MATHEMATICS · GRADES 10-12

Factoring trinomials of the form ax^2+bx+c

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you break apart a curving equation where the squared term has a coefficient. A rectangular garden with a known area and a known relationship between its sides can be solved this way, giving you its length and width. The coefficient adds one extra step, but the idea is the same as the simpler case. It is the factoring you need when the leading number is not one.



Rule

Factoring trinomials: to factor $ax^2 + bx + c$, find two numbers that multiply to $a \times c$ and add to b, then use them to split the middle term and factor by grouping.

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Worked examples

EXAMPLE 1

Q Factor $2x^2 + 7x + 3$

SOLUTION

Multiply a by c: $2 \times 3 = 6$

$__ \times __ = 6$

$__ + __ = 7$

$6 \times 1 = 6$ and $6 + 1 = 7$, so the numbers are 6 and 1

Split the middle term: $2x^2 + 6x + x + 3$

Group and factor: $2x(x + 3) + 1(x + 3) = (2x + 1)(x + 3)$

EXAMPLE 2

Q Factor $3x^2 + 10x + 8$

SOLUTION

Multiply a by c: $3 \times 8 = 24$

$__ \times __ = 24$

$__ + __ = 10$

$6 \times 4 = 24$ and $6 + 4 = 10$, so the numbers are 6 and 4

Split the middle term: $3x^2 + 6x + 4x + 8$

Group and factor: $3x(x + 2) + 4(x + 2) = (3x + 4)(x + 2)$

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Practice questions

1 Factor $2x^2 + 5x + 3$

- **A** (2x + 1)(x + 3)
- **B** (2x + 3)(x + 1)
- **C** (2x - 3)(x - 1)
- **D** (2x + 3)(x - 1)

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2 Factor $3x^2 + 8x + 4$

- **A** (3x - 2)(x - 2)
- **B** (3x + 1)(x + 2)
- **C** (3x + 2)(x - 2)
- **D** (3x + 2)(x + 2)

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3 Factor $2x^2 + 9x + 10$

A (2x + 5)(x + 2)

B (2x + 5)(x - 2)

C (2x - 5)(x + 2)

D (2x + 2)(x + 5)

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4 Factor $4x^2 + 11x + 6$

A (4x + 3)(x - 2)

B (4x - 3)(x + 2)

C (4x + 3)(x + 2)

D (4x + 2)(x + 3)

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5 Factor $3x^2 + 7x + 2$

- **A** $(3x + 1)(x - 2)$
- **B** $(3x + 1)(x + 2)$
- **C** $(3x - 1)(x + 2)$
- **D** $(3x + 2)(x + 1)$

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6 A rectangle has area $2x^2 + 7x + 3$. What are its length and width?

- **A** $(2x + 3)(x + 1)$
- **B** $(2x + 1)(x - 3)$
- **C** $(2x - 1)(x - 3)$
- **D** $(2x + 1)(x + 3)$

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7 A rectangle's sides are $(3x + 2)$ and $(x + 4)$. What was its area as a trinomial?

- **A** $3x^2 + 10x + 8$
- **B** $3x^2 + 14x + 8$
- **C** $3x^2 + 12x + 8$
- **D** $3x^2 + 14x + 6$

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8 $2x^2 + 7x + 3$ is factored as $(2x + 3)(x + 1)$. What middle term does this factorization give?

- **A** $7x$
- **B** $3x$
- **C** $5x$
- **D** $6x$

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9 Factor $2x^2 + 11x + 5$

- **A** $(2x + 5)(x + 1)$
- **B** $(2x + 1)(x - 5)$
- **C** $(2x + 1)(x + 5)$
- **D** $(2x - 1)(x - 5)$

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10 Which one does not factor with whole numbers?

- **A** $2x^2 + 5x + 3$
- **B** $2x^2 + 7x + 3$
- **C** $3x^2 + 7x + 2$
- **D** $2x^2 + 9x + 3$

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ANSWER KEY

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

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

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

4. $(4x + 3)(x + 2)$

5. $(3x + 1)(x + 2)$

6. $(2x + 1)(x + 3)$

7. $3x^2 + 14x + 8$

8. $5x$

9. $(2x + 1)(x + 5)$

10. $2x^2 + 9\ x\ + 3$

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