Perfect Square Trinomials

LEVEL 1: The Basics (Easy)

Factor each perfect square trinomial:

- $x^2 + 2x + 1$
- $y^2 - 2y + 1$
- $a^2 + 4a + 4$
- $b^2 - 4b + 4$
- $m^2 + 6m + 9$
- $n^2 - 6n + 9$
- $p^2 + 8p + 16$
- $q^2 - 8q + 16$
- $r^2 + 10r + 25$
- $s^2 - 10s + 25$
- $t^2 + 12t + 36$
- $u^2 - 12u + 36$
- $v^2 + 14v + 49$
- $w^2 - 14w + 49$
- $x^2 + 16x + 64$
- $y^2 - 16y + 64$
- $z^2 + 18z + 81$
- $a^2 - 18a + 81$
- $b^2 + 20b + 100$
- $c^2 - 20c + 100$

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LEVEL 2: Dive Deeper

Factor each perfect square trinomial:

- $4x^2 + 4x + 1$
- $4y^2 - 4y + 1$
- $9a^2 + 6a + 1$
- $9b^2 - 6b + 1$
- $16m^2 + 8m + 1$
- $16n^2 - 8n + 1$
- $25p^2 + 10p + 1$
- $25q^2 - 10q + 1$
- $4x^2 + 12x + 9$
- $4y^2 - 12y + 9$
- $9a^2 + 12a + 4$
- $9b^2 - 12b + 4$
- $16m^2 + 24m + 9$
- $16n^2 - 24n + 9$
- $25p^2 + 20p + 4$
- $25q^2 - 20q + 4$
- $36r^2 + 12r + 1$
- $36s^2 - 12s + 1$
- $49t^2 + 14t + 1$
- $49u^2 - 14u + 1$

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LEVEL 3: Mastering the Concept

Factor each expression if it's a perfect square trinomial, or state "Not a perfect square trinomial":

- $x^2 + 6xy + 9y^2$
- $a^2 - 8ab + 16b^2$
- $4m^2 + 12mn + 9n^2$
- $9p^2 - 24pq + 16q^2$
- $25r^2 + 30rs + 9s^2$
- $36t^2 - 60tu + 25u^2$
- $x^2 + 5x + 25$
- $y^2 - 7y + 49$
- $4a^2 + 20a + 25$
- $9b^2 - 30b + 25$
- $16m^2 + 40m + 25$
- $25n^2 - 70n + 49$
- $x^4 + 2x^2 + 1$
- $y^4 - 4y^2 + 4$
- $a^4 + 6a^2 + 9$
- $b^4 - 8b^2 + 16$
- $(x + 1)^2 + 4(x + 1) + 4$
- $(y - 2)^2 - 6(y - 2) + 9$
- $x^2 + 8x + 15$
- $y^2 - 10y + 24$

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Real-Life / Word Problems

1. Square Garden: A square garden has side length $(x + 3)$ feet. Write an expression for the area and identify it as a perfect square trinomial.

2. Picture Frame: A square picture has side length $(2x - 1)$ inches. If the area is expressed as a trinomial, factor it completely.

3. Box Volume: A cubic box has side length $(3x + 2)$ units. If we consider the area of one face, write and factor the expression.

4. Tile Pattern: A square tile pattern has side length $(4x - 5)$ units. Express the area as a trinomial and factor it.

Challenge Problems

1. Factor completely: $x^4 - 6x^2 + 9$

2. Factor: $(x + y)^2 + 2(x + y) + 1$

3. Factor: $4(a - b)^2 - 12(a - b) + 9$

4. If $x^2 + 6x + 9 = 16$, solve for x by factoring first.

5. Factor: $9x^2 + 6xy + y^2 - 4$

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