

## Perfect Square Trinomials



Example 1: Basic Perfect Square Trinomial (Positive Middle Term)

Factor:  $x^2 + 8x + 16$

Solution:

Step 1: Check pattern  $\rightarrow x^2$  (perfect square),

$$16 = 4^2 \text{ (perfect square),}$$

$$8x = 2(x)(4) \quad \checkmark$$

Step 2: Square roots  $\rightarrow \sqrt{x^2} = x, \sqrt{16} = 4$

Step 3: Middle term positive  $\rightarrow$  use +

Step 4: Write answer  $\rightarrow (x + 4)^2$

Step 5: Check  $\rightarrow (x + 4)^2 = x^2 + 8x + 16 \quad \checkmark$

CHECK:

$$\begin{aligned}(x + 4)(x + 4) &= x^2 + 4x + 4x + 16 \\ &= x^2 + 8x + 16\end{aligned}$$

Example 2: Perfect Square Trinomial (Negative Middle Term)

Factor:  $y^2 - 10y + 25$

Solution:

Step 1: Check pattern  $\rightarrow y^2$  (perfect square),

$$25 = 5^2 \text{ (perfect square),}$$

$$-10y = -2(y)(5) \quad \checkmark$$

Step 2: Square roots  $\rightarrow \sqrt{y^2} = y, \sqrt{25} = 5$

Step 3: Middle term negative  $\rightarrow$  use -

Step 4: Write answer  $\rightarrow (y - 5)^2$

Step 5: Check  $\rightarrow (y - 5)^2 = y^2 - 10y + 25 \quad \checkmark$

CHECK:

$$\begin{aligned}(y - 5)(y - 5) &= y^2 - 5y - 5y + 25 \\ &= y^2 - 10y + 25\end{aligned}$$

## Perfect Square Trinomials



Example 3: Perfect Square Trinomial with Coefficients

Factor:  $4x^2 + 12x + 9$

Solution:

Step 1: Check pattern  $\rightarrow 4x^2 = (2x)^2$  (perfect square),

$$9 = 3^2 \text{ (perfect square),}$$

$$12x = 2(2x)(3) \quad \checkmark$$

Step 2: Square roots  $\rightarrow \sqrt{4x^2} = 2x, \sqrt{9} = 3$

Step 3: Middle term positive  $\rightarrow$  use +

Step 4: Write answer  $\rightarrow (2x + 3)^2$

Step 5: Check  $\rightarrow (2x + 3)^2 = 4x^2 + 12x + 9 \quad \checkmark$

Example 4: Perfect Square Trinomial with Variables

Factor:  $9a^2 - 12ab + 4b^2$

Solution:

Step 1: Check pattern  $\rightarrow 9a^2 = (3a)^2$  (perfect square),

$$4b^2 = (2b)^2 \text{ (perfect square),}$$

$$-12ab = -2(3a)(2b) \quad \checkmark$$

Step 2: Square roots  $\rightarrow \sqrt{9a^2} = 3a, \sqrt{4b^2} = 2b$

Step 3: Middle term negative  $\rightarrow$  use -

Step 4: Write answer  $\rightarrow (3a - 2b)^2$

Step 5: Check  $\rightarrow (3a - 2b)^2 = 9a^2 - 12ab + 4b^2 \quad \checkmark$

## Perfect Square Trinomials



Example 5: Testing if it's NOT a Perfect Square Trinomial

Factor:  $x^2 + 7x + 9$

Solution:

Step 1: Check pattern  $\rightarrow x^2$  (perfect square),

$$9 = 3^2 \text{ (perfect square),}$$

but  $7x \neq 2(x)(3) = 6x \text{ } \times$

Conclusion: This is NOT a perfect square trinomial  $\times$

Must use other factoring methods or check if it factors at all

Example 6: Perfect Square Trinomial with Larger Coefficients

Factor:  $16x^2 - 24x + 9$

Solution:

Step 1: Check pattern  $\rightarrow 16x^2 = (4x)^2$  (perfect square),

$$9 = 3^2 \text{ (perfect square),}$$

$-24x = -2(4x)(3) \checkmark$

Step 2: Square roots  $\rightarrow \sqrt{16x^2} = 4x, \sqrt{9} = 3$

Step 3: Middle term negative  $\rightarrow$  use  $-$

Step 4: Write answer  $\rightarrow (4x - 3)^2$

Step 5: Check  $\rightarrow (4x - 3)^2 = 16x^2 - 24x + 9 \checkmark$