

Multiplying Polynomials

Name: _____

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Q Quick Review

To multiply polynomials, use the **distributive property** — every term in the first polynomial multiplies every term in the second. For **monomial** \times **polynomial**: distribute the single term across. For **binomial** \times **binomial**: **FOIL** (First, Outer, Inner, Last) or use the box method. For larger polynomials: distribute each term carefully and then combine like terms. When multiplying powers of the same variable, *add* the exponents: $x^a \cdot x^b = x^{a+b}$. The most common errors: forgetting to distribute to every term, or missing a sign change with negatives.

PRACTICE

Multiply each expression.

- | | | | |
|----------------------|-------|-------------------------------|-------|
| 1. $2x(x + 3)$ | _____ | 11. $(2x + 1)^2$ | _____ |
| 2. $3x(x^2 - x + 1)$ | _____ | 12. $-x(x + 5)$ | _____ |
| 3. $(x + 2)(x + 5)$ | _____ | 13. $(x + 1)(x^2 + 2x + 1)$ | _____ |
| 4. $(x - 3)(x + 4)$ | _____ | 14. $(2x - 3)(2x + 3)$ | _____ |
| 5. $(x - 1)(x - 7)$ | _____ | 15. $(x + y)(x - y)$ | _____ |
| 6. $(2x + 1)(x - 3)$ | _____ | 16. $3(x + 2)(x - 1)$ | _____ |
| 7. $(3x - 2)(x + 4)$ | _____ | 17. $(x - 2)^3$ | _____ |
| 8. $(x + 5)^2$ | _____ | 18. $4x^2(x - 1)$ | _____ |
| 9. $(x - 4)^2$ | _____ | 19. $(x + a)(x + b)$ | _____ |
| 10. $(x + 3)(x - 3)$ | _____ | 20. $(x - 1)(x + 1)(x^2 + 1)$ | _____ |

◆ Word Problems

21. A rectangular garden has length $x + 5$ feet and width $x + 2$ feet. Write the area in expanded form.
- _____
22. A square tile has side length $x - 3$ inches. Write its area in expanded form.
- _____
23. A rectangular courtyard has side expressions $(x + 2)$ meters and $(x - 2)$ meters. Write the area in expanded form.
- _____
24. A pool's length is $2x + 1$ ft and its width is $x - 3$ ft. Write the area in expanded form.
- _____



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Answer Keys

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. $2x^2 + 6x$ 2. $3x^3 - 3x^2 + 3x$ 3. $x^2 + 7x + 10$ 4. $x^2 + x - 12$ 5. $x^2 - 8x + 7$ 6. $2x^2 - 5x - 3$ 7. $3x^2 + 10x - 8$ 8. $x^2 + 10x + 25$ 9. $x^2 - 8x + 16$ 10. $x^2 - 9$ 11. $4x^2 + 4x + 1$ 12. $-x^2 - 5x$ | <ol style="list-style-type: none"> 13. $x^3 + 3x^2 + 3x + 1$ 14. $4x^2 - 9$ 15. $x^2 - y^2$ 16. $3x^2 + 3x - 6$ 17. $x^3 - 6x^2 + 12x - 8$ 18. $4x^3 - 4x^2$ 19. $x^2 + (a + b)x + ab$ 20. $x^4 - 1$ 21. $x^2 + 7x + 10$ 22. $x^2 - 6x + 9$ 23. $x^2 - 4$ 24. $2x^2 - 5x - 3$ |
|--|---|

Step-by-Step Tutor Notes

1. Focus on the main idea of the problem, then simplify carefully. Distribute: $2x \cdot x + 2x \cdot 3$. So the answer is $2x^2 + 6x$.
2. Use the clue in the question first, then let the arithmetic finish the job. $3x$ hits each term. So the answer is $3x^3 - 3x^2 + 3x$.
3. Start with the definition the problem is testing, then apply it directly. FOIL. So the answer is $x^2 + 7x + 10$.
4. Start with the definition the problem is testing, then apply it directly. $-3 + 4 = 1$ for middle term. So the answer is $x^2 + x - 12$.
5. Focus on the main idea of the problem, then simplify carefully. Both negatives: middle $-1 - 7 = -8$; product $(-1)(-7) = 7$. So the answer is $x^2 - 8x + 7$.
6. Use the clue in the question first, then let the arithmetic finish the job. FOIL: $2x^2 - 6x + x - 3$. So the answer is $2x^2 - 5x - 3$.
7. Focus on the main idea of the problem, then simplify carefully. FOIL: $3x^2 + 12x - 2x - 8$. So the answer is $3x^2 + 10x - 8$.
8. Take it one clear step at a time and keep the original question in mind. $(x + 5)(x + 5)$. So the answer is $x^2 + 10x + 25$.
9. Take it one clear step at a time and keep the original question in mind. Square of binomial. So the answer is $x^2 - 8x + 16$.
10. Take it one clear step at a time and keep the original question in mind. Difference of squares pattern. So the answer is $x^2 - 9$.
11. Take it one clear step at a time and keep the original question in mind. $(2x)^2 + 2(2x)(1) + 1^2$. So the answer is $4x^2 + 4x + 1$.
12. Use the clue in the question first, then let the arithmetic finish the job. Both terms get negated. So the answer is $-x^2 - 5x$.
13. This is a good place to slow down, check the notation, and simplify cleanly. Distribute x and 1 over the trinomial. So the answer is $x^3 + 3x^2 + 3x + 1$.
14. Use the clue in the question first, then let the arithmetic finish the job. Difference of squares: $(2x)^2 - 3^2$. So the answer is $4x^2 - 9$.
15. This is a good place to slow down, check the notation, and simplify cleanly. Classic difference of squares. So the answer is $x^2 - y^2$.
16. This is a good place to slow down, check the notation, and simplify cleanly. FOIL first: $x^2 + x - 2$. Then $\times 3$. So the answer is $3x^2 + 3x - 6$.
17. Take it one clear step at a time and keep the original question in mind. $(x - 2)^2 = x^2 - 4x + 4$, then times $(x - 2)$: distribute. So the answer is $x^3 - 6x^2 + 12x - 8$.
18. Focus on the main idea of the problem, then simplify carefully. $4x^3 - 4x^2$. So the answer is $4x^3 - 4x^2$.
19. Start with the definition the problem is testing, then apply it directly. FOIL: middle term sum, last term product. So the answer is $x^2 + (a + b)x + ab$.
20. $(x - 1)(x + 1) = x^2 - 1$. Then $(x^2 - 1)(x^2 + 1) = x^4 - 1$. (Difference of squares twice.)
21. Area = length \times width = $(x + 5)(x + 2) = x^2 + 2x + 5x + 10 = x^2 + 7x + 10$.
22. Set up the model from the story, then calculate carefully. Area = $(x - 3)^2 = x^2 - 6x + 9$.
23. Difference of squares: $(x + a)(x - a) = x^2 - a^2$. With $a = 2$: $x^2 - 4$.
24. Set up the model from the story, then calculate carefully. $(2x + 1)(x - 3) = 2x^2 - 6x + x - 3 = 2x^2 - 5x - 3$.



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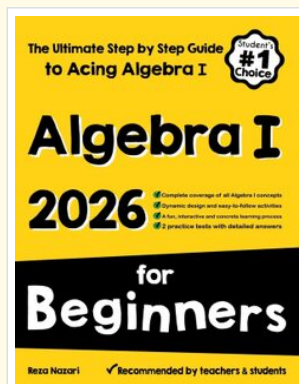
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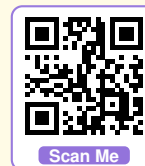
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