# Quadratic Equation Roots Calculator (ax² + bx + c = 0)

Real or complex roots of a quadratic equation ax² + bx + c = 0, the discriminant and the vertex, computed in the numerically stable form.

**Method:** Quadratic formula; numerically stable form (Press et al., Numerical Recipes §5.6)

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Coefficient a (of x²) | 1.0000 | |
| Coefficient b (of x) | -3.0000 | |
| Constant c | 2.0000 | |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Discriminant b² − 4ac | 1.0000 | |
| First root (real part when complex) | 1.0000 | |
| Second root (real part when complex) | 2.0000 | |
| Imaginary part (0 for real roots) | 0 | |
| Vertex x = −b / 2a | 1.5000 | |
| Vertex value c − b² / 4a | -0.25000 | |

**Notes for this case**

- Two real roots.

## Formula and method

$$D = b^2 - 4ac, \quad q = -\frac{1}{2}\left(b + \operatorname{sign}(b)\sqrt{D}\right), \quad x_1 = \frac{q}{a}, \; x_2 = \frac{c}{q}$$

$$x = -\frac{b}{2a} \pm i\,\frac{\sqrt{-D}}{2a} \;\; (D < 0)$$

### Variables

| | | |
|---|---|---|
| $a$ | Coefficient a (of x²) | - |
| $b$ | Coefficient b (of x) | - |
| $c$ | Constant c | - |
| $D$ | Discriminant b² − 4ac | - |
| $x_1$ | First root (real part when complex) | - |
| $x_2$ | Second root (real part when complex) | - |
| $\pm i\,y$ | Imaginary part (0 for real roots) | - |
| $x_v$ | Vertex x = −b / 2a | - |
| $y_v$ | Vertex value c − b² / 4a | - |

### Method and standards

Quadratic formula in the cancellation-free form.

### Assumptions and limits

- a must not be zero.

### References

- Quadratic formula; numerically stable form (Press et al., Numerical Recipes §5.6)

## Report details

| | |
|---|---|
| Report reference | FCC-S11H-NNMG (the same inputs always give the same reference) |
| Generated | 17 November 2026, 19:45 UTC |
| Calculator | Quadratic Equation Roots Calculator ($ax^2 + bx + c = 0$) |
| Method last reviewed | 12 November 2026 |
| Software release | FireCAD Calc, release of 17 November 2026 |
| Release checks | 3 reference cases of this calculator, computed independently, are checked on every release |

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

### This calculator online

https://calc.firecad.com/general/geometry/quadratic-equation-roots

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.