■ The Quadratic and Cubic Equations

The solution to the general quadratic equation $a x^2 + b x + c = 0$ is as follows:

$$x = \frac{-b - \sqrt{b^2 - 4 a c}}{2 a}$$
$$x = \frac{-b + \sqrt{b^2 - 4 a c}}{2 a}$$

The solution to the general cubic equation $a x^3 + b x^2 + c x + d = 0$ is as follows:

$$x = \frac{-2 b + \frac{2\, 2^{1/3} (b^2 - 3 a c)}{\left(-2 b^3 + 9 a b c - 27 a^2 d + \sqrt{-4 (b^2 - 3 a c)^3 + (2 b^3 - 9 a b c + 27 a^2 d)^2}\right)^{1/3}} + 2^{2/3} \left(-2 b^3 + 9 a b c - 27 a^2 d + \sqrt{-4 (b^2 - 3 a c)^3 + (2 b^3 - 9 a b c + 27 a^2 d)^2}\right)^{1/3}}{6 a}$$

$$x = \frac{-4 b - \frac{2 \mathbb{i}\, 2^{1/3} (-\mathbb{i} + \sqrt{3}) (b^2 - 3 a c)}{\left(-2 b^3 + 9 a b c - 27 a^2 d + \sqrt{-4 (b^2 - 3 a c)^3 + (2 b^3 - 9 a b c + 27 a^2 d)^2}\right)^{1/3}} + \mathbb{i}\, 2^{2/3} (\mathbb{i} + \sqrt{3}) \left(-2 b^3 + 9 a b c - 27 a^2 d + \sqrt{-4 (b^2 - 3 a c)^3 + (2 b^3 - 9 a b c + 27 a^2 d)^2}\right)^{1/3}}{12 a}$$

$$x = -\frac{4 b + \frac{2\, 2^{1/3} (1 - \mathbb{i} \sqrt{3}) (b^2 - 3 a c)}{\left(-2 b^3 + 9 a b c - 27 a^2 d + \sqrt{-4 (b^2 - 3 a c)^3 + (2 b^3 - 9 a b c + 27 a^2 d)^2}\right)^{1/3}} + 2^{2/3} (1 + \mathbb{i} \sqrt{3}) \left(-2 b^3 + 9 a b c - 27 a^2 d + \sqrt{-4 (b^2 - 3 a c)^3 + (2 b^3 - 9 a b c + 27 a^2 d)^2}\right)^{1/3}}{12 a}$$

Note: The symbol $\mathbb{i}$ stands for the imaginary *i*.