MATHEMATICS · GRADES 10-12

Factoring perfect-square trinomials

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you spot a pattern that collapses into a single squared bracket. A square patio has an area that is a perfect square, and working out its side from the area takes one step when you recognise the pattern. Instead of factoring the long way, you read the side straight off. It is the shortcut for the neatest kind of quadratic.



Rule

Perfect square trinomials: $a^2 + 2ab + b^2 = (a + b)^2$, and $a^2 - 2ab + b^2 = (a - b)^2$.

Check that the first and last terms are squares and the middle term is twice the product of their square roots.

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Worked examples

EXAMPLE 1

Q Factor $x^2 + 10x + 25$

SOLUTION

Check the ends: x^2 is $(x)^2$ and 25 is $(5)^2$

Check the middle: $2 \times x \times 5 = 10x$, which matches.

Write the squared bracket: $(x + 5)^2$

EXAMPLE 2

Q Factor $4x^2 - 12x + 9$

SOLUTION

Check the ends: $4x^2$ is $(2x)^2$ and 9 is $(3)^2$

Check the middle: $2 \times 2x \times 3 = 12x$, and the sign is negative.

Write the squared bracket: $(2x - 3)^2$

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Practice questions

1 Factor $x^2 + 6x + 9$.

- **A** $(x - 3)^2$
- **B** $(x + 9)^2$
- **C** $(x + 3)(x - 3)$
- **D** $(x + 3)^2$

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2 Factor $x^2 - 8x + 16$.

- **A** $(x + 4)^2$
- **B** $(x - 4)^2$
- **C** $(x - 16)^2$
- **D** $(x - 4)(x + 4)$

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3 Factor $9x^2 + 12x + 4$.

- **A** $(3x + 2)^2$
- **B** $(3x - 2)^2$
- **C** $(3x + 4)^2$
- **D** $(3x + 2)(3x - 2)$

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4 A square has area $25x^2 - 10x + 1$. How long is one side?

- **A** $5x + 1$
- **B** $5x - 1$
- **C** $x - 1$
- **D** $5x - 5$

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5 A square has area $16x^2 + 24x + 9$. How long is one side?

- **A** 4x - 3
- **B** x + 3
- **C** 4x + 3
- **D** 4x + 9

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6 A square has area $x^2 + 14x + 49$. How long is one side?

- **A** x - 7
- **B** x + 7
- **C** 7x + 1
- **D** x + 14

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7 A square has area $x^2 - 20x + 100$. How long is one side?

- **A** x - 10
- **B** x + 10
- **C** 10 - x
- **D** x + 20

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8 A square has area $x^2 + 12x + 36$. What is its perimeter?

- **A** 4x + 24
- **B** x + 6
- **C** 4x + 6
- **D** x + 24

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9 What is $(x - 8)^2$ as a trinomial?

- A $x^2 - 16x - 64$
- B $x^2 + 16x + 64$
- C $x^2 - 16x + 64$
- D $x^2 - 8x + 64$

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10 Which trinomial is a perfect square?

- A $x^2 + 10x + 25$
- B $x^2 + 10x + 20$
- C $x^2 + 9x + 25$
- D $x^2 + 10x + 30$

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ANSWER KEY

1. $(x + 3)^2$

2. $(x - 4)^2$

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

4. $5x - 1$

5. $4x + 3$

6. $x + 7$

7. $x - 10$

8. $4x + 24$

9. $x^2 - 16x + 64$

10. $x^2 + 10x + 25$

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