

## Factoring



## Preliminaries and Objectives

Preliminaries:

- Distributive Law
- The FOIL method

$$a(b + c) = ab + ac$$

Objectives:

- Factor expressions into binomials

## Distributive Law

$$3x(x + 4)$$

$$3x^2 + 12x$$

## FOIL

$$(2x + 3)(3x - 1)$$

$$6x^2 - 2x + 9x - 3$$

$$6x^2 + 7x - 3$$

## FOIL

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

$$4x^2 - 6x + 6x - 9$$

$$4x^2 - 9$$

## Undo Distributive Law

- Technique: Greatest Common Factor (GCF)

$$3x^2 + 12x$$

$$3 \cdot x \cdot x + 2 \cdot 2 \cdot 3 \cdot x$$

$$3x(x + 4)$$

## Example 1

$$2x^4 + 8x^3 - 16x^2$$

$$2x^2(x^2 + 4x - 8)$$

## Difference of Squares

- Technique: Difference of Squares

$$4x^2 - 9$$

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

## Example 2

$$16x^4 - 25$$

$$(4x^2 + 5)(4x^2 - 5)$$

### Example 2

$$16x^3 - 25$$

does not factor

### Undoing FOIL

$$3x^2 + 11x - 4$$

$$\begin{aligned} &(3x + 4)(x - 1) \\ &(3x - 4)(x + 1) \\ &(3x + 2)(x - 2) \\ &(3x - 2)(x + 2) \\ &(3x + 1)(x - 4) \\ &(3x - 1)(x + 4) \end{aligned}$$

### Undoing FOIL

$$3x^2 + 11x - 4$$

$3x^2 + x - 4$	No	$(3x + 4)(x - 1)$
$3x^2 - x - 4$	No	$(3x - 4)(x + 1)$
$3x^2 - 4x - 4$	No	$(3x + 2)(x - 2)$
$3x^2 + 4x - 4$	No	$(3x - 2)(x + 2)$
$3x^2 - 11x - 4$	No	$(3x + 1)(x - 4)$
$3x^2 + 11x - 4$	Yes	$(3x - 1)(x + 4)$

### Undoing FOIL

$$\begin{aligned} ax^2 + bx + c &\rightarrow ( \quad )( \quad ) \\ ax^2 - bx + c &\rightarrow ( \quad )( \quad ) \\ ax^2 + bx - c &\rightarrow ( \quad )( \quad ) \\ ax^2 - bx - c &\rightarrow ( \quad )( \quad ) \end{aligned}$$

### Undoing FOIL

- Technique: Grouping

$$6x^3 - 15x^2 + 8x - 20$$

### Undoing FOIL

- Technique: Grouping

$$x^3 + 2x^2 - 9x - 18$$

### Undoing FOIL

- Technique: Grouping

$$\begin{aligned} x^3 + 2x^2 - 9x - 18 \\ (x^2 - 9)(x + 2) \end{aligned}$$

### Undoing FOIL

- Technique: Grouping

$$\begin{aligned} x^3 + 2x^2 - 9x - 18 \\ (x^2 - 9)(x + 2) \\ (x + 3)(x - 3)(x + 2) \end{aligned}$$