

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.

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

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 $x^2 + 6x + 9$.



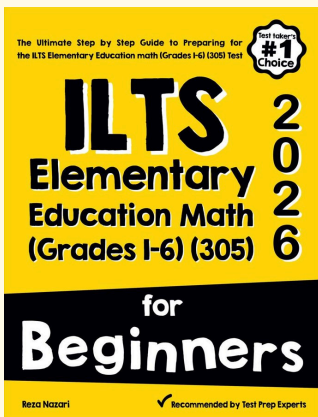
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