

Mathematics for Biology

MAT1142

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Quadratic Equations

Introduction

The standard form of a quadratic equation is as follows,

$$ax^2 + bx + c = 0.$$

- ▶ **a**, **b** and **c** are called as coefficients.
- ▶ In general we know values of **a**, **b** and **c** .
- ▶ They can have any value, except that **a** cannot be **0**.
- ▶ "**x**" is the variable (you don't know it yet).

this makes it Quadratic

$$5x^2 - 3x + 3 = 0$$

Different forms of quadratic equations

In disguise	In standard Form	a, b and c
$x^2 = 5x - 2$	$x^2 - 5x + 2 = 0$	$a = 1, b = -5, c = 2$
$3(t^2 - 3t) = 8$	$3t^2 - 9t - 8 = 0$	$a = 3, b = -9, c = -8$
$2u(u - 2) = -7$	$2u^2 - 4u + 7 = 0$	$a = 2, b = -4, c = 7$
$5 + \frac{1}{w} - \frac{1}{w^2} = 0$	$5w^2 + w - 1 = 0$	$a = 5, b = 1, c = -1$
$4x - 9 = 0$	Not quadratic	$a = 0, b = 4, c = -9$

Examples

$$(i) \quad x^2 + 5x - 6 = 0$$

$$(ii) \quad 3t^2 - 7t = 0$$

$$(iii) \quad 4x^2 - 8x + 4 = 0$$

$$(iv) \quad x(x - 3) = x^2 - 6$$

$$(v) \quad x^2 - 2ax + a^2 = 0$$

$$(vi) \quad 5x^2 + 6x + 1 = 0$$

Special formula to find roots

The standard form of a quadratic equation is as follows,

$$\mathbf{ax^2 + bx + c = 0.}$$

By substituting the values of **a**, **b** and **c**, in below expression we can get root of above quadratic equation.

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

Discriminant

- ▶ $b^2 - 4ac$ is called discriminant.
- ▶ When $b^2 - 4ac$ is positive, we get two real solutions.
- ▶ When it is zero we get just one real solution (both answers are the same).
- ▶ When it is negative we get two complex solutions.

Examples

$$(i) \quad 5x^2 + 6x + 1 = 0$$

$$(ii) \quad x^2 - 2x + 1 = 0$$

$$(iii) \quad 5x^2 + 2x + 1 = 0$$

$$(iv) \quad x(x - 3) = x^2 - 6$$

$$(v) \quad u^2 + u + 5 = 0$$

$$(vi) \quad 2x^2 + 4x + 1 = 0$$

Thank You