

Final Study Guide (LT 4.1-4.3)

The Quadratic Formula and the Discriminant

Quadratic Formula The **Quadratic Formula** can be used to solve *any* quadratic equation once it is written in the form $ax^2 + bx + c = 0$.

Quadratic Formula	The solutions of $ax^2 + bx + c = 0$, with $a \neq 0$, are given by $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.
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Example: Solve $x^2 - 5x = 14$ by using the Quadratic Formula.

Rewrite the equation as $x^2 - 5x - 14 = 0$.

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

$$= \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-14)}}{2(1)} \quad \text{Replace } a \text{ with } 1, b \text{ with } -5, \text{ and } c \text{ with } -14.$$

$$= \frac{5 \pm \sqrt{81}}{2} \quad \text{Simplify.}$$

$$= \frac{5 \pm 9}{2}$$

$$= 7 \text{ or } -2$$

The solutions are -2 and 7 .

Exercises

Solve each equation by using the Quadratic Formula.

1. $x^2 + 2x - 35 = 0$

2. $x^2 + 10x + 24 = 0$

3. $x^2 - 11x + 24 = 0$

4. $4x^2 + 19x - 5 = 0$

5. $14x^2 + 9x + 1 = 0$

6. $2x^2 - x - 15 = 0$

7. $3x^2 + 5x = 2$

8. $2y^2 + y - 15 = 0$

9. $3x^2 - 16x + 16 = 0$

10. $8x^2 + 6x - 9 = 0$

11. $r^2 - \frac{3r}{5} + \frac{2}{25} = 0$

12. $x^2 - 10x - 50 = 0$

13. $x^2 + 6x - 23 = 0$

14. $4x^2 - 12x - 63 = 0$

15. $x^2 - 6x + 21 = 0$

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The Quadratic Formula and the Discriminant

Roots and the Discriminant

Discriminant	The expression under the radical sign, $b^2 - 4ac$, in the Quadratic Formula is called the discriminant .
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Discriminant	Type and Number of Roots;	Solutions
$b^2 - 4ac > 0$ and a perfect square	2 rational roots;	2 solutions
$b^2 - 4ac > 0$, but not a perfect square	2 irrational roots;	2 solutions
$b^2 - 4ac = 0$	1 rational root;	1 solution
$b^2 - 4ac < 0$	2 complex roots;	0 solutions

Example: Find the value of the discriminant for each equation. Describe and state the number of solutions for each equation.

a. $2x^2 + 5x + 3$

The discriminant is $b^2 - 4ac = 5^2 - 4(2)(3)$ or 1. The discriminant is a perfect square, so the equation has 2 solutions. They have no i's or square roots.

b. $3x^2 - 2x + 5$

The discriminant is $b^2 - 4ac = (-2)^2 - 4(3)(5)$ or -56 . The discriminant is negative, so the equation has 0 solutions.

Exercises

Complete parts a–c for each quadratic equation.

- Find the value of the discriminant.
- Describe and state the number of solutions.
- Find the exact solutions by using the Quadratic Formula.

1. $p^2 + 12p = -4$

2. $9x^2 - 6x + 1 = 0$

3. $2x^2 - 7x - 4 = 0$

4. $x^2 + 4x - 4 = 0$

5. $5x^2 - 36x + 7 = 0$

6. $4x^2 - 4x + 11 = 0$

7. $x^2 - 7x + 6 = 0$

8. $m^2 - 8m = -14$

9. $25x^2 - 40x = -16$

10. $4x^2 + 20x + 29 = 0$

11. $6x^2 + 26x + 8 = 0$

12. $4x^2 - 4x - 11 = 0$