Special Products of Polynomials

Name: _____	Date: _____	Score: _____ / 24

Quick Review

Some products show up so often that memorizing them saves time: **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**: $(a+b)(a-b) = a^2 - b^2$. The key word in the squares is the **middle term** $(2ab)$ — that's the part students forget. $(x+3)^2 \neq x^2 + 9$; the middle is $2(x)(3) = 6x$, giving $x^2 + 6x + 9$. Recognizing these patterns also helps with factoring later: any perfect square trinomial can be factored as a binomial squared, and any difference of two squares factors as $(a+b)(a-b)$.

PRACTICE

Expand each using the special products patterns.

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

2. $(x-6)^2$ _____

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

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

5. $(3x-2)^2$ _____

6. $(2x+3)(2x-3)$ _____

7. $(x+a)^2$ _____

8. $(5x-1)^2$ _____

9. $(x+\frac{1}{2})^2$ _____

10. $(7+x)(7-x)$ _____

11. $(x-y)^2$ _____

12. $(a+b)(a-b)$ _____

13. $(4x+5)(4x-5)$ _____

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

15. $(2x+3)(2x+3)$ _____

16. $(\sqrt{2}+x)(\sqrt{2}-x)$ _____

17. $(x-3)(x+3)$ _____

18. $(3x+y)^2$ _____

19. $(10+1)^2 = 11^2$ _____

20. $(x+y)^2 - (x-y)^2$ _____

Word Problems

21. A square garden has side length $x+5$ feet. Write its area in expanded form.

_____

22. A display panel is 99 cm by 101 cm. Use the difference of squares pattern to find its area quickly.

_____

23. A square patio has side length x ft. The owner adds a 3 ft strip along one side and another 3 ft strip along the adjacent side, making the new square side $x+3$. By how much does the area increase?

_____

24. A rectangular courtyard has length $x+y$ and width $x-y$. Use the difference of squares pattern to write it

_____

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Answer Keys

1. $x^2 + 8x + 16$
2. $x^2 - 12x + 36$
3. $x^2 - 25$
4. $4x^2 + 4x + 1$
5. $9x^2 - 12x + 4$
6. $4x^2 - 9$
7. $x^2 + 2ax + a^2$
8. $25x^2 - 10x + 1$
9. $x^2 + x + \frac{1}{4}$
10. $49 - x^2$
11. $x^2 - 2xy + y^2$
12. $a^2 - b^2$
13. $16x^2 - 25$
14. $x^4 + 6x^2 + 9$
15. $4x^2 + 12x + 9$
16. $2 - x^2$
17. $x^2 - 9$
18. $9x^2 + 6xy + y^2$
19. 121
20. $4xy$
21. $x^2 + 10x + 25$
22. $9999\ \text{cm}^2$
23. $6x + 9$
24. $x^2 - y^2$

Step-by-Step Tutor Notes

1. Take it one clear step at a time and keep the original question in mind. $a = x, b = 4$. Middle: $2(x)(4) = 8x$. So the answer is $x^2 + 8x + 16$.
2. Use the clue in the question first, then let the arithmetic finish the job. $2(x)(6) = 12x$, with $-$ sign. So the answer is $x^2 - 12x + 36$.
3. This is a good place to slow down, check the notation, and simplify cleanly. Difference of squares: $a^2 - b^2$ with $a = x, b = 5$. So the answer is $x^2 - 25$.
4. Take it one clear step at a time and keep the original question in mind. $(2x)^2 + 2(2x)(1) + 1 = 4x^2 + 4x + 1$. So the answer is $4x^2 + 4x + 1$.
5. This is a good place to slow down, check the notation, and simplify cleanly. $9x^2 - 2(3x)(2) + 4$. So the answer is $9x^2 - 12x + 4$.
6. Use the clue in the question first, then let the arithmetic finish the job. $(2x)^2 - 3^2 = 4x^2 - 9$. So the answer is $4x^2 - 9$.
7. Use the clue in the question first, then let the arithmetic finish the job. Pattern with general a. So the answer is $x^2 + 2ax + a^2$.
8. This is a good place to slow down, check the notation, and simplify cleanly. $25x^2 - 2(5x)(1) + 1$. So the answer is $25x^2 - 10x + 1$.
9. Focus on the main idea of the problem, then simplify carefully. Middle: $2(x)(\frac{1}{2}) = x$. So the answer is $x^2 + x + \frac{1}{4}$.
10. Take it one clear step at a time and keep the original question in mind. Order doesn't matter for the pattern: $7^2 - x^2$. So the answer is $49 - x^2$.
11. Start with the definition the problem is testing, then apply it directly. Two-variable version of difference squared. So the answer is $x^2 - 2xy + y^2$.
12. Focus on the main idea of the problem, then simplify carefully. The pattern itself. So the answer is $a^2 - b^2$.
13. Focus on the main idea of the problem, then simplify carefully. $(4x)^2 - 5^2$. So the answer is $16x^2 - 25$.
14. Start with the definition the problem is testing, then apply it directly. $a = x^2, b = 3$. $(x^2)^2 = x^4$; middle $6x^2$. So the answer is $x^4 + 6x^2 + 9$.
15. Start with the definition the problem is testing, then apply it directly. This is just $(2x + 3)^2$. So the answer is $4x^2 + 12x + 9$.
16. Focus on the main idea of the problem, then simplify carefully. $(\sqrt{2})^2 - x^2 = 2 - x^2$. So the answer is $2 - x^2$.
17. Use the clue in the question first, then let the arithmetic finish the job. Difference of squares. So the answer is $x^2 - 9$.
18. This is a good place to slow down, check the notation, and simplify cleanly. $(3x)^2 + 2(3x)(y) + y^2$. So the answer is $9x^2 + 6xy + y^2$.
19. Use the clue in the question first, then let the arithmetic finish the job. $100 + 2(10)(1) + 1 = 121$. (Cool mental-math trick.). So the answer is 121.
20. Expand both: $(x^2 + 2xy + y^2) - (x^2 - 2xy + y^2) = 4xy$. All the squared terms cancel; the middle terms combine.
21. Name the quantities first so the model is easy to read. $(x + 5)^2 = x^2 + 10x + 25$.
22. $99 \cdot 101 = (100 - 1)(100 + 1) = 100^2 - 1^2 = 10000 - 1 = 9999$. The panel's area is 9999 square centimeters.
23. Name the quantities first so the model is easy to read. $(x + 3)^2 - x^2 = (x^2 + 6x + 9) - x^2 = 6x + 9$.
24. Set up the model from the story, then calculate carefully. Difference of squares: $(x + y)(x - y) = x^2 - y^2$.

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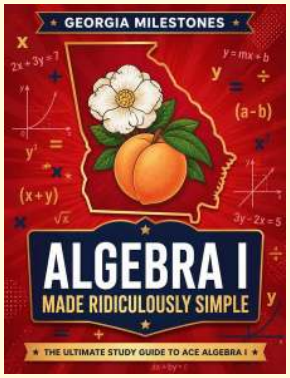

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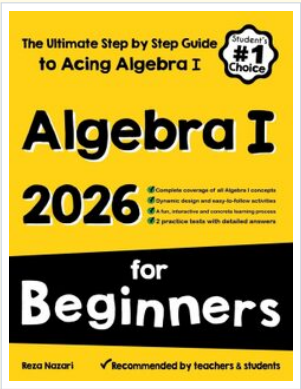

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