

## 7.8 Factor Polynomials Completely (by Grouping)

Essential Question: How can you factor a polynomial completely?

### Core Vocabulary

factoring by grouping, p. 404  
factored completely, p. 404

*Previous*  
polynomial  
binomial

### What You Will Learn

- ▶ Factor polynomials by grouping
- ▶ Factor polynomials completely.  $(2x-6)$
- ▶ Use factoring to solve real-life problems.

Feb 5-3:41 PM

## Factoring Polynomials by Grouping

You have used the Distributive Property to factor out a greatest common monomial from a polynomial. Sometimes, you can factor out a common binomial. You may be able to use the Distributive Property to factor polynomials with four terms, as described below.

### CORE CONCEPT: Factoring by Grouping

To factor a polynomial with four terms, group the terms into pairs. Factor the GCF out of each pair of terms. Look for and factor out the common binomial factor. This process is called factoring by grouping.

2) 2 terms

1) GCF  
3 terms

4 terms

## 7.8 Factor Completely by Factoring by Grouping DAY ONE with work

1) How do you **factor 2 terms?** Factor out the overall **GCF** (reverse distribute) then look for **difference of perfect squares**. <sup>2 terms</sup> <sub>[-]</sub>

a)  $5x^2 + 25$   
 $5(x^2 + 5)$

*Binomials*  
 b)  $x^2 - 100$   
 $(x)^2 - (10)^2$   
 $(x+10)(x-10)$

c)  $x^2 + 36$   
 unfactorable

2) How do you **factor 3 terms?** Overall **GCF** then reverse **FOIL**. Keep in mind special products. *trinomial*

a)  $x^2 - 7x + 6$   
 $(x-1)(x-6)$

b)  $2x^2 - 20x + 50$   
 $2(x^2 - 10x + 25)$   
 $2(x-5)^2$

$(x \quad | \quad x)$   
 $(-1 \quad | \quad 25)$   
 $(-5 \quad | \quad 5)$

3) Explain the difference between  $x^2 - 7x + 6$  and  $x^2 - 7x + 6 = 0$   
*expression* ← *equation*

↓  
 unFOIL / factor (x)  $x = \_ /$  solve

4) How do you factor **4 terms?** Let's find out! (Freshman - I know the excitement is building but stay calm!)

Feb 5-3:48 PM

### DISCOVERING how to Factor 4 terms:

First multiply a binomial by a binomial by double distributing? Let's double distribute:

$(2a + 7x)(3m + 4z)$   
 $2a(3m + 4z) + 7x(3m + 4z)$   
 $(6am + 8az) + (21mx + 28xz)$   
 $2a(3m + 4z) + 7x(3m + 4z) \checkmark$

Now how could you take that final product and inverse the process to get our 2 starting binomial factors?

Feb 5-4:00 PM

## 7.8 Factor Completely by Factoring by Grouping DAY ONE with work

Factor 4 terms by a process called "Factor by Grouping"

### Examples:

Factor each polynomial by grouping.

a.  $(x^3 + 3x^2) + (2x + 6)$

$$x^2(x+3) + 2(x+3)$$

$$(x^2+2)(x+3)$$

$$x^2(x+3) + 2(x+3)$$

b.  $x^2 + xy + x + y$

$$(x^2 + y) + (x + xy)$$

$$(x^2 + x) + (y + xy)$$

$$x(x+1) + y(1+x)$$

$$(x+y)(x+1)$$

Feb 5-4:04 PM

### Your Turn:

Factor each polynomial by grouping.

a)  $(x^3 + 4x^2 - 2x - 8)$

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

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

b)  $x^2 + 4y - 2x - 2xy$

$$(x^2 - 2xy) - (2x - 4y)$$

$$x(x-2y) - 2(x-2y)$$

$$(x-2)(x-2y)$$

Feb 5-4:08 PM

## 7.8 Factor Completely by Factoring by Grouping DAY ONE with work

Factor:

Red Flag on power of 4

(a)  $3x^3 + 6x^2 - 18x$

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

x	x
-1	6
-2	3

(b)  $7x^4 - 28x^2$

$$7x^2(x^2 - 4)$$

$$7x^2(x+2)(x-2)$$

Diff 2 terms ✓  
 (a+b)(a-b) ✓

Solve:  $x = \underline{\hspace{2cm}}$

(c)  $2x^2 + 8x - 10 = 0$

$$\frac{2x^2}{2x} + \frac{8x}{2x} = \frac{10}{2x}$$

$$2x(x^2 + 4x - 5) = 0$$

$$2x(x^2 + 4x - 5) = 0$$

x	x
-1	5

$$2x(x-1)(x+5) = 0$$

$$2x = 0 \quad x-1 = 0 \quad x+5 = 0$$

$$x = 0 \quad x = 1 \quad x = -5$$

$$x = -5, 0, 1$$

Feb 5-4:13 PM

## Real-Life Application



(w + 4) in.

(36 - w) in.

w in.

A terrarium in the shape of a rectangular prism has a volume of 4608 cubic inches. Its length is more than 10 inches. The dimensions of the terrarium in terms of its width are shown. Find the length, width, and height of the terrarium.

$$(36-w)(w+4)$$

$$36w + 144 - w^2 - 4w$$

$$-w^2 + 32w + 144$$

$$24 \text{ in} \times 12 \text{ in} \times 16 \text{ in}$$

$$V = lwh$$

$$4608 = (36-w)(w)(w+4)$$

$$4608 = (w)(-w^2 + 32w + 144)$$

$$4608 = -w^3 + 32w^2 + 144w$$

$$0 = (-w^3 + 32w^2) + (144w - 4608)$$

$$0 = -w^2(w-32) + 144(w-32)$$

$$0 = (-w^2 + 144)(w-32)$$

$$+w^2 + 144 = 0 \quad w-32 = 0$$

$$(w+12)(w-12) = 0 \quad w = 32$$

$$w = \pm 12, 32 \quad 36-32 = 4 < 10$$

Feb 5-4:14 PM

## 7.8 DAY ONE Assignment

## 7.8 DAY ONE WS