

# 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:**  $x^2 + 6x + 9$

|     |       |       |
|-----|-------|-------|
|     | $a$   | $b$   |
| $a$ | $a^2$ | $ab$  |
| $b$ | $ab$  | $b^2$ |

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

## ◆ 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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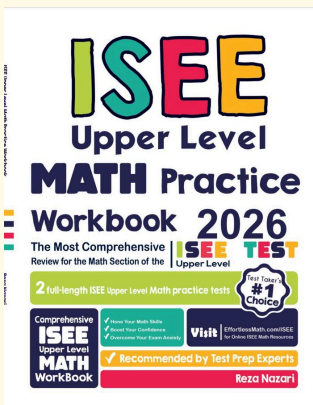


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