6.3 Factoring Polynomials

Study 6.3 # 27-37, 1-17, 25, 41, 43, 47, 51, 55, 59

Study 6.4 # 1-19, 23, 27, 33, 37, 41, 45, 51, 67, 72

6.3 Factoring Polynomials

Previous Multiplication

$2x\,(x + y - xy)$	$(2x + 1)(x - 3)$
$2x(x) + 2x(y) - 2x(xy)$	F O I L $2x(x) + 2x(-3) + 1x + 1(-3)$
$2x^2 + 2xy - 2x^2y$	$2x^2 - 5x - 3$

6.3 Factoring Polynomials

Now: Reverse of Multiplication
Find the Factored Form

$\square\,(\square)$	$(\square)(\square)$
$2x^2 + 2xy - 2x^2y$	$2x^2 - 5x - 3$

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6.3 Factoring Polynomials

Now: Reverse of Multiplication
Find the Factored Form

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

$2x^2 + 2xy - 2x^2y$

Look for common factor(s)

Use the DP to factor

$2x \cdot x + 2x \cdot y - 2x \cdot xy$

$2x(x+y-xy)$

$2x\ (x + y - xy)$

6.3 Factoring Polynomials

Now: Reverse of Multiplication
Find the Factored Form

$$2x^2 + 2xy - 2x^2y$$

Look for common factor(s)

$$2x \cdot x + 2x \cdot y - 2x \cdot xy$$

Use the DP to factor

$$2x\,(x + y - xy)$$

$$\square\,(\qquad\qquad)$$

6.3 Factoring Polynomials

Factor: $32x^3y + 40x^2y^4$

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6.3 Factoring Polynomials

Factor: $32x^3y + 40x^2y^4$

$8x^2y \cdot 4x + 8x^2y \cdot 5y^3$

$8x^2y(4x + 5y^3)$

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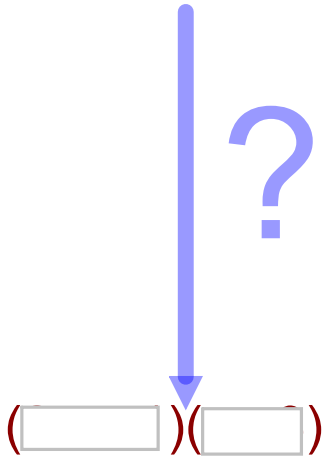
6.3 Factoring Polynomials

Now: Reverse of Multiplication
Find the Factored Form

$2x^2 - 5x - 3$



Two Approaches:

1. Trial and Error
2. Factor by Grouping

6.3 Factoring Polynomials

Trial and Error

Try

First

Last

$2x^2 - 5x - 3$

$(\quad)(\quad)$

Adjust until middle works

$(\square\quad)(\square\quad)$

6.3 Factoring Polynomials

Trial and Error

Try

First

Last

Adjust until middle works

$2x^2 - 5x - 3$

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

x

$-6x$

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

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6.3 Factoring Polynomials

Factor by Grouping

$ax^2 + bx + c$ or $ax^2 + bxy + cy^2$

1. Put your trinomial into standard form, as above.
2. Find two numbers who product is **ac** and whose sum is **b**
3. List all possible factors of **ac**
4. Compare the sum and differences of each pair of factors to **b**
5. Write the product, **(m) (n) = ac**, and the sum, **(m) + (n) = b**, accounting for both positive and negative factors

   Note: If no numbers fit, then the trinomial is PRIME
6. Substitute for the bx term, getting two middle terms, mx + nx
7. Factor by grouping: Factor common factors from:
   a) the 1st two terms only , then b) the 2nd two terms
8. Use the Distributive Property to factor the common binomial.
   Check by multiplication

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6.3 Factoring Polynomials

Factor by Grouping

1. standard form
2. ( ) ( ) = **ac;** ( )+( ) = **b**
3. factors of **ac**
4. consider sum and difference of each
5. Write **( )( ) = ac** and **( )+( ) = b**
   consider pos and neg factors
6. Substitute for the b term, getting two middle terms
7. Factor by grouping
8. Distributive Property

-6=(-1)(6)=(1)(-6)
=(-2)(3)=(2)(-3)

$2x^2 - 5x - 3$

(-6)(1) = 2(-3)= **-6**
(-6)+(1) = **-5**

( ) ( ) = **-6**
( )+( ) = **-5**

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

( )( )+( )( )

( )( )

( )( )

6.3 Factoring Polynomials

Factor by Grouping

1. standard form
2. ( ) ( ) = **ac;** ( )+( ) = **b**
3. factors of **ac**
4. consider sum and difference of each
5. Write **( )( ) = ac** and **( )+( ) = b**
   consider pos and neg factors
6. Substitute for the b term,
   getting two middle terms
7. Factor by grouping
8. Distributive Property

$2x^2 - 5x - 3$

-6=(-1)(6)=(1)(-6)
=(-2)(3)=(2)(-3)

( ) ( ) = 2(-3)= **-6**
( )+( ) = **-5**

(-6) (+1) = -6
(-6)+(+1) = -5

$2x^2 \mathbf{- 6x + x} - 3$

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

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

( )( )

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6.3 Factoring Polynomials

Factor by Grouping

ax^2+bx+c

$x^2 - 8x + 15$

1. standard form
2. (1) (15) = **ac;** ( )+( ) = **b**
3. factors of **ac**
4. consider sum and difference of each
5. Write **( )( ) = ac** and **( )+( ) = b**
   consider pos and neg factors
6. Substitute for the b term,
   getting two middle terms
7. Factor by grouping
8. Distributive Property

( ) ( ) =
( )+( ) =

( ) ( ) =
( )+( ) =

$x^2 +(\ )x +(\ )x + 15$

( )( )+( )( )

( )( )

6.3 Factoring Polynomials

Factor by Grouping

1. standard form
2. ( ) ( ) = **ac;** ( )+( ) = **b**
3. factors of **ac**
4. consider sum and difference of each
5. Write **( )( ) = ac** and **( )+( ) = b**
   consider pos and neg factors
6. Substitute for the b term,
   getting two middle terms
7. Factor by grouping
8. Distributive Property

ax^2+bx+c

$1x^2 - 8x + 15$

$15 = 1 \cdot 15$

$3 \cdot 5$

$(a)(c) = 15$

$(\ )+(\ ) = -8$

$(-3)(-5) = 15$

$(-3)+(-5) = -8$

$x^2 + (-3)x + (-5)x + 15$

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

$(x-5)(x-3)$

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6.3 Factoring Polynomials

Factor by Grouping, +

$7x^2 + 21x + 14$

$7(\quad)$

1. standard form
2. ( ) ( ) = **ac;** ( )+( ) = **b**
3. factors of **ac**
4. consider sum and difference of each
5. Write **( )( ) = ac** and **( )+( ) = b**
   consider pos and neg factors
6. Substitute for the b term,
   getting two middle terms
7. Factor by grouping
8. Distributive Property

( ) ( ) =
( )+( ) =

( ) ( ) =
( )+( ) =

$(7)[\,x^2 + (\quad)x + (\quad)x + 2\,]$

$(7)[\,(\quad)(\quad) + (\quad)(\quad)\,]$

$(7)(\quad)(\quad)$

Why are [ ] needed above, but not at end?

6.3 Factoring Polynomials

Factor by Grouping, +

$7x^2 + 21x + 14$

$7(x^2+3x+2)$

1. standard form
2. ( ) ( ) = **ac;** ( )+( ) = **b**
3. factors of **ac**
4. consider sum and difference of each
5. Write **( )( ) = ac** and **( )+( ) = b**
   consider pos and neg factors
6. Substitute for the b term,
   getting two middle terms
7. Factor by grouping
8. Distributive Property

( ) ( ) = 2
( )+( ) = 3

(2) (1) = 2
(2)+(1) = 3

$(7)[x^2+(2)x+(1)x+2]$

$(7)[(x)(x+2)+(1)(x+2)]$

$(7)(x+1)(x+2)$

Why are [ ] needed above, but not at end?

6.3 Factoring Polynomials

Factor by Grouping

1. standard form
2. ( ) ( ) = **ac;** ( )+( ) = **b**
3. factors of **ac**
4. consider sum and difference of each
5. Write **( )( ) = ac** and **( )+( ) = b**
   consider pos and neg factors
6. Substitute for the b term,
   getting two middle terms
7. Factor by grouping
8. Distributive Property

$\_\_x^2 + \_\_x + \_\_$

( ) ( ) =
( )+( ) =

( ) ( ) =
( )+( ) =

$x^2 +(\ )x +(\ )x + \_\_$

( )( )+( )( )

( )( )

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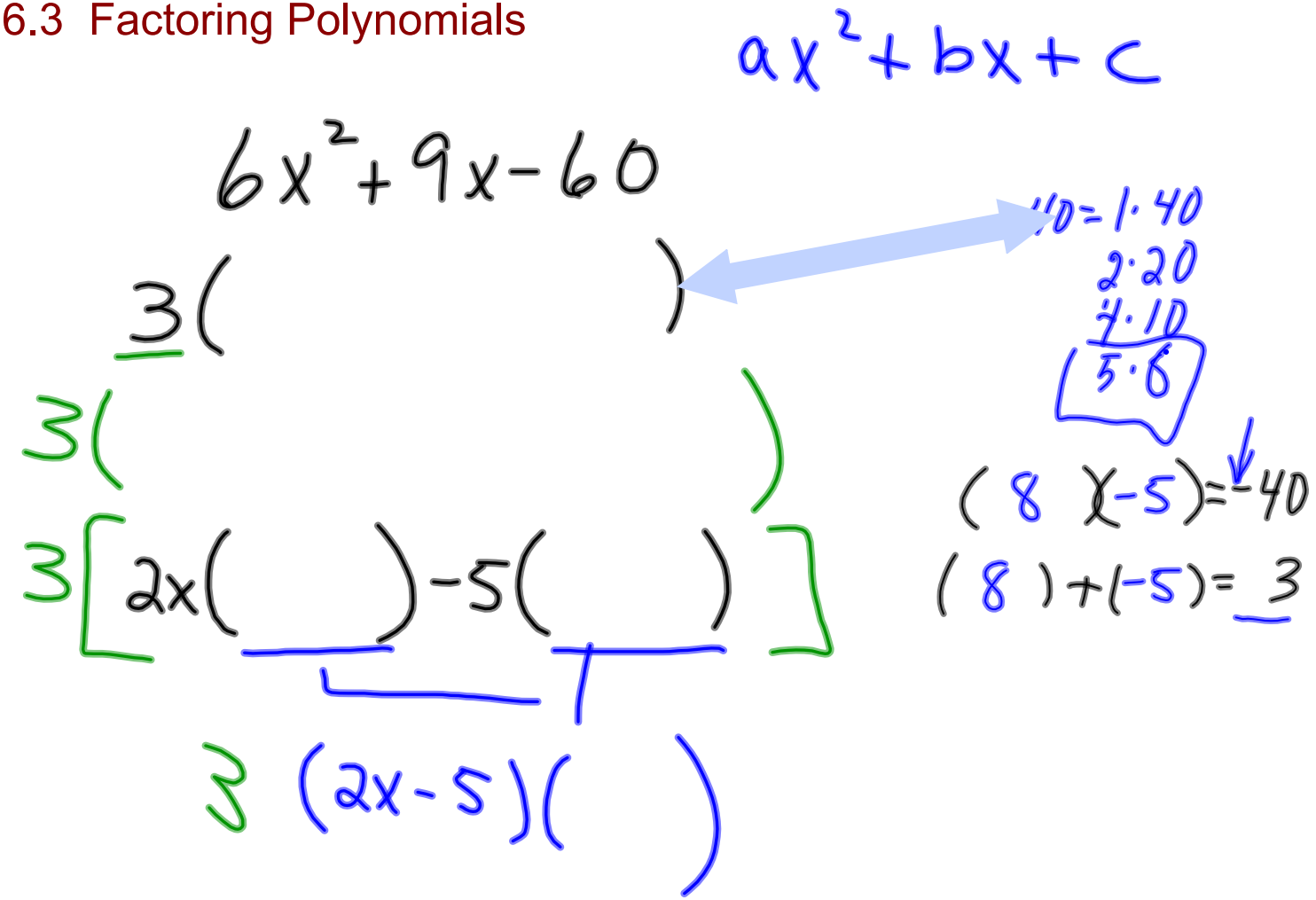
6.3 Factoring Polynomials



6.3 Factoring Polynomials

ax^2+bx+c

$6x^2+9x-60$

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

$-40 = 1\cdot 40$
$2\cdot 20$
$4\cdot 10$
$5\cdot 8$

$(8)(-5) = -40$
$(8)+(-5) = 3$

$3(2x^2+8x-5x-20)$

$3[2x(x+4)-5(x+4)]$

$3(2x-5)(x+4)$

6.3 Factoring Polynomials

$12w^2 - 19w - 10$

$ac = -120$

$b = -19$

$12w^2 \qquad -10$

$12w(\quad)+5(\quad)$

$(12w+5)(\quad)$

$(\quad)(\quad) = -120$

$(\quad)+(\quad) = -19$

$120 = 1 \cdot 120 \quad 4 \cdot 30$

$2 \cdot 60 \quad 10 \cdot 12$

$3 \cdot 40$

$5 \cdot 24$

$6 \cdot 20$

$8 \cdot 15$

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6.3 Factoring Polynomials

$12w^2 - 19w - 10$

$ac = -120$

$b = -19$

$12w^2 - 24w + 5w - 10$

$(5)(-24) = -120$ ✓

$(-24) + (5) = -19$

$12w(w-2) + 5(w-2)$

$120 = 1 \cdot 120 \quad 4 \cdot 30$

$2 \cdot 60 \quad 10 \cdot 12$

$3 \cdot 40$

$5 \cdot 24$

$6 \cdot 20$

$8 \cdot 15$

$(12w+5)(w-2)$

FOIL

6.3 Factoring Polynomials

$12w^2 - 20w - 10$

$2(6w^2 + 10w - 5)$

prime

$(\quad)(\quad) = -30$

$(\quad) + (\quad) = -10$

$30 = 1 \cdot 30$ 29

$= 2 \cdot 15$ 13

$= 3 \cdot 10$ 7

$= 5 \cdot 6$ 1

6.3 Factoring Polynomials

$a=1$
$b=3$
$c=-18$

ax^2+bx+c

$x^2+3x-18$

$ac=-18$
$b=3$

6.3 Factoring Polynomials

$a=1$
$b=3$
$c=-18$

ax^2+bx+c

$x^2+3x-18$

$ac=-18$
$b=3$

$(-6)(3)=-18$
$(+6)+(-3)=3$

$18=1\cdot 18$
$=2\cdot 9$
$=3\cdot 6$

$x^2+6x-3x-18$

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

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

$x^2+4x-18$

$a=1$
$b=4$
$c=-18$

17
7
3

$\therefore$ prime

6.3 Factoring Polynomials

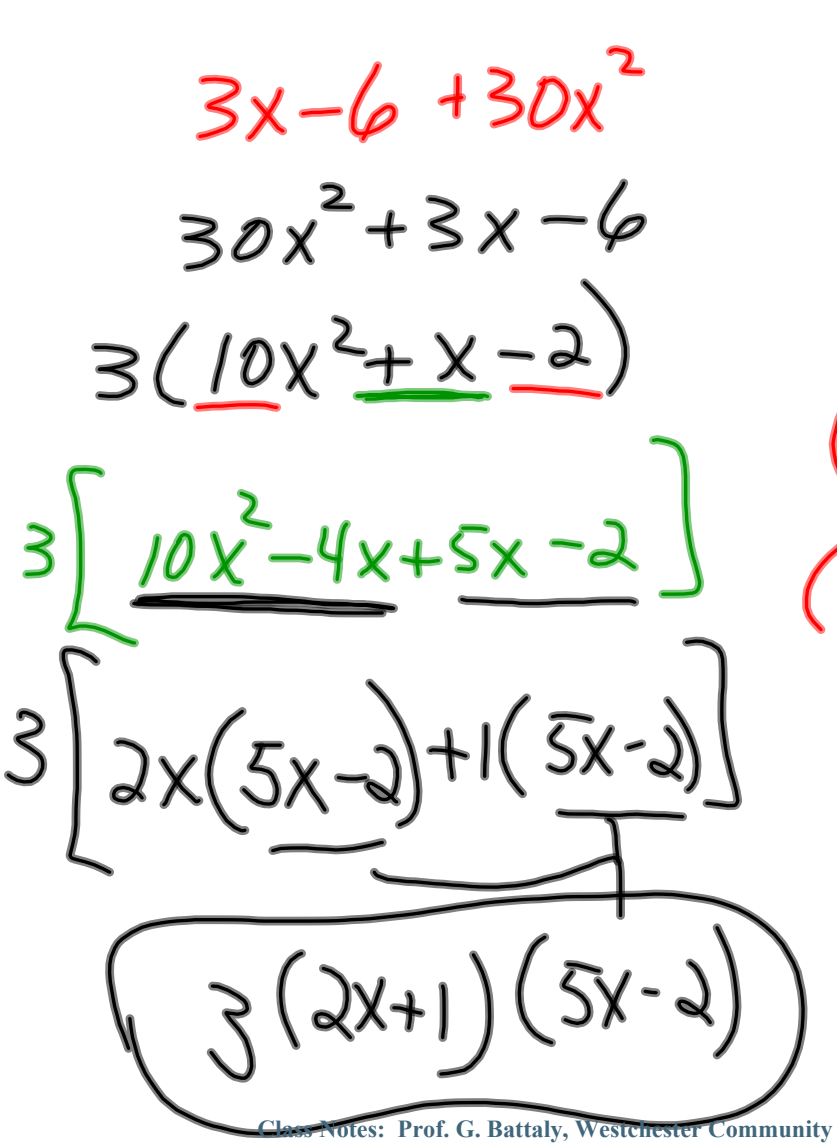
$3x-6+30x^2$

$30x^2+3x-6$

$3(\quad)$

ax^2+bx+c

6.3 Factoring Polynomials



ax^2+bx+c

$10(-2)=-20$

$(-4)(5)=-20$

$(-4)+(5)=1$

$20=1\cdot 20$ 19

$2\cdot 10$ 8

$4\cdot 5$ 1

6.3 Factoring Polynomials

$8x^2+37x-15$

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6.3 Factoring Polynomials

$8x^2+37x-15$

$8x^2-3x+40x-15$

$(-3)(40)=-120$

$(-3)+(40)=37$

$x(8x-3)+5(8x-3)$

$(x+5)(8x-3)$

FOIL $\begin{bmatrix} 8x^2-3x+40x-15 \\ 8x^2+37x-15 \end{bmatrix}$

$120=1\cdot 120$

$2\cdot 60$

$3\cdot 40$

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