

Algebra I

8.1 Adding and Subtracting Polynomials

Objectives: To classify, add, and subtract polynomials
To identify the degree of a polynomial and write a polynomial in standard form.

Warm-Up

Admission to a museum costs \$15 per person and \$5 for parking.

Admission to an aquarium costs \$20 per person and \$6 for parking.

If p people and c cars plan on visiting, find:

a. the total cost of visiting the museum only. _____

b. the total cost of visiting the aquarium only: _____

c. the total cost of visiting both the museum and the aquarium: _____

Degree of a monomial: The sum of the _____ of the variables of a monomial.

Degree of a polynomial: The highest _____ of any term of the polynomial.

Standard Form of a Polynomial: Placing the terms in _____ order by _____

Finding the Degree of a Monomial: Determine the degree of each monomial.

- 1) $5x$ 2) $6x^3y^2$ 3) 4 4) $8xy$ 5) $-7y^4z$ 6) $\frac{3}{4}x^3$

Adding and Subtracting Monomials: Simplify each expression and find the degree.

Example 1) $3x^2 + 5x^2$

Example 2) $4x^3y - x^3y$

Example 3) $-6x^4 + 11x^4$

Example 4) $2x^2y^4 - 7x^2y^4$

Naming a Polynomial Based on Degree and Number of Terms:

<i>Polynomial</i>	<i>Degree</i>	<i>Classified by Degree</i>	<i>Number of Terms</i>	<i>Classified by Term</i>
6				
$-2x$				
$3x + 1$				
$x^2 + 2x - 5$				
$4x^3 - 8x$				
$2x^4 - 7x^3 - 5x + 1$				

Classifying Polynomials: Write each polynomial in standard form. What is the name of the polynomial based on its degree and number of terms?

Example 5) $3x + 4x^2$

Example 6) $4x^2 - 1 + 5x^3 + 7x$

Example 7) $2x - 3 + 8x^2$

Example 8) $6x - x^4 + 3x^2 - 7$

Adding & Subtracting Polynomials: You can do this either vertically or horizontally. All answers should be in standard form.

Example 9) $(3x^2 - 2x + 1) + (x^2 + 4x - 3)$

HORIZONTAL (i.e., GROUP LIKE TERMS)

VERTICAL (i.e., LINE UP LIKE TERMS)

Add or subtract and then classify by the degree and number of terms.

10) $(5x + 4) - (-2x + 3)$

11) $(3x^4 + 4x^3 + 7 - 5x) + (-5x^4 + 2x^3 + 3x - 2)$

12) $(6x^4 - 5x^2 + 3x) + (2x^4 - 8x^2 + 11)$

13) $(2x^3 + 6x^2 - 2x - 6) - (5x^3 + 2x - 2)$

14) $(3x^2 + 7x - 6) + (x^3 + 3x - x - 4)$

15) $(5x^4 - 2x + 7) - (-3x^4 + 6x^2 - 5)$

Algebra I

8.2 Multiplying and Factoring

Objective: To multiply a monomial by a polynomial
To factor a monomial from a polynomial

Warm-Up: Simplify.

1. $5y^3 - 8y^3$ 2. $(7x^2 + 6x - 5) - (2x^2 - 3x + 7)$ 3. $(8p^5 - 2p) + (p^5 + 9p)$

Recall: The Distributive Property: $a(b + c) =$ _____

Simplify and write in standard form.

Example 1 $4y^2(5y^4 - 3y^2 + 2)$

Example 2 $4b(5b^2 + b + 6)$

Example 3 $-7h(3h^2 - 8h - 1)$

Example 4 $2x(x^2 - 6x + 5)$

Example 5 $x^2(x + 1) - x(x^2 - 1)$

Example 6 $2m(4m^2 - 3) - m(5m)$

PRACTICE

Factoring out the GCF

What is the GCF of $14b^3$, $21b^2$ and $-42b$?

What is the GCF of $-12x^3 + 24x^2 - 16x$?

Determine the GCF of each polynomial.

1. $25b - 60$

2. $15w^4 + 5w^2$

3. $4k^3 - 12k^2 + 24k$

Factor each polynomial.

4. $7x - 14$

5. $12n^4 - 18n^2 + 6$

6. $-15p^4 + 24p^3 - 6p^2 + 12p$

7. $x^4 - x^3 + x^2$

8. $-2m^2 + 6m$

9. $9a^2b^3 - 15ab^2$

Algebra I

8.3 Multiplying Binomials

Objective: To multiply a binomial to a binomial or a binomial to a trinomial

Warm-Up: Find and factor out the GCF.

1. $8y^2 - 12y$

2. $5m^2 - 15m + 25$

3. $-3a^4 - 18a^2$

EXAMPLE 1 Simplify $(x + 2)(x - 5)$ using the specified method.

a. Distributive Property

b. Table

c. F.O.I.L.

PRACTICE Simplify each using FOIL.

1. $(m - 7)(m - 3)$

2. $(2b + 1)(b + 5)$

3. $(3p + 1)(p - 4)$

4. $(2d + 3)(7d - 2)$

5. $(6n^2 - 5)(n + 2)$

6. $(3a^2 - 4)(a + 2)$

Multiplying Binomials and Trinomials

Simplify and write in standard form using the distributive property.

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

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

PRACTICE Simplify each product and write in standard form.

7. $(x + 3)(4x^2 - x + 9)$

8. $(4x^2 - 3x + 2)(x - 1)$

APPLICATION

9. What is the area of a rectangle with length $(2x + 1)$ feet and width $(5x - 2)$ feet?

Algebra I

8.4 Multiplying Special Cases

Objective: To find the square of a binomial and to find the product of the sum and

Warm-Up

Factor using the GCF.

1. $-5x^3 + 20x - 45$

2. $-2a^3b^4 + 10ab^2$

Multiply the binomials using FOIL.

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

4. $(2m - 1)(m - 3)$

EXAMPLE 1: Perfect Square Binomial - Addition

a) What does $(a + b)^2$ mean? _____

b) What do you get when you FOIL the product?

EXAMPLE 2: Perfect Square Binomial - Subtraction

a) What does $(a - b)^2$ mean? _____

b) What do you get when you FOIL the product?

EXAMPLE 3: Difference of Squares

a) What do you get when you FOIL the product? $(a + b)(a - b)$

KEY CONCEPTS:

$$(a + b)^2 = \underline{\hspace{15em}}$$

$$(a - b)^2 = \underline{\hspace{15em}}$$

$$(a + b)(a - b) = \underline{\hspace{15em}}$$

EXAMPLE 4 Simplify each $(a + b)^2$ product.

a. $(x + 5)^2$

b. $(5n + 2)^2$

EXAMPLE 5 Simplify each $(a - b)^2$ product.

a. $(2m - 3)^2$

b. $(d^3 - 3p^2)^2$

EXAMPLE 6 Simplify each difference of squares.

a. $(3w^2 - 4y)(3w^2 + 4y)$

b. $(2p + 5q)(2p - 5q)$

EXAMPLE 7 Rewrite each problem as a special case product and FOIL.

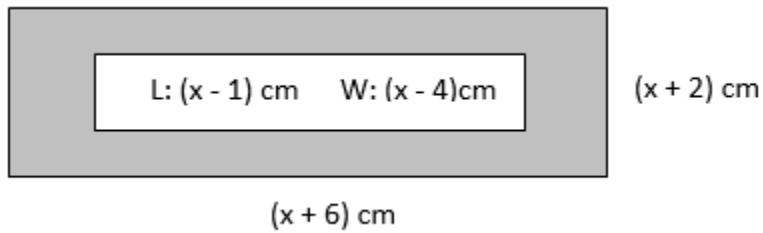
a. 29^2

b. 42^2

c. $47 \cdot 53$

d. $32 \cdot 28$

EXAMPLE 8 Determine the area of the shaded region.



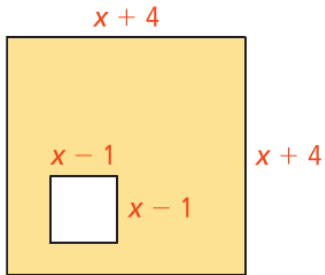
Algebra I

8.5 Factoring $x^2 + bx + c$

Objective: To factor trinomials of the form $x^2 + bx + c$

Warm-Up

1. Find the area of the shaded region.



Example 1 Find each product using FOIL.

a. $(x + 4)(x + 9)$

b. $(x - 4)(x - 9)$

c. $(x + 4)(x - 9)$

d. $(x - 4)(x + 9)$

Example 2 Factor each of the following.

a. $x^2 + 5x + 6$

b. $x^2 + 2x - 7$

#1 RULE OF FACTORING: _____

Example 3 Factor each of the following.

a. $-3d^2 - 39d - 120$

b. $2n^2 + 4n - 126$

Example 4 Factor each of the following.

a. $x^2 + 2x - 8$

b. $k^2 - 8k + 16$

c. $3h^2 + 33h + 72$

d. $a^2 - 4a + 9$

e. $m^2 - 13mn + 42n^2$

f. $2m^2 - 26m + 24$

g. $k^2 + 4kt - 96t^2$

h. $x^2 + 17xy + 72y^2$

Algebra I

8.6 Factoring $ax^2 + bx + c$

Objective: To factor trinomials of the form $ax^2 + bx + c$

Warm-Up Factor each completely.

1. $x^2 + 8x + 15$

2. $p^2 + 5p - 24$

3. $x^2 - 9x - 36$

Steps to factoring trinomials of the form $ax^2 + bx + c$:

STEP 1: Factor out the GCF, if one exists

STEP 2: Determine the values of the sum and product:

- Sum \rightarrow "b" value
- Product \rightarrow Multiply the "a" value to the "c" value

STEP 3: SPLIT the middle term of the trinomial, make into 4 terms

STEP 4: Factor out the GCF of each 2 term group

STEP 5: Regroup using the distributive property

Steps to Factor $ax^2 + bx + c$

Ex 1. Factor $6x^2 + 23x + 7$

STEP 1: Factor out the GCF, if one exists

STEP 2: Determine the values of the sum and product:

SUM: "b"

PRODUCT: multiply "a" and "c"

STEP 3: SPLIT the middle term of the trinomial
(make into 4 terms)

STEP 4: Factor out the GCF of each 2 term group

STEP 5: Regroup using the distributive property

Example 2: Factor $3x^2 + 4x - 15$

STEP 1: Factor out the GCF, if one exists

STEP 2: Determine the values of the sum and product:

SUM: "b"

PRODUCT: multiply "a" and "c"

**STEP 3: SPLIT the middle term of the trinomial
(make into 4 terms)**

STEP 4: Factor out the GCF of each 2 term group

STEP 5: Regroup using the distributive property

Example 3: Factor $2x^2 - 13x - 7$

STEP 1: Factor out the GCF, if one exists

STEP 2: Determine the values of the sum and product:

SUM: "b"

PRODUCT: multiply "a" and "c"

**STEP 3: SPLIT the middle term of the trinomial
(make into 4 terms)**

STEP 4: Factor out the GCF of each 2 term group

STEP 5: Regroup using the distributive property

Example 4: Factor $18x^2 - 33x + 12$

STEP 1: Factor out the GCF, if one exists

STEP 2: Determine the values of the sum and product:

SUM: "b"

PRODUCT: multiply "a" and "c"

**STEP 3: SPLIT the middle term of the trinomial
(make into 4 terms)**

STEP 4: Factor out the GCF of each 2 term group

STEP 5: Regroup using the distributive property

Example 5: Factor $12x^2 - 46x - 8$

STEP 1: Factor out the GCF, if one exists

STEP 2: Determine the values of the sum and product

SUM: "b"

PRODUCT: multiply "a" and "c"

**STEP 3: SPLIT the middle term of the trinomial
(make into 4 terms)**

STEP 4: Factor out the GCF of each 2 term group

STEP 5: Regroup using the distributive property

RECALL: Not all trinomials are factorable, these are called _____

PRACTICE: Factor each of the following completely.

1) $7m^2 + 50m + 7$

2) $24m^2 - 32m + 8$

3) $8y^2 - 10y - 3$

4) $25x^2 - 10x - 15$

5) $13p^2 + 8p - 5$

6) $3x^2 - 17x + 10$

Algebra I

8.7 Factoring Special Cases

Objective: To factor perfect square trinomials and the difference of two squares.

Warm-Up Factor each completely.

1. $2x^2 - x - 3$

2. $6p^2 + 26p + 24$

RECALL SPECIAL CASES:

PERFECT SQUARE TRINOMIALS:

$$(a + b)^2 = \underline{\hspace{15em}}$$

$$(a - b)^2 = \underline{\hspace{15em}}$$

DIFFERENCE OF SQUARES:

$$(a - b)(a + b) = \underline{\hspace{15em}}$$

IF YOU DON'T RECOGNIZE THE SPECIAL CASE THEN USE THE STEPS FROM §8-6 BELOW

Steps to factoring trinomials of the form $ax^2 + bx + c$:

STEP 1: Factor out the GCF, if one exists

STEP 2: Determine the values of the sum and product:

SUM: "b"

PRODUCT: multiply "a" and "c"

STEP 3: SPLIT the middle term of the trinomial, make into 4 terms

STEP 4: Factor out the GCF of each 2 term group

STEP 5: Regroup using the distributive property

FACTOR EACH PERFECT SQUARE TRINOMIAL COMPLETELY.

Example 1: $x^2 + 8x + 16$

Example 2: $4n^2 - 12n + 9$

Example 3: $x^2 - 12x + 36$

Example 4: $4m^2 + 20m + 25$

Example 5: $100y^2 - 220y + 121$

Example 6: $49p^2 - 84p + 36$

RECALL: Not all trinomials are factorable, these are called _____

FACTOR EACH DIFFERENCE OF SQUARES COMPLETELY.

Example 7: $m^2 - 16$

Example 8: $25n^2 - 49$

Example 9: $64x^2 - 1$

Example 10: $49y^2 - 4$

RECALL #1 RULE of FACTORING:

PRACTICE:

a) $3y^2 + 48x + 192$

b) $5k^2 - 245$

c) $6m^3 - 150m$

d) $48x^2 - 72x + 27$

List the perfect squares:

Example 11: Factor each using the Difference of Squares. (Mental math practice.)

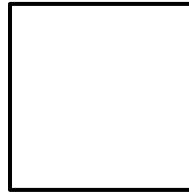
a) 99

b) 72

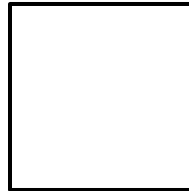
c) 117

Find the length of each side of the square given the area of the square.

Example 12: $A = (36x^2 + 84x + 49) \text{ ft}^2$



Example 13: $A = (64r^2 - 144r + 81) \text{ m}^2$



Algebra I

8.8 Factoring by Grouping

Objectives: To factor higher degree polynomials by grouping

Warm-Up Factor each completely.

1. $25m^5n^3 - 15m^3n$

2. $-12ab^3 - 18a^2b^2 + 30b^2$

3. $x^2 + 7x - 18$

4. $x^2 - 11 - 12$

5. Determine the width of a rectangle if the area is $(x^2 + 8x + 12) m^2$ and the length is $(x + 6) m$

Some polynomials of a degree greater than 2 can be factored.

This process is called **factoring by grouping**.

Step 1 Group the two terms with the highest degrees.

Step 2 Factor out the GCF of each group.

Step 3 Factor out the GCF of the whole problem.

Example 1 Factor by grouping. $3n^3 - 12n^2 + 2n - 8$

Example 2 Factor by grouping. $8t^3 + 14t^2 + 20t + 35$

PRACTICE: Factor each polynomial by grouping.

1. $15q^3 + 40q^2 + 3q + 8$

2. $14z^3 - 35z^2 - 16z + 40$

Before factoring by grouping, you may be need to factor out the GCF of all the terms.

Example 3 Factor by grouping. $4q^4 - 8q^3 + 12q^2 - 24q$?

Example 4 Factor by grouping. $6h^4 + 9h^3 - 12h^2 - 18h$

PRACTICE: Factor completely.

3. $3w^4 - 2w^3 + 18w^2 - 12w$

4. $6q^4 + 3q^3 - 24q^2 - 12q$

ALGEBRA 1
CHAPTER 8 REVIEW

Name _____
Date _____

Note: All work, must be shown, all answers simplified.

In problems 1 and 2, write each problem in standard form and state the degree.

1. $2x - 3x^2 + 6 + 5x^3$ 1. _____
Degree: _____

2. $7 + 9x - 8x^5 + 2x^2$ 2. _____
Degree: _____

Simplify problems 3 and 4.

3. $(5x^2 - x + 8) + (3x^2 - 7x - 10)$ 3. _____

4. $(7x^2 - 3x - 7) - (11x^2 + 8x - 12)$ 4. _____

Multiply problems 5 - 7.

5. $7x(3x - 4)$ 6. $-3m^2(2m^2 + 5m - 7)$ 5. _____

6. _____

7. $(3m - 2)(4m^2 - m + 5)$ 7. _____

Simplify problems 8 - 9.

8. $a(4a - 1) + 2a(a + 5)$

9. $3y(2y + 3) - 5y(y - 3)$

8. _____

9. _____

Multiply using F.O.I.L.

10. $(5x - 4)(3x + 2)$

11. $(3x - 2)^2$

10. _____

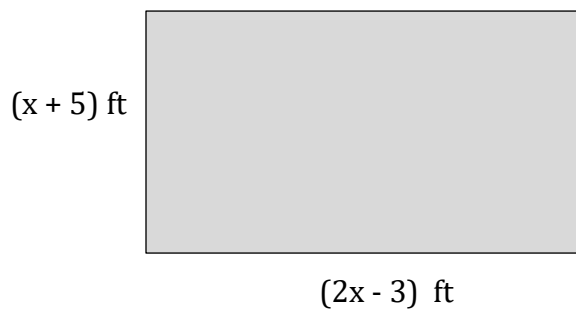
11. _____

12. $(4y + 5)(4y - 5)$

12. _____

13. Find the area of the rectangle.

13. _____



In 14 and 15, factor each polynomial using the GCF.

14. $32b^2 - 8b$

14. _____

15. $12a^2b - 18ab + 24ab^2$

15. _____

Factor each problem completely. Factor the GCF first, if applicable!

16. $x^2 + 8x + 15$

17. $2c^2 + 2c - 24$

16. _____

17. _____

18. $3m^2 - 12m - 63$

19. $x^2 + 5xy - 36y^2$

18. _____

19. _____

Factor each problem completely. Factor the GCF first, if applicable!

20. $4y^2 - 5y - 6$

21. $6m^2 + 7m - 5$

20. _____

21. _____

22. $9y^2 - 16$

23. $4m^2 - 12m + 9$

22. _____

23. _____

In 24 - 25, factor each problem by grouping.

24. $15x^3 + 2x^2 - 45x - 6$

25. $7m^4 - 4m^3 + 28m^2 - 16m$

24. _____

25. _____

26. The area of a square garden is $(x^2 + 6x + 9) m^2$.
Find the length of one side.

26. _____