

Definition:

- **Trinomial:** is a polynomial with three terms.

Important Properties:

- Factoring is completed by trial and error. The more you do, the easier factoring will become and the quicker you will be able to see the integers to use.
- You should always check your solution by multiplication.
- Remember to look for the greatest common factor (GCF) first. If the original problem has no common factors then none of its factors will either.

Factoring $x^2 + bx + c$: Find two integers whose product is c and whose sum is b .

- If c and b are both positive, then the integers must be positive.
- If c is positive and b is negative, then the integers must be negative.
- If c is negative, then one integer will be positive and one integer will be negative.

Factoring $ax^2 + bx + c$: We need to find integers p , q , r , and s such that

$$pq = a, \quad rs = c \quad \text{and} \quad ps + qr = b.$$

In other words,

$$ax^2 + bx + c = \overset{\text{factors of } a}{(\downarrow p x + r)} (\downarrow q x + s) = (p x + \underset{\text{factors of } c}{\uparrow r}) (\underset{\text{factors of } c}{\uparrow} q x + s)$$

Common Mistakes to Avoid:

- If the problem has a GCF, do not forget to write it with the answer in the final step.
- You can avoid sign mistakes by checking your answer with multiplication.

PROBLEMS

Factor completely.

1. $x^2 - 14x + 48$

$$\frac{x^2 - 14x + 48}{(x - 8)(x - 6)}$$

2. $x^2 - 4x - 21$

$$\frac{x^2 - 4x - 21}{(x - 7)(x + 3)}$$

3. $x^2 + 18x + 81$

$$\frac{x^2 + 18x + 81}{(x + 9)(x + 9)}$$

OR $(x + 9)^2$

4. $x^2 - 5xy + 6y^2$

$$\frac{x^2 - 5xy + 6y^2}{(x - 3y)(x - 2y)}$$

5. $x^2y^2 + 3xy - 4$

$$\frac{x^2y^2 + 3xy - 4}{(xy + 4)(xy - 1)}$$

6. $4x^2 - 4x - 48$

First, factor out the GCF of 4.

$$\frac{4x^2 - 4x - 48}{4(x^2 - x - 12)}$$

$$\frac{4(x - 4)(x + 3)}{4(x - 4)(x + 3)}$$

7. $2x^5 - 14x^4 + 24x^3$

First, factor out the GCF of $2x^3$.

$$\frac{2x^5 - 14x^4 + 24x^3}{2x^3(x^2 - 7x + 12)}$$

$$\frac{2x^3(x - 4)(x - 3)}{2x^3(x - 4)(x - 3)}$$

8. $3x^2 + 20x - 63$

$$\frac{3x^2 + 20x - 63}{(3x - 7)(x + 9)}$$

9. $2x^2 - x - 6$

$$\frac{2x^2 - x - 6}{(2x + 3)(x - 2)}$$

10. $8x^2 - 17x + 9$

$$\frac{8x^2 - 17x + 9}{(8x - 9)(x - 1)}$$

11. $4x^2 - 8x - 21$

$$\frac{4x^2 - 8x - 21}{(2x + 3)(2x - 7)}$$

12. $12x^3 - 27x^2 - 27x$

First, factor out the GCF of $3x$.

$$\frac{12x^3 - 27x^2 - 27x}{3x(4x^2 - 9x - 9)}$$

$$\frac{3x(4x + 3)(x - 3)}{3x(4x + 3)(x - 3)}$$

13. $12x^3 - 62x^2 + 10x$

First, factor out the GCF of $2x$.

$$\frac{12x^3 - 62x^2 + 10x}{2x(6x^2 - 31x + 5)}$$

$$\frac{2x(6x - 1)(x - 5)}{2x(6x - 1)(x - 5)}$$

14. $10x^6 - 15x^5 - 10x^4$

First, factor out the GCF of $5x^4$.

$$\frac{10x^6 - 15x^5 - 10x^4}{5x^4(2x^2 - 3x - 2)}$$

$$\frac{5x^4(2x + 1)(x - 2)}{5x^4(2x + 1)(x - 2)}$$

15. $12 + 16x - 3x^2$

$$\frac{12 + 16x - 3x^2}{(6 - x)(2 + 3x)}$$

16. $7 - 12x - 4x^2$

$$\frac{7 - 12x - 4x^2}{(7 + 2x)(1 - 2x)}$$

17. $16 + 22x - 3x^2$

$$\frac{16 + 22x - 3x^2}{(8 - x)(2 + 3x)}$$