2.1 - Quadratic Equations

Completing the square ... again.

To make \( x^2 + bx \) a perfect square, for example \( x^2 - 6x \),

1.

2.

A quadratic equation is an equation of the form

The solutions to a quadratic equation (and any polynomial equation for that matter) are called .

**Example.** Solve the following quadratic equation:

- \( x^2 - 2x - 3 = 0 \)

- \( x^2 - 2x - 4 = 0 \)
The Quadratic Formula.

Example. Solve the equation $3x^2 + 6bx + 4 = 0$ (in terms of $b$)
The Quadratic Formula

Example. Solve the equation $ax^2 + bx + c = 0$ (in terms of $a, b, c$).

Thus, the quadratic formula says that the solutions to $ax^2 + bx + c = 0$ are
Example. Solve the following quadratic equations:

- $x^2 - 12x + 35 = 0$

- $x^2 - 12x + 36 = 0$

- $x^2 - 12x + 37 = 0$

Therefore, the number of solutions you get to a quadratic equation is either
The product and sum of roots.

Suppose the roots of \( x^2 + bx + c = 0 \) are \( r_1 \) and \( r_2 \).

Then \( x^2 + bx + c = \) 

So

**Example.** Find the roots of the following equations:

- \( x^2 - 2x - 3 = 0 \)
- \( x^2 + x - 1 = 0 \)

Product of roots: 

Product of roots: 

Sum of roots: 

Sum of roots: 

**Example.** Find the sum and product of the roots of the following equations:

- \( x^2 + 4x - 7 = 0 \)
- \( 2x^2 + 6x - 135 = 0 \)
The Discriminant.

The **discriminant** of the quadratic equation $ax^2 + bx + c = 0$ is 

The discriminant can be used to tell how many solutions a quadratic equation will have.

- If $b^2 - 4ac < 0$, then there are **solution(s)**.
- If $b^2 - 4ac = 0$, then there are **solution(s)**.
- If $b^2 - 4ac > 0$, then there are **solution(s)**.

**Example.** Find the number of real solutions for $2x^2 - 3x - 1 = 0$.

**Example.** Find a value of $k$ which makes $kx^2 + 4x - 7 = 0$ have no real solutions.