

Factoring Trinomials: $x^2 + bx + c$

Quick Review and Helpful Hints

Goal: Write $x^2 + bx + c$ as $(x + p)(x + q)$.

Step 1 Find two numbers p and q whose **product** is c and whose **sum** is b .

Step 2 Write the factored form: $(x + p)(x + q)$.

Step 3 Check by FOILing back.

Sign guide:

$c > 0, b > 0$ both p, q are positive $x^2 + 7x + 12 = (x + 3)(x + 4)$

$c > 0, b < 0$ both p, q are negative $x^2 - 7x + 12 = (x - 3)(x - 4)$

$c < 0$ p, q have different signs $x^2 + x - 12 = (x + 4)(x - 3)$

Prime trinomial: If no integer pair has product c and sum b , the trinomial is *not factorable* over the integers.

Q Example: Factor: $x^2 + 9x + 20$.

👉 Need two numbers with product 20 and sum 9.

Factor pairs of 20: $1 \cdot 20, 2 \cdot 10, 4 \cdot 5$.

$4 + 5 = 9$ ✓

💡 Answer: $(x + 4)(x + 5)$

✂ Practice Problems

Factor completely. Write "prime" if the trinomial cannot be factored over the integers.

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|-----------------------|-------|-----------------------|-------|
| 1. $x^2 + 5x + 6 =$ | _____ | 7. $x^2 + x - 30 =$ | _____ |
| 2. $x^2 + 8x + 15 =$ | _____ | 8. $x^2 - 11x + 30 =$ | _____ |
| 3. $x^2 - 6x + 8 =$ | _____ | 9. $x^2 + 4x - 12 =$ | _____ |
| 4. $x^2 - 3x - 10 =$ | _____ | 10. $x^2 - x - 42 =$ | _____ |
| 5. $x^2 + 2x - 24 =$ | _____ | 11. $x^2 + 3x + 5 =$ | _____ |
| 6. $x^2 - 10x + 21 =$ | _____ | 12. $x^2 - 9x + 14 =$ | _____ |

✂ Word Problems

13. A rectangular patio has area $x^2 + 7x + 10$ square feet. Factor to find expressions for the length and width. _____

14. The height of a ball thrown upward is modeled by $h = -t^2 + 3t + 18$ (in feet). Factor -1 out first, then factor the trinomial to find when $h = 0$. _____