First Example

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Using this document

This is a first example of a document compiled from LaTeX into multiple formats. The outputs from this can be used to test setups and as a first example for students to try out.

1 Quadratic equations

A quadratic equation is an equation with the form $ax^2 + bx + c = 0$ where x represents an unknown and a, b and c are known numbers with $a \neq 0$.

1.1 Solutions to a quadratic equation

A solution to a quadratic equation is a value of x such that the equation balances. The solutions to quadratic equations can be found by using the quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}. \tag{1}$$

Example. *For instance, the solutions to* $x^2 + 2x - 3 = 0$ *are:*

$$\begin{aligned} x &= \frac{-2 \pm \sqrt{2^2 - 4 \times 1 \times -3}}{2 \times 1} \\ &= \frac{-2 \pm \sqrt{4 + 12}}{2} \\ &= \frac{-2 \pm \sqrt{16}}{2} \\ &= \frac{-2 \pm 4}{2} \end{aligned}$$

Hence, $x = 1$ *or* $x = -3$.

1.2 The discriminant

Definition (Discriminant)**.** The *discriminant* of a quadratic equation with coefficients $a, b, c \in \mathbb{R}$ is:

$$\Delta = b^2 - 4ac.$$

Remark. Note that this is the expression beneath the square root symbol in the quadratic formula (1).

We can use the discriminant to determine the number of real roots of a quadratic equation. The number depends on the value of Δ as in table 1.

Value of Δ	Real roots
$\Delta > 0$	Two, distinct
$\Delta = 0$	One, repeated
$\Delta < 0$	Zero

Table 1: Number of real roots of a quadratic equation, given the discriminant

Figure 1 shows an example of each possibility[1].

[1]The image is due to Olin, CC-BY-AS 3.0 downloaded from Wikimedia Commons

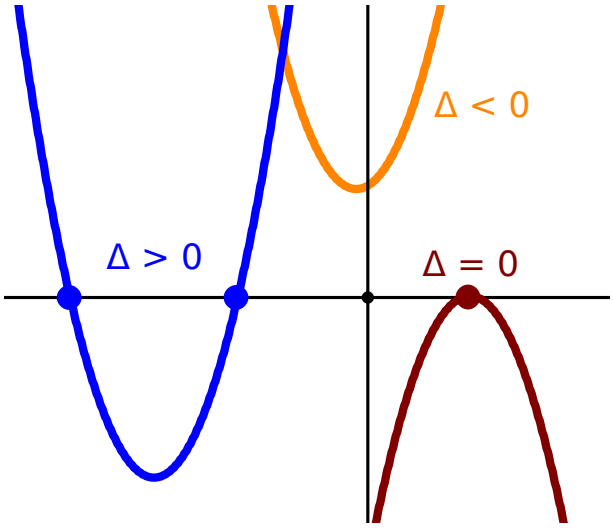

Figure 1: Examples of quadratic functions with zero, one and two real roots.