

# The Quadratic Formula

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

## Quick Review and Helpful Hints

For  $ax^2 + bx + c = 0$ , the solutions are  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ . Identify  $a, b, c$ , then substitute carefully. The *discriminant*  $b^2 - 4ac$  tells how many real solutions: positive gives two, zero gives one, negative gives none.

▶ **Example:** Solve  $x^2 + 5x + 6 = 0$  with the formula. **Work:**  $a = 1, b = 5, c = 6$ . Discriminant  $= 25 - 24 = 1$ .  $x = \frac{-5 \pm 1}{2}$ . ★ **Answer:**  $x = -2$  or  $x = -3$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Identify  $a, b, c$ , then substitute.

### Practice Problems

Solve, or find the discriminant, as directed.

- |                        |       |                                    |       |
|------------------------|-------|------------------------------------|-------|
| 1. $x^2 + 5x + 6 = 0$  | _____ | 8. $x^2 - 6x + 5 = 0$              | _____ |
| 2. $x^2 - 3x - 4 = 0$  | _____ | 9. $x^2 + 2x - 15 = 0$             | _____ |
| 3. $x^2 + x - 12 = 0$  | _____ | 10. $x^2 - 7x + 10 = 0$            | _____ |
| 4. $x^2 - 5x + 6 = 0$  | _____ | 11. $x^2 + 4x + 3 = 0$             | _____ |
| 5. $x^2 - 2x - 3 = 0$  | _____ | 12. $x^2 - x - 20 = 0$             | _____ |
| 6. $x^2 + 7x + 12 = 0$ | _____ | 13. Discriminant of $x^2 + 3x + 2$ | _____ |
| 7. $x^2 - 9 = 0$       | _____ | 14. Discriminant of $x^2 - 4x + 4$ | _____ |

### Word Problems

15. A quadratic revenue model is set equal to zero:  $x^2 + 6x + 8 = 0$ . Use the formula to find the break-even  $x$ -values. \_\_\_\_\_
16. Before graphing  $x^2 + 5x + 6$ , a student checks the discriminant. Find it and use it to decide how many real solutions there are. \_\_\_\_\_
17. A walkway model leads to  $x^2 - 8x + 12 = 0$ . Use the quadratic formula to solve for  $x$ . \_\_\_\_\_
18. How many real solutions are there if the discriminant equals 0? \_\_\_\_\_



## Answer Keys

1.  $x = -2, -3$

2.  $x = 4, -1$

3.  $x = 3, -4$

4.  $x = 2, 3$

5.  $x = 3, -1$

6.  $x = -3, -4$

7.  $x = 3, -3$

8.  $x = 1, 5$

9.  $x = 3, -5$

10.  $x = 2, 5$

11.  $x = -1, -3$

12.  $x = 5, -4$

13.  $1$

14.  $0$

15.  $x = -2, -4$

16.  $1$

17.  $x = 2, 6$

18.  $\text{one}$

### Step-by-Step Explanations

1. Start by naming the process: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $b^2 - 4ac = 25 - 24 = 1$ ;  $x = \frac{-5 \pm 1}{2} = -2, -3$ . So the final answer is  $x = -2, -3$ .

2. A good way to think about this is: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $9 + 16 = 25$ ;  $x = \frac{3 \pm 5}{2} = 4, -1$ . So the final answer is  $x = 4, -1$ .

3. Step by step: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $1 + 48 = 49$ ;  $x = \frac{-1 \pm 7}{2} = 3, -4$ . So the final answer is  $x = 3, -4$ .

4. Take it one move at a time: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $25 - 24 = 1$ ;  $x = \frac{5 \pm 1}{2} = 3, 2$ . So the final answer is  $x = 2, 3$ .

5. Start by naming the process: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $4 + 12 = 16$ ;  $x = \frac{2 \pm 4}{2} = 3, -1$ . So the final answer is  $x = 3, -1$ .

6. A good way to think about this is: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $49 - 48 = 1$ ;  $x = \frac{-7 \pm 1}{2} = -3, -4$ . So the final answer is  $x = -3, -4$ .

7. Step by step: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $a = 1, b = 0, c = -9$ ;  $x = \frac{\pm 6}{2} = 3, -3$ . So the final answer is  $x = 3, -3$ .

8. Take it one move at a time: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $36 - 20 = 16$ ;  $x = \frac{6 \pm 4}{2} = 5, 1$ . So the final answer is  $x = 1, 5$ .

9. Start by naming the process: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $4 + 60 = 64$ ;  $x = \frac{-2 \pm 8}{2} = 3, -5$ . So the final answer is  $x = 3, -5$ .

10. A good way to think about this is: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $49 - 40 = 9$ ;  $x = \frac{7 \pm 3}{2} = 5, 2$ . So the final answer is  $x = 2, 5$ .

11. Step by step: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $16 - 12 = 4$ ;  $x = \frac{-4 \pm 2}{2} = -1, -3$ . So the final answer is  $x = -1, -3$ .

12. Take it one move at a time: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $1 + 80 = 81$ ;  $x = \frac{1 \pm 9}{2} = 5, -4$ . So the final answer is  $x = 5, -4$ .

13. Start by naming the process: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $b^2 - 4ac = 9 - 8 = 1$ . So the final answer is 1.

14. A good way to think about this is: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $b^2 - 4ac = 16 - 16 = 0$ . So the final answer is 0.

15. Step by step: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $36 - 32 = 4$ ;  $x = \frac{-6 \pm 2}{2} = -2, -4$ . So the final answer is  $x = -2, -4$ .

16. Take it one move at a time: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $25 - 24 = 1$ . So the final answer is 1.

17. Start by naming the process: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $64 - 48 = 16$ ;  $x = \frac{8 \pm 4}{2} = 6, 2$ . So the final answer is  $x = 2, 6$ .

18. A good way to think about this is: Use the quadratic formula step by step: identify  $a$ ,  $b$ , and  $c$ , compute the discriminant, then simplify. The setup/work is  $A$  discriminant of 0 gives exactly one real solution. So the final answer is one.



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