Quadratic Equations

equation, roots, plots

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Outline

1. About quadratic equation and roots

2. Roots of quadratic equation in a table

3. Plots

Quadratic Equations

When $a \neq 0$, quadratic equation [1]

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

has two roots and they are

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

Type of Roots

Discriminant

$$d = b^2 - 4ac$$

- $d \geq 0$; roots are real
  - $d > 0$; roots are real and distinct
  - $d = 0$; roots are real and same
- $d < 0$; roots are complex

Vertex of Parabola

$$
\begin{aligned}
y &= ax^2 + bx + c \\
&= a\left(x^2 + 2 \times \frac{b}{2a}x + \frac{c}{a}\right) \\
&= a\left(x + \frac{b}{2a}\right)^2 - \frac{b^2}{4a} + c
\end{aligned}
$$

Vertex of the parabola, $y = f(x)$ is $\left(-\frac{b}{2a}, c - \frac{b^2}{4a}\right)$.

Table: Type of roots

$d = b^2 - 4ac$	comment about roots
$d > 0$	roots are real and distinct
$d = 0$	roots are real and same
$d < 0$	roots are complex

Plots of quadratic equations

Figure: LaTex: Quadratic Functions
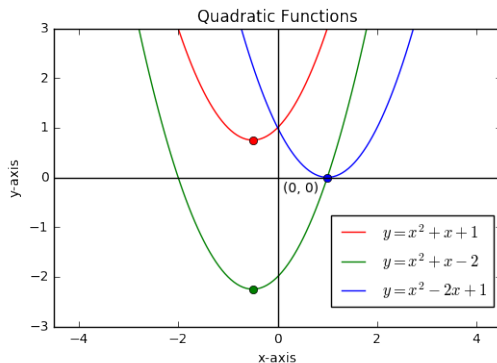
Reference

Howard Anton, Irl Bivens, and Stephen Davis.
Calculus, volume 2.
Wiley Hoboken, 2002.