Mathematics for Biology

MAT1142

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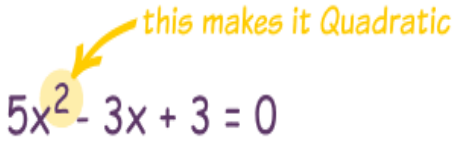
Quadratic Equations

Introduction

The standard form of a quadratic equation is as follows,

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

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



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

Find solutions of following quadratic equations.

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

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

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

(iv) $x(x - 3) = 2x - 6$

(v) $5x^2 + 6x + 1 = 0$

(vi) $8x^2 + 2x + 5 = 0$

Special formula to find roots

The standard form of a quadratic equation is as follows,

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

By subsituting 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

- $\mathbf{b^2 - 4ac}$ is called discriminant.
- When $\mathbf{b^2 - 4ac}$ 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) $5x^2 + 6x + 1 = 0$

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

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

(iv) $x(x - 3) = x - 6$

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

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

Exercise

(i) $x^2 - 5x + 4 = 0$

(ii) $x^2 - 6x + 10 = 0$

(iii) $3 - x - 2x^2 = 0$

(iv) $x^2 - 6x + 9 = 0$

(v) $2x^2 - 6x + 4 = 0$

(vi) $x(1 - x) = x(2x - 1)$

Exercise
Answers

(i) $x = 4, x = 1$

(ii) $x = 3 + i, x = 3 - i$

(iii) $x = 1, x = -\frac{3}{2}$

(iv) $x = 3, x = 3$

(v) $x = 2, x = 1$

(vi) $x = 0, x = \frac{2}{3}$

Thank You