

# Multiplying Polynomials

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Score: \_\_\_\_\_ / 24

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

### 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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