  $3ax$

$$3ax(x - 2a)$$

$$3ax^2 - 6a^2x$$

### Factoring $x^2 + bx + c$

To factor an expression of the form  $ax^2 + bx + c$ , where  $a = 1$

Ask yourself 2 questions:

1. What two numbers multiply to make  $c$ ?

**AND**

2. What two numbers add to make  $b$ ?

+

Factor each quadratic expression.

a.  $x^2 + 5x + 4$

$$(x+1)(x+4)$$

$$x^2 + 4x + x + 4$$

+5x

b.  $x^2 + 6x + 8$

$$(x+2)(x+4)$$

$$x^2 + 4x + 2x + 8$$

+6x

Factor each quadratic expression.

c.  $x^2 - 7x + 10$

$$(x-2)(x-5)$$

$$x^2 - 5x - 2x + 10$$

-7x

x to +10 -2 - 5

+ to -7 -2 - 5

(2 neg.)

d.  $x^2 - 2x - 8$

$$(x+2)(x-4)$$

x to -8 = +2 - 4

+ to -2 = +2 - 4

(+ & -)

## Factoring $x^2 + bx + c$

To factor an expression of the form  $ax^2 + bx + c$ , where  $a = \text{not } 1$

1. Multiply a and c
2. Find factors of the product of ac that add to give you b
3. Rewrite your polynomial using the numbers you found in step 2 to break up b into two terms.
4. Find the GCF by grouping
5. Write out binomials

Factor each expression

$2x^2 + 13x + 15$   
a    b    c

1.  $a \cdot c = 2 \cdot 15 = 30$
2. Factors of a·c  
 $30 : 1+30=31$   
 $2+15=17$   
 $3+10=13 \star$   
 $5+6=11$
3. Add to  $b=13$   
 $(2x^2 + 3x) + (10x + 15)$
4. Factor by grouping  
 $(2x+3)(x+5)$
5.  $(2x+3)(x+5)$

$2x^2 + 10x + 3x + 15$   
 $2x^2 + 13x + 15$

$6x^2 + 11x + 3$   
a    b    c

$6 \cdot 3 = 18$   
 What multiplies to 18  
 adds to 11

$1 \cdot 18 = 19$   
 $18 = 2 \cdot 9 = 11 \star$

$(6x^2 + 2x) + (9x + 3)$   
 $2x(3x+1) + 3(3x+1)$   
 $(3x+1)(2x+3)$   
 $6x^2 + 9x + 2x + 3$   
 $+11x$

Factor each expression.

$$3x^2 + 11x - 20$$

$$3 \cdot -20 = -60$$

Multiply to  $-60$   $\begin{matrix} + & \cdot & - \\ + & & - \end{matrix}$

Add to  $+11$   $\begin{matrix} \text{big} & \text{small} \\ + & - \end{matrix}$

$$-1 \cdot 60 = 59$$

$$-2 \cdot 30 = 28$$

$$-3 \cdot 20 = 17$$

$$-4 \cdot 15 = 11 \star$$

$$(3x^2 - 4x) + (15x - 20)$$

$$x(3x - 4) + 5(3x - 4)$$

$$(3x - 4)(x + 5)$$

$15x - 4x$

$$4x^2 - 13x + 3$$

$$x(2 \quad + -13)$$

$$-1 \cdot -12 = -13$$

$$(4x^2 - 1x)(-12x + 3)$$

$$x(4x - 1) - 3(4x - 1)$$

$$(4x - 1)(x - 3)$$

Factor each quadratic expression.

$$56 + 10x - x^2$$

$$35 - 12x + x^2$$

Solve each equation by factoring.

$$x^2 - 4x - 21 = 0$$

$$x^2 + 3x - 4 = 0$$

Use factoring to find the zeros of each quadratic function.

$$h(x) = x^2 - 12x$$

$$g(x) = 2x^2 + 17x - 9$$

$$(x)(x - 12)$$

$$\boxed{0, 12 = \text{zeros}}$$

$$0(-12) = 0$$

$$(12)(0) = 0$$

★ Zeros: number we plug in for  $x$   
to make the factor = 0

$$\text{zeros} = 0, 12$$

$$x = 0, 12$$

Write an equation with given zeros.

a.  $x=1, x=2$

$(x - \text{zero})$

Factor

$(x-1)(x-2)$

b.  $x=-7,3$

$(x+7)(x-3)$

Write an equation with given zeros.

c.  $x=0,4$

d. The zeros are -9 and 1

