Factoring Polynomials: GCF, Grouping, and Difference of Two Squares

Intermediate Algebra Worksheet · Grade 9-12 · numberbender.com

Name: _____ Date: _____ Score: / 10

Learning Objectives

- Find the greatest common factor (GCF) of a polynomial
- Factor polynomials by grouping
- Recognize and factor the difference of two squares
- Apply factoring techniques to simplify polynomial expressions

Factor each polynomial completely using the appropriate technique (GCF, grouping, or difference of two squares).

1. Find the GCF of the terms.

$12x^3,\ 18x^2,\ 24x$

Answer: _____

2. Factor out the GCF.

$15x^4 - 25x^3 + 10x^2$

Answer: _____

3. Factor out the GCF.

$8a^3b^2 - 12a^2b^3 + 20ab^2$

Answer: _____

4. Factor by grouping.

$x^3 + 2x^2 + 3x + 6$

Answer: _____

5. Factor by grouping.

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

Answer: _____

6. Factor by grouping.

$2x^3 - 6x^2 + 5x - 15$

Answer: _____

7. Factor the difference of two squares.

$x^2 - 49$

Answer: _____

Scan to watch

8. Factor the difference of two squares.

$9y^2 - 25$

Answer: _____

9. Factor completely (use GCF first, then difference of squares).

$3x^3 - 27x$

Answer: _____

10. Factor completely.

$16x^4 - 81$

Answer: _____

Factoring Polynomials: GCF, Grouping, and Difference of Two Squares

ANSWER KEY & SOLUTIONS

Intermediate Algebra Worksheet · Grade 9-12 · numberbender.com

This worksheet covers all topics from the video: warm-up review, GCF factoring, factoring by grouping, and difference of two squares. Problems progress from basic GCF identification through multi-step grouping and special pattern recognition.

Solutions

1. Find the GCF of the terms.

$12x^3,\ 18x^2,\ 24x$

→ *The greatest common numerical factor of 12, 18, and 24 is 6.*
→ *The smallest power of x common to all terms is x to the first power.*
→ *Multiply these together to get the GCF of 6x.*

Answer: $6x$

---

2. Factor out the GCF.

$15x^4 - 25x^3 + 10x^2$

→ *Identify the GCF of the coefficients 15, 25, and 10, which is 5.*
→ *The smallest power of x in all terms is x squared.*
→ *Factor out 5x squared from each term to get 5x squared times the quantity 3x squared minus 5x plus 2.*

Answer: $5x^2(3x^2 - 5x + 2)$

---

3. Factor out the GCF.

$8a^3b^2 - 12a^2b^3 + 20ab^2$

→ *The GCF of 8, 12, and 20 is 4.*
→ *The smallest power of a is a to the first, and the smallest power of b is b squared.*
→ *Factor out 4ab squared from each term to get 4ab squared times the quantity 2a squared minus 3ab plus 5.*

Answer: $4ab^2(2a^2 - 3ab + 5)$

---

4. Factor by grouping.

$x^3 + 2x^2 + 3x + 6$

→ *Group the first two terms and the last two terms.*
→ *Factor x squared from the first group and 3 from the second group to get x squared times the quantity x plus 2 plus 3 times the quantity x plus 2.*
→ *The common binomial factor is x plus 2, so the result is the quantity x plus 2 times the quantity x squared plus 3.*

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

---

5. Factor by grouping.

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

→ *Group the first two terms and the last two terms.*
→ *Factor 3x from the first group and 2 from the second group to get 3x times the quantity 2x plus 3 plus 2 times the quantity 2x plus 3.*
→ *Factor out the common binomial 2x plus 3 to get the quantity 3x plus 2 times the quantity 2x plus 3.*

Answer: $(3x + 2)(2x + 3)$

Scan to watch

6. Factor by grouping.

$2x^3 - 6x^2 + 5x - 15$

→ *Group the first two terms and the last two terms.*
→ *Factor 2x squared from the first group and 5 from the second group to get 2x squared times the quantity x minus 3 plus 5 times the quantity x minus 3.*
→ *The common binomial factor is x minus 3, giving the quantity x minus 3 times the quantity 2x squared plus 5.*

Answer: $(x - 3)(2x^2 + 5)$

---

7. Factor the difference of two squares.

$x^2 - 49$

→ *Recognize that x squared and 49 are both perfect squares.*
→ *The square root of x squared is x and the square root of 49 is 7.*
→ *Apply the difference of squares pattern to write the factored form as the quantity x plus 7 times the quantity x minus 7.*

Answer: $(x + 7)(x - 7)$

---

8. Factor the difference of two squares.

$9y^2 - 25$

→ *Identify 9y squared as the square of 3y and 25 as the square of 5.*
→ *Apply the difference of squares formula a squared minus b squared equals the quantity a plus b times the quantity a minus b.*
→ *Write the factored form as the quantity 3y plus 5 times the quantity 3y minus 5.*

Answer: $(3y + 5)(3y - 5)$

---

9. Factor completely (use GCF first, then difference of squares).

$3x^3 - 27x$

→ *Factor out the GCF of 3x from both terms to get 3x times the quantity x squared minus 9.*
→ *Recognize x squared minus 9 as a difference of two squares.*
→ *Factor it as the quantity x plus 3 times the quantity x minus 3, giving 3x times the quantity x plus 3 times the quantity x minus 3.*

Answer: $3x(x + 3)(x - 3)$

---

10. Factor completely.

$16x^4 - 81$

→ *Recognize 16x to the fourth and 81 as perfect squares, so apply the difference of squares to get the quantity 4x squared plus 9 times the quantity 4x squared minus 9.*
→ *The factor 4x squared minus 9 is itself a difference of squares.*
→ *Factor it as the quantity 2x plus 3 times the quantity 2x minus 3 to get the final answer of the quantity 4x squared plus 9 times the quantity 2x plus 3 times the quantity 2x minus 3.*

Answer: $(4x^2 + 9)(2x + 3)(2x - 3)$