

1-2 Factoring Polynomials

A1 Classnotes!!!

Objectives:

1-2a: I can factor a polynomial expression by grouping.

1-2b: I can factor a trinomial.

1-1c: I can solve equations using factoring.

Bellwork: $3y^2(y - 1) - 4(y - 1)$

Binomial (pointing to $(y - 1)$)

Greatest Common Factor (pointing to $(y - 1)$)

1) Factor out the GCF (or GCBF in this case)

$$(y - 1)(3y^2 - 4)$$

2) Double distribute (aka "FOIL") to find the polynomial

$$3y^3 - 4y - 3y^2 + 4$$

$$3y^3 - 3y^2 - 4y + 4$$

$$14) \quad 10x^2 = -5x \quad (\text{Need } = 0 \text{ to solve for } x)$$

$$\quad \quad \quad +5x \quad +5x$$

$$10x^2 + 5x = 0$$

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

$$\cancel{5}x = 0$$

$$\cancel{5} \quad 5$$

$$x = 0$$

$$\boxed{x = 0, -\frac{1}{2}}$$

$$2x + 1 = 0$$

$$\quad \quad -1 \quad -1$$

$$\frac{2x}{2} = \frac{-1}{2}$$

$$x = -\frac{1}{2}$$

$$\frac{x^2}{x} \rightarrow \frac{\cancel{x} \cdot x}{\cancel{x}} = x$$

To solve for x
UNDO operations

$$18) \quad x^2 = -6x$$

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

$$(x)(x+6) = 0$$

$$x = 0 \quad x = -6$$

$$x + 6 = 0$$

$$\quad -6 \quad -6$$

$$x = -6$$

Factor by Grouping.

Is there a GCF?

$$\begin{array}{l}
 4x^2 + 6x - 2x - 3 \\
 \underline{2x(2x+3) - 1(2x+3)} \\
 (2x+3)(2x-1)
 \end{array}
 \quad
 \begin{array}{l}
 \vdots \\
 \left[x^3 - 3x^2 \right] + \left[x - 3 \right] \\
 \vdots \\
 x^2(x-3) + 1(x-3) \\
 \vdots \\
 (x-3)(x^2+1) \\
 \vdots \\
 \vdots \\
 \vdots
 \end{array}$$

You're up!

$$\begin{array}{l}
 \left[9x^2 + 6x \right] + \left[6x + 4 \right] \\
 \underline{3x(3x+2) + 2(3x+2)} \\
 (3x+2)(3x+2)
 \end{array}
 \quad
 4x^2 - 8x + x - 2$$



Riddle...r me this...

$$-4 \times 3$$

What two numbers multiply to -12, but also add to -1?

$$3, -4$$

*	-12	+ -1
	1 · 12	
	2 · 6	
	3 · 4	→ 3 + -4 = -1 ✓

What two numbers multiplies to 15 that also add to 8?

*	15	+ 8
	1 · 15	
	3 · 5	✓

What two numbers multiply to -15 that also add to -2?

$$3 + -5$$

-	15	- 2
	3 · 5	
		3 + -5 = -2 ✓

Factor the following polynomial

Break "into the two we found"

$$2x^2 - x - 6$$

$$2x^2 + 3x - 4x - 6$$

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

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

GCF

DONE!
WE FACTORED!

-12	-1
1 · 12	
2 · 6	
3 · 4	→ 3 + -4 ✓

Factor the following trinomials.

$$1 \cdot x^2 + 8x + 15 = 0$$

* 15	8
3 · 5	

$$x^2 + 8x + 15$$

$$x^2 + 3x + 5x + 15$$

$$x(x+3) + 5(x+3)$$

$$(x+3)(x+5) = 0$$

$x = -3, -5$

General Method

$$ax^2 + bx + c$$

$$ax^2 + \frac{bx}{a} + \frac{c}{a}$$

*	*
a	c
-	+

Factor the following trinomials cont'd

$3x^2 - 11x - 12 \longrightarrow$

-36	-11
1 · 36	UH OH!!! None of the factors of -36 add to -11.
2 · 18	
3 · 12	
4 · 9	
6 · 6	

NOTICE:
 Sometimes our
 trinomials WON'T
 FACTOR.

So the answer to
 this one is not factorable

How to Factor a QuadraticFactoring quadratics in the form $ax^2 + bx + c$

1. Factor out the GCF
2. Multiply a and c
3. Find two factors of ac that add to b
 - *If ac is negative, factors must have opposite signs
 - *If ac is positive, factors must have same (+ or -) signs
4. Re-write equation with b split up into factors
5. Find the GCF by grouping
6. Factor the GCF of the whole

Solve the following equations.

$$(x-4)(x+7) = 0$$

TRICK
opposite of number
is answer

$$x = 4, -7$$

$$3x(x+3)(x-1) = 0$$

$x = -3, 1, 0$
and $\frac{3x}{3} = \frac{0}{3}$
 $x = 0$

You try:

$$(3x+1)(x-5) = 0$$

5 (B/C $x-5=0$
 $x=5$)

$$3x+1=0$$

$$3x = -1$$

$$x = -\frac{1}{3}$$

$$x = -\frac{1}{3}, 5$$

$$3(x+2)(x-3) = 0$$

opposite is -2
opposite is 3

$$x = -2, 3$$

Solve the following equations.

$$x^2 + 3x - 10 = 0$$

$$1 \cdot x^2 + 3x - 10 = 0$$

$$x^2 + 5x - 2x - 10 = 0$$

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

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

$$x = -5, 2$$

$$\begin{array}{r|l} -10 & +3 \\ \hline 1 \cdot 10 & \\ 2 \cdot 5 & \end{array}$$

$-2 + 5 = 3$ ✓ It works

again opposites

$$\begin{array}{l} x+5=0 \\ -5 \quad -5 \\ x=-5 \\ x-2=0 \\ +2 \quad +2 \\ x=2 \end{array}$$

$$x^2 + x - 5 = -7$$

understood

$$1 \cdot x^2 + x + 2 = 0$$

To solve, must set equal to 0

$$\begin{array}{r|l} 2 & 1 \\ \hline 1 \cdot 2 & \end{array}$$

Doesn't work.

Not factorable so we cannot solve. (yet...)

$$x^2 + 11x + 24 = 0$$

$$x^2 + 3x + 8x + 24 = 0$$

$$x(x+3) + 8(x+3) = 0$$

$$(x+3)(x+8) = 0$$

$$x = -3, -8$$

24	11
1·24	
2·12	
3·8	→ 3+8 ✓
4·6	

$$x+3=0$$

$$x=-3$$

$$x+8=0$$

$$x=-8$$

$$x^2 - 7x + 27 = 5x$$

$$x^2 - 12x + 27 = 0$$

$$x^2 - 3x - 9x + 27 = 0$$

$$x(x-3) - 9(x-3) = 0$$

$$(x-3)(x-9) = 0$$

$$x = 3, 9$$

To solve, set
equal to 0

27	-12
1·27	
3·9	→ -3+-9 ✓

(SAME PROBLEM)

$$x^2 - 7x + 27 = 5x$$

$-5x$
 $-5x$

$$x^2 - 12x + 27 = 0$$

$$x^2 - 3x - 9x + 27 = 0$$

$$x(x-3) - 9(x-3) = 0$$

$$(x-3)(x-9) = 0$$

$$x = 3, 9$$

To solve, set
equal to 0

27	-12
1 · 27	
3 · 9	→ -3 + -9 ✓

Did you
factor out the
negative correctly?

Solve the following equations.

$$-3x^2 - 7x - 4 = 0$$

(This is the one I did real quick end of class, work is on following page)

$$-3x^2 - 7x - 4 = 0$$

*	12	+
1 · 12		-7
2 · 6		
3 · 4		→ -3, -4

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

$$-3x(x+1) - 4(x+1) = 0$$

$$(x+1)(-3x-4) = 0$$

$x = -1$

$$-3x - 4 = 0$$

$$-3x = 4$$

$$x = -\frac{4}{3}$$

Solve the following equations.

$$3x^2 + 12x - 63 = 0$$

$$3x^2 + 21x - 9x - 63 = 0$$

$$3x(x+7) - 9(x+7) = 0$$

$$(x+7)(3x-9) = 0$$

$x = -7, 3$

$$3x - 9 = 0$$

$$3x = 9$$

$$x = 3$$

*	-189	+
1 · 189		12
3 · 63		
7 · 27		
9 · 21		→ -9 + 21 or 21 - 9 (same thing right?)

BUT WHAT IF... →

AH! There is a GCF!

$$3x^2 + 12x - 63 = 0$$

$$3(x^2 + 4x - 21) = 0$$

$$3(x^2 - 3x + 7x - 21) = 0$$

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

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

$$\boxed{x = 3, -7}$$

-21	4
1 · 21	
3 · 7	→ -3 + 7 ✓

Factoring
out the GCF
simplifies
these two
steps

You try:

$$2x^2 - 13x - 7 = 0 \quad -6x^2 - 14x - 8 = 0$$

You try: $2x^2 - 13x - 7 = 0$

$$2x^2 + x - 14x - 7 = 0$$

$$x(2x+1) - 7(2x+1) = 0$$

$$(2x+1)(x-7) = 0$$

$$2x+1=0 \quad x=7$$

$$2x=-1$$

$$x=-1/2$$

$x = -\frac{1}{2}, 7$

*	-14	+	-13
	1 · 14		1 + -14

You try: $-6x^2 - 14x - 8 = 0$

6/2 $-2(3x^2 + 7x + 4) = 0$

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

$$-2(3x(x+1) + 4(x+1)) = 0$$

$$-2(x+1)(3x+4) = 0$$

$$x = -1 \quad \left. \begin{array}{l} 3x+4=0 \\ 3x=-4 \end{array} \right\} x = -\frac{4}{3}$$

$x = -\frac{4}{3}, -1$

*	12	+	7
	1 · 12		
	2 · 6		
	3 · 4		→ 3+4

Challenge Problem!

$$12k^3 - 36k^2 + 14k - 42$$

TRY IT 😊