

Special Products of Polynomials

Name: _____

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Quick Review and Helpful Hints

Three handy patterns: square of a sum $(a + b)^2 = a^2 + 2ab + b^2$; square of a difference $(a - b)^2 = a^2 - 2ab + b^2$; difference of squares $(a + b)(a - b) = a^2 - b^2$. Spotting these lets you expand quickly without full FOIL.

▷ **Example:** Expand $(x + 3)^2$. **Work:** Use $(a + b)^2 = a^2 + 2ab + b^2$ with $a = x$, $b = 3$: $x^2 + 2(x)(3) + 9$. ★ **Answer:** $x^2 + 6x + 9$

	a	b
a	a^2	ab
b	ab	b^2

$$(a + b)^2 = a^2 + 2ab + b^2.$$

◆ Practice Problems

Expand each product.

1. $(x + 1)^2$

8. $(3x - 2)^2$

2. $(x + 4)^2$

9. $(x + 6)^2$

3. $(x - 2)^2$

10. $(2x + 5)(2x - 5)$

4. $(x - 5)^2$

11. $(x - 1)^2$

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

12. $(5x + 3)(5x - 3)$

6. $(x + 7)(x - 7)$

13. $(4x + 1)^2$

7. $(2x + 1)^2$

14. $(x - 8)(x + 8)$

◆ Word Problems

15. A square has side $(x + 2)$. Write its area, expanded.

16. A square patio is planned with side length $(x + 10)$ feet. Write the expanded expression for its area.

17. Multiply $(x + 9)(x - 9)$.

18. A square has side $(2x - 3)$. Write its area, expanded.



Answer Keys

- | | | |
|---------------------|---------------------|-----------------------|
| 1. $x^2 + 2x + 1$ | 7. $4x^2 + 4x + 1$ | 13. $16x^2 + 8x + 1$ |
| 2. $x^2 + 8x + 16$ | 8. $9x^2 - 12x + 4$ | 14. $x^2 - 64$ |
| 3. $x^2 - 4x + 4$ | 9. $x^2 + 12x + 36$ | 15. $x^2 + 4x + 4$ |
| 4. $x^2 - 10x + 25$ | 10. $4x^2 - 25$ | 16. $x^2 + 20x + 100$ |
| 5. $x^2 - 9$ | 11. $x^2 - 2x + 1$ | 17. $x^2 - 81$ |
| 6. $x^2 - 49$ | 12. $25x^2 - 9$ | 18. $4x^2 - 12x + 9$ |

Step-by-Step Explanations

1. Use the square-of-a-sum pattern $(a + b)^2 = a^2 + 2ab + b^2$. Here $a = x$ and $b = 1$, so $x^2 + 2(x)(1) + 1^2 = x^2 + 2x + 1$.
2. This is another square of a sum. Let $a = x$ and $b = 4$; then $(x + 4)^2 = x^2 + 2(x)(4) + 4^2 = x^2 + 8x + 16$.
3. For a square of a difference, use $(a - b)^2 = a^2 - 2ab + b^2$. With $a = x$ and $b = 2$, the result is $x^2 - 4x + 4$.
4. Use $(a - b)^2 = a^2 - 2ab + b^2$ with $a = x$ and $b = 5$. That gives $x^2 - 2(x)(5) + 25 = x^2 - 10x + 25$.
5. The factors have the same first term and opposite signs, so use the difference-of-squares pattern $(a + b)(a - b) = a^2 - b^2$. Here $a = x$ and $b = 3$, giving $x^2 - 9$.
6. This is a difference of squares because the signs are opposite. Square x and square 7, then subtract: $x^2 - 7^2 = x^2 - 49$.
7. Use $(a + b)^2 = a^2 + 2ab + b^2$ with $a = 2x$ and $b = 1$. Then $(2x)^2 = 4x^2$, $2(2x)(1) = 4x$, and $1^2 = 1$, so the expansion is $4x^2 + 4x + 1$.
8. Use the square-of-a-difference pattern with $a = 3x$ and $b = 2$. Square each end and subtract twice the product: $9x^2 - 12x + 4$.
9. Here $a = x$ and $b = 6$ in $(a + b)^2$. The middle term is $2ab = 2(x)(6) = 12x$, and $6^2 = 36$, so the expansion is $x^2 + 12x + 36$.
10. The signs are opposite, so the middle terms cancel. Use $a^2 - b^2$ with $a = 2x$ and $b = 5$: $(2x)^2 - 5^2 = 4x^2 - 25$.
11. This is $(x - 1)^2$, so use $a^2 - 2ab + b^2$. With $a = x$ and $b = 1$, the expansion is $x^2 - 2x + 1$.
12. Opposite signs mean difference of squares. Square $5x$ to get $25x^2$ and square 3 to get 9, so the product is $25x^2 - 9$.
13. Use the square-of-a-sum pattern with $a = 4x$ and $b = 1$. The terms are $(4x)^2 = 16x^2$, $2(4x)(1) = 8x$, and $1^2 = 1$, so the expansion is $16x^2 + 8x + 1$.
14. This matches $(a - b)(a + b)$, so use $a^2 - b^2$. Here $a = x$ and $b = 8$, so the expanded form is $x^2 - 64$.
15. The area of a square is side squared, so the expression is $(x + 2)^2$. Use $(a + b)^2$ to get $x^2 + 2(x)(2) + 4 = x^2 + 4x + 4$.
16. Use $(a + b)^2$ with $a = x$ and $b = 10$. The middle term is $2(x)(10) = 20x$, and $10^2 = 100$, so the answer is $x^2 + 20x + 100$.
17. The binomials are conjugates, meaning the same terms with opposite signs. The middle terms cancel, so $(x + 9)(x - 9) = x^2 - 9^2 = x^2 - 81$.
18. The side length is $(2x - 3)$, so the area is $(2x - 3)^2$. Use $(a - b)^2$ with $a = 2x$ and $b = 3$ to get $4x^2 - 12x + 9$.



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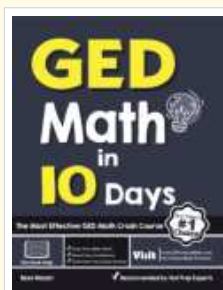
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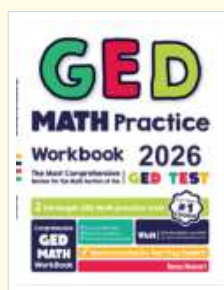
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