**8-9 The Quadratic Formula and the Discriminant**

**Objective:** Solve quadratic equations by using the Quadratic Formula. Determine the number of solutions of a quadratic equation by using the discriminant.

**The Quadratic Formula:** The solutions of ax2 + bx + c = 0, where a ≠ 0, are x = $\frac{-b\pm \sqrt{b^{2}-4ac}}{2a}$.

**Example 1:** Solve using the Quadratic Formula.

1. 6x2 + 5x – 4 = 0
2. x2 = x + 20

**Example 2:** Solve x2 + 3x – 7 = 0 by using the Quadratic Formula.

The ***discriminant*** of the quadratic equation ax2 + bx + c = 0 is b2 – 4ac.

|  |  |  |  |
| --- | --- | --- | --- |
| **Equation** | x2 – 4x + 3 = 0 | x2 + 2x + 1 = 0 | x2 – 2x + 2 = 0 |
| **Discriminant** | a = 1, b = –4, c = 3b2 – 4ac(–4)2 – 4(1)(3)16 – 124The discriminant is positive. | a = 1, b = 2, c = 1b2 – 4ac(2)2 – 4(1)(1)4 – 40The discriminant is zero. | a = 1, b = –2, c = 2b2 – 4ac(–2)2 – 4(1)(2)4 – 8–4The discriminant is negative. |
| **Graph of Related Function** | Notice that the related function has two x-intercepts.http://www.staff.vu.edu.au/mcaonline/units/graphs/imagesgraph/grquad9.gif | Notice that the related function has one x-intercept. | Notice that the related function has no x-intercepts. |
| **Number of Solutions** | Two real solutions | One real solution | No real solution |

**The Discriminant of Quadratic Equation ax2 + bx + c = 0**

* If b2 – 4ac > 0, the equation has two real solutions.
* If b2 – 4ac = 0, the equation has one real solution.
* If b2 – 4ac < 0, the equation has no real solutions.

**Example 3:** Find the number of real solutions of each equation using the discriminant.

1. 3x2 – 2x + 2 = 0
2. 2x2 + 11x + 12 = 0
3. x2 + 8x + 16 = 0