

# Factoring Trinomials $ax^2 + bx + c$

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

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

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

## Q Quick Review

To factor  $ax^2 + bx + c$  when  $a \neq 1$ , use the **AC method**: **(1)** multiply  $a \cdot c$ ; **(2)** find two numbers that multiply to  $ac$  and add to  $b$ ; **(3)** split the middle term using those numbers; **(4)** factor by grouping. **Always factor out the GCF first** if there is one. Some trinomials are prime. As a shortcut for small  $a$ , you can also use trial and error: write  $(\_x + \_)(\_x + \_)$  and try integer pairs for each blank until FOIL gives the original. The AC method is more systematic and almost always works when an integer factoring exists.

## PRACTICE

Factor each trinomial.

- |                      |       |                      |       |
|----------------------|-------|----------------------|-------|
| 1. $2x^2 + 5x + 3$   | _____ | 11. $4x^2 - 4x + 1$  | _____ |
| 2. $3x^2 + 10x + 8$  | _____ | 12. $9x^2 + 12x + 4$ | _____ |
| 3. $2x^2 - 7x + 3$   | _____ | 13. $6x^2 + 7x + 2$  | _____ |
| 4. $5x^2 + 11x + 2$  | _____ | 14. $8x^2 - 2x - 3$  | _____ |
| 5. $3x^2 - 5x - 2$   | _____ | 15. $2x^2 + 9x + 10$ | _____ |
| 6. $6x^2 + 5x - 6$   | _____ | 16. $3x^2 - 7x + 2$  | _____ |
| 7. $4x^2 + 8x + 3$   | _____ | 17. $4x^2 + 3x - 7$  | _____ |
| 8. $2x^2 + x - 1$    | _____ | 18. $6x^2 - 13x + 6$ | _____ |
| 9. $3x^2 + 8x + 4$   | _____ | 19. $10x^2 + 9x - 9$ | _____ |
| 10. $5x^2 - 13x + 6$ | _____ | 20. $2x^2 + 3x + 5$  | _____ |

## ◆ Word Problems

21. A projectile model reaches ground level when  $2t^2 + 5t - 3 = 0$ . Factor to find the positive time.
- \_\_\_\_\_
22. A rectangular sign has area  $6x^2 + 7x + 2$  square feet. Factor to find possible length and width expressions.
- \_\_\_\_\_
23. A fundraiser's break-even model is  $3x^2 - 2x - 1 = 0$ . Factor to find the values of  $x$  where profit is zero.
- \_\_\_\_\_
24. A rectangular sign has area  $5x^2 + 12x + 4$  square feet. Factor to find possible side expressions.
- \_\_\_\_\_



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## Answer Keys

- |  |   |
|--|---|
| <p>1. <math>(2x + 3)(x + 1)</math></p> <p>2. <math>(3x + 4)(x + 2)</math></p> <p>3. <math>(2x - 1)(x - 3)</math></p> <p>4. <math>(5x + 1)(x + 2)</math></p> <p>5. <math>(3x + 1)(x - 2)</math></p> <p>6. <math>(3x - 2)(2x + 3)</math></p> <p>7. <math>(2x + 1)(2x + 3)</math></p> <p>8. <math>(2x - 1)(x + 1)</math></p> <p>9. <math>(3x + 2)(x + 2)</math></p> <p>10. <math>(5x - 3)(x - 2)</math></p> <p>11. <math>(2x - 1)^2</math></p> <p>12. <math>(3x + 2)^2</math></p> | <p>13. <math>(3x + 2)(2x + 1)</math></p> <p>14. <math>(4x - 3)(2x + 1)</math></p> <p>15. <math>(2x + 5)(x + 2)</math></p> <p>16. <math>(3x - 1)(x - 2)</math></p> <p>17. <math>(4x + 7)(x - 1)</math></p> <p>18. <math>(3x - 2)(2x - 3)</math></p> <p>19. <math>(5x - 3)(2x + 3)</math></p> <p>20. prime</p> <p>21. <math>t = \frac{1}{2}</math> second</p> <p>22. <math>(3x + 2)(2x + 1)</math></p> <p>23. <math>x = 1</math> or <math>x = -\frac{1}{3}</math></p> <p>24. <math>(5x + 2)(x + 2)</math></p> |
|--|---|

### Step-by-Step Tutor Notes

1.  $ac = 6$ , pair 2, 3. Split:  $2x^2 + 2x + 3x + 3 = 2x(x + 1) + 3(x + 1)$ .
2. Focus on the main idea of the problem, then simplify carefully.  $ac = 24$ , pair 4, 6. So the answer is  $(3x + 4)(x + 2)$ .
3. Focus on the main idea of the problem, then simplify carefully.  $ac = 6$ , pair  $-1, -6$ . So the answer is  $(2x - 1)(x - 3)$ .
4. Take it one clear step at a time and keep the original question in mind.  $ac = 10$ , pair 1, 10. So the answer is  $(5x + 1)(x + 2)$ .
5. Start with the definition the problem is testing, then apply it directly.  $ac = -6$ , pair 1,  $-6$ . So the answer is  $(3x + 1)(x - 2)$ .
6.  $ac = -36$ , pair  $-4, 9$ . Split:  $6x^2 - 4x + 9x - 6 = 2x(3x - 2) + 3(3x - 2)$ .
7. This is a good place to slow down, check the notation, and simplify cleanly.  $ac = 12$ , pair 2, 6. So the answer is  $(2x + 1)(2x + 3)$ .
8. Start with the definition the problem is testing, then apply it directly.  $ac = -2$ , pair  $-1, 2$ . So the answer is  $(2x - 1)(x + 1)$ .
9. Start with the definition the problem is testing, then apply it directly.  $ac = 12$ , pair 2, 6. So the answer is  $(3x + 2)(x + 2)$ .
10. Take it one clear step at a time and keep the original question in mind.  $ac = 30$ , pair  $-3, -10$ . So the answer is  $(5x - 3)(x - 2)$ .
11. Use the clue in the question first, then let the arithmetic finish the job. Perfect square trinomial. So the answer is  $(2x - 1)^2$ .
12. Use the clue in the question first, then let the arithmetic finish the job. Perfect square:  $(3x)^2 + 2(3x)(2) + 4$ . So the answer is  $(3x + 2)^2$ .
13. Use the clue in the question first, then let the arithmetic finish the job.  $ac = 12$ , pair 3, 4. So the answer is  $(3x + 2)(2x + 1)$ .
14. Use the clue in the question first, then let the arithmetic finish the job.  $ac = -24$ , pair  $-6, 4$ . So the answer is  $(4x - 3)(2x + 1)$ .
15. Focus on the main idea of the problem, then simplify carefully.  $ac = 20$ , pair 4, 5. So the answer is  $(2x + 5)(x + 2)$ .
16. Focus on the main idea of the problem, then simplify carefully.  $ac = 6$ , pair  $-1, -6$ . So the answer is  $(3x - 1)(x - 2)$ .
17. Focus on the main idea of the problem, then simplify carefully.  $ac = -28$ , pair 7,  $-4$ . So the answer is  $(4x + 7)(x - 1)$ .
18. Take it one clear step at a time and keep the original question in mind.  $ac = 36$ , pair  $-4, -9$ . So the answer is  $(3x - 2)(2x - 3)$ .
19. This is a good place to slow down, check the notation, and simplify cleanly.  $ac = -90$ , pair  $-6, 15$ . So the answer is  $(5x - 3)(2x + 3)$ .
20. Take it one clear step at a time and keep the original question in mind.  $ac = 10$ , no pair sums to 3. So the answer is prime.
21. Factor:  $(2t - 1)(t + 3) = 0$ . So  $t = \frac{1}{2}$  or  $t = -3$ . Time cannot be negative, so the positive time is  $\frac{1}{2}$  second.
22. Name the quantities first so the model is easy to read. Using AC method or trial and error:  $(3x + 2)(2x + 1)$ .
23. First identify the feature of the graph or equation that matches the wording of the question. Factor:  $(3x + 1)(x - 1) = 0$ . So  $x = -\frac{1}{3}$  or  $x = 1$ . That leads to  $x = 1$  or  $x = -\frac{1}{3}$ .
24.  $ac = 20$ , pair 2, 10. Split:  $5x^2 + 2x + 10x + 4 = x(5x + 2) + 2(5x + 2) = (5x + 2)(x + 2)$ .



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