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

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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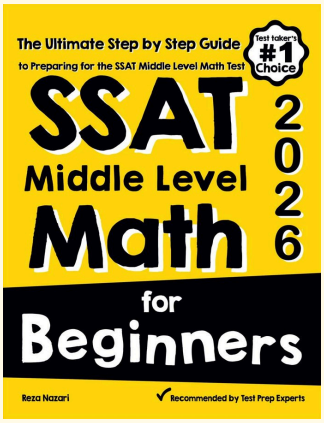

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