

# Multiplying Binomials

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 18

## Quick Review and Helpful Hints

A **binomial** is a two-term expression like  $x + 3$ . To multiply two binomials, every term in the first must meet every term in the second. The friendly shortcut is **FOIL** — **F**irst, **O**uter, **I**nner, **L**ast — which simply keeps track of all four products. After multiplying, **combine the like terms** (the two middle  $x$ -terms) to finish.

▷ **Example:** Multiply  $(x + 3)(x + 2)$ .

**Work:** **F**irst:  $x \cdot x = x^2$ . **O**uter:  $x \cdot 2 = 2x$ . **I**nner:  $3 \cdot x = 3x$ . **L**ast:  $3 \cdot 2 = 6$ . That gives  $x^2 + 2x + 3x + 6$ . The like terms  $2x$  and  $3x$  add to  $5x$ .

★ **Answer:**  $x^2 + 5x + 6$

	$x$	$+2$
$x$	$x^2$	$2x$
$+3$	$3x$	$6$

Area (box) model: the four pieces are the four FOIL products.

### Practice Problems

Multiply and simplify. Combine the like terms in your answer.

- |  |  |
|--|--|
| 1. Multiply $(x + 1)(x + 4)$ .<br>_____  | 8. Multiply $(3x - 2)(x + 4)$ .<br>_____   |
| 2. Multiply $(x + 2)(x + 5)$ .<br>_____  | 9. Multiply $(x - 7)(x + 2)$ .<br>_____    |
| 3. Multiply $(x + 3)(x - 2)$ .<br>_____  | 10. Multiply $(2x + 3)(2x - 3)$ .<br>_____ |
| 4. Multiply $(x - 4)(x - 1)$ .<br>_____  | 11. Multiply $(x + 6)(x + 1)$ .<br>_____   |
| 5. Multiply $(x - 3)(x + 6)$ .<br>_____  | 12. Multiply $(4x + 1)(x - 2)$ .<br>_____  |
| 6. Multiply $(2x + 1)(x + 3)$ .<br>_____ | 13. Multiply $(x - 3)(x - 3)$ .<br>_____   |
| 7. Multiply $(x + 5)(x - 5)$ .<br>_____  | 14. Multiply $(5x + 2)(x + 1)$ .<br>_____  |

### Word Problems

15. A rectangular garden is  $(x + 5)$  feet long and  $(x + 2)$  feet wide. Write a simplified expression for its area. \_\_\_\_\_
16. A banner is  $(2x + 1)$  inches long and  $(x + 3)$  inches tall. Write a simplified expression for its area. \_\_\_\_\_
17. A rug measures  $(x - 2)$  feet by  $(x + 4)$  feet. Write a simplified expression for its area. \_\_\_\_\_
18. A square floor tile has a side length of  $(x + 3)$  inches. Write a simplified expression for its area. \_\_\_\_\_



## Answer Keys

- |                    |                     |                     |
|--------------------|---------------------|---------------------|
| 1. $x^2 + 5x + 4$  | 7. $x^2 - 25$       | 13. $x^2 - 6x + 9$  |
| 2. $x^2 + 7x + 10$ | 8. $3x^2 + 10x - 8$ | 14. $5x^2 + 7x + 2$ |
| 3. $x^2 + x - 6$   | 9. $x^2 - 5x - 14$  | 15. $x^2 + 7x + 10$ |
| 4. $x^2 - 5x + 4$  | 10. $4x^2 - 9$      | 16. $2x^2 + 7x + 3$ |
| 5. $x^2 + 3x - 18$ | 11. $x^2 + 7x + 6$  | 17. $x^2 + 2x - 8$  |
| 6. $2x^2 + 7x + 3$ | 12. $4x^2 - 7x - 2$ | 18. $x^2 + 6x + 9$  |

### Step-by-Step Explanations

1. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Use FOIL – multiply the First, Outer, Inner, and Last pairs:  $x^2 + 4x + x + 4$ . Combining the two middle terms gives  $x^2 + 5x + 4$ . So the final answer is  $x^2 + 5x + 4$ .
2. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is FOIL gives  $x^2 + 5x + 2x + 10$ ; combine the middle terms for  $x^2 + 7x + 10$ . So the final answer is  $x^2 + 7x + 10$ .
3. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is FOIL:  $x^2 - 2x + 3x - 6$ . The middle terms combine to  $+x$ , so  $x^2 + x - 6$ . So the final answer is  $x^2 + x - 6$ .
4. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is FOIL:  $x^2 - x - 4x + 4$ , then combine:  $x^2 - 5x + 4$ . Two negatives in the last spot give  $+4$ . So the final answer is  $x^2 - 5x + 4$ .
5. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is FOIL:  $x^2 + 6x - 3x - 18$ , which combines to  $x^2 + 3x - 18$ . So the final answer is  $x^2 + 3x - 18$ .
6. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is FOIL:  $2x^2 + 6x + x + 3$ ; combine the middle for  $2x^2 + 7x + 3$ . So the final answer is  $2x^2 + 7x + 3$ .
7. This is a difference of squares: the outer and inner terms cancel, leaving  $x^2 - 25$ .
8. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is FOIL:  $3x^2 + 12x - 2x - 8$ , then combine:  $3x^2 + 10x - 8$ . So the final answer is  $3x^2 + 10x - 8$ .
9. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is FOIL:  $x^2 + 2x - 7x - 14$ , combine to  $x^2 - 5x - 14$ . So the final answer is  $x^2 - 5x - 14$ .

10. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Another difference of squares:  $(2x)^2 - 3^2 = 4x^2 - 9$ . So the final answer is  $4x^2 - 9$ .

11. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is FOIL:  $x^2 + x + 6x + 6$ , combine to  $x^2 + 7x + 6$ . So the final answer is  $x^2 + 7x + 6$ .

12. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is FOIL:  $4x^2 - 8x + x - 2$ , combine to  $4x^2 - 7x - 2$ . So the final answer is  $4x^2 - 7x - 2$ .

13. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Squaring a binomial:  $x^2 - 3x - 3x + 9 = x^2 - 6x + 9$ . The middle term is twice  $-3x$ . So the final answer is  $x^2 - 6x + 9$ .

14. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is FOIL:  $5x^2 + 5x + 2x + 2$ , combine to  $5x^2 + 7x + 2$ . So the final answer is  $5x^2 + 7x + 2$ .

15. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Area is length times width:  $(x + 5)(x + 2) = x^2 + 7x + 10$  square feet. So the final answer is  $x^2 + 7x + 10$ .

16. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Multiply length by height:  $(2x + 1)(x + 3) = 2x^2 + 7x + 3$ . So the final answer is  $2x^2 + 7x + 3$ .

17. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Area is length times width:  $(x - 2)(x + 4) = x^2 + 2x - 8$ . So the final answer is  $x^2 + 2x - 8$ .

18. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is A square's area is its side squared:  $(x + 3)^2 = x^2 + 6x + 9$ . So the final answer is  $x^2 + 6x + 9$ .



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