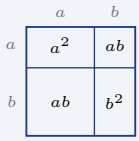
Special Products of Polynomials

Name: _____	Date: _____	Score: _____ / 18

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



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

Practice Problems

Expand each product.

1. $(x+1)^2$ _____
2. $(x+4)^2$ _____
3. $(x-2)^2$ _____
4. $(x-5)^2$ _____
5. $(x+3)(x-3)$ _____
6. $(x+7)(x-7)$ _____
7. $(2x+1)^2$ _____
8. $(3x-2)^2$ _____
9. $(x+6)^2$ _____
10. $(2x+5)(2x-5)$ _____
11. $(x-1)^2$ _____
12. $(5x+3)(5x-3)$ _____
13. $(4x+1)^2$ _____
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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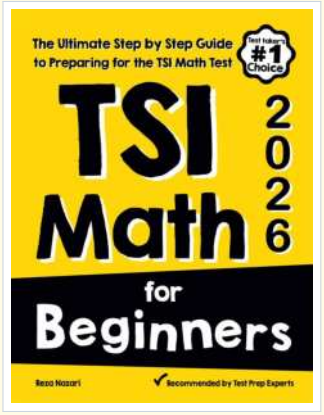

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