

Section 4.8 – The Quadratic Formula and the Discriminant

Recall:

Standard form of a quadratic equation:

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

Definitions:

Discriminant: $b^2 - 4ac$

Note,

If $b^2 - 4ac > 0$ then the quadratic equation has 2 solutions.

If $b^2 - 4ac = 0$ then the quadratic equation has 1 solution.

If $b^2 - 4ac < 0$ then the quadratic equation has 2i solutions.

Example 1.) Use the quadratic formula to solve the equations.

a.) $x^2 - 6x + 10 = 0$

$$\begin{aligned} x &= \frac{6 \pm \sqrt{(-6)^2 - 4(1)(10)}}{2(1)} = \frac{6 \pm i\sqrt{4}}{2} \\ &= \frac{6 \pm \sqrt{36 - 40}}{2} = \frac{6 \pm 2i}{2} \\ &= \frac{6 \pm \sqrt{-4}}{2} \end{aligned}$$

$x = 3 \pm i$

c.) $x^2 - 6x = -9$

$$\begin{aligned} x^2 - 6x + 9 &= 0 \\ x &= \frac{6 \pm \sqrt{(-6)^2 - 4(1)(9)}}{2(1)} \\ &= \frac{6 \pm \sqrt{36 - 36}}{2} \\ &= \frac{6 \pm \sqrt{0}}{2} \\ &= \frac{6}{2} = \boxed{3} \end{aligned}$$

b.) $-3 = -4x^2$

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

$$\begin{aligned} x &= \frac{0 \pm \sqrt{0^2 - 4(4)(-3)}}{2(4)} = \frac{\pm 4\sqrt{3}}{8} \\ &= \frac{0 \pm \sqrt{48}}{8} \\ &= \frac{\pm \sqrt{48}}{8} \end{aligned}$$

$x = \frac{\pm \sqrt{3}}{2}$

$\frac{48}{\sqrt{16}\sqrt{3}}$

Example 2.) Find the discriminant of the quadratic equation given, then describe what type of solutions the equation has.

a.) $x^2 + 9x + 31 = 0$

b.) $4x^2 + 5x - 7 = 0$

$$9^2 - 4(1)(31)$$

$$81 - 124$$

Discriminant -43

Discriminant _____

Solution Type 2i

Solution Type _____

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