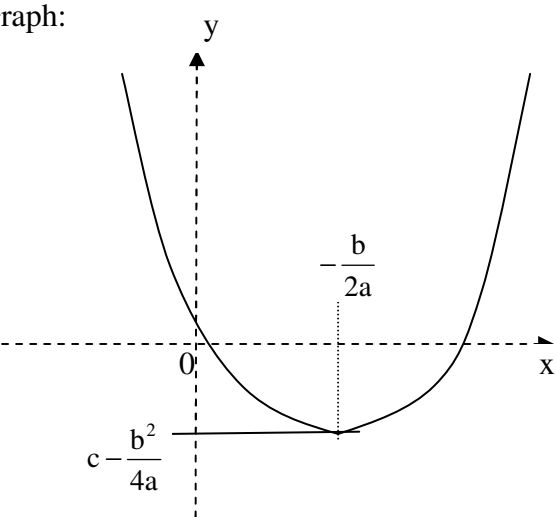
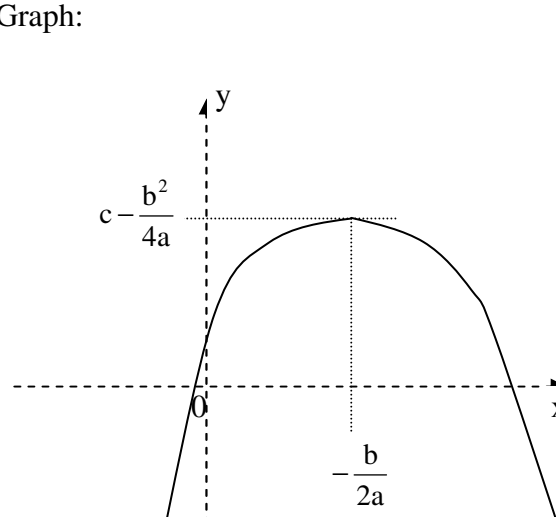


QUADRATIC FUNCTIONS AND THEIR PROPERTIES

Definition: **Quadratic function** is each function given by formula $y = ax^2 + bx + c$; where $a, b, c \in \mathbb{R}$; $a \neq 0$. Domain of a quadratic function is set of real numbers \mathbb{R} . A graph of quadratic function is **parabola** symmetric along axis parallel to y-axis (this axis passes through the vertex).

$a > 0$ (convex parabola)	$a < 0$ (concave parabola)
Graph: 	Graph: 
Domain $D(f) = \mathbb{R}$	Domain $D(f) = \mathbb{R}$
Range of values $V(f) = \left\langle c - \frac{b^2}{4a}, \infty \right\rangle$	Range of values $V(f) = \left(-\infty, c - \frac{b^2}{4a} \right]$
Increasing on $\left\langle -\frac{b}{2a}, \infty \right\rangle$	Increasing on $\left(-\infty, -\frac{b}{2a} \right]$
Decreasing on $\left(-\infty, -\frac{b}{2a} \right]$	Decreasing on $\left\langle -\frac{b}{2a}, \infty \right\rangle$
Bounded from below	Bounded from above
Pointed minimum at point $-\frac{b}{2a}$	Pointed maximum at point $-\frac{b}{2a}$

To find $x_{1,2}$ = the intersections of parabole with x – axis, you need to set the quadratic function equal to zero, and then calculate the quadratic equation through discriminant, completing the square, factorising or applying Viete’s formulae.

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

$$D = b^2 - 4ac, \quad x_{1,2} = \frac{-b \pm \sqrt{D}}{2a}$$

Ex: Find out properties (domain, range of values, monotony, boundaries, maximum/minimum) of function $y = 9x^2 + 3x - 5$. Draw a graph of this function.

$$D(f) = \mathbb{R}, V(f) = \left\langle -5 - \frac{3^2}{4 \cdot 9}, \infty \right\rangle = \langle -5.25, \infty \rangle$$

$$\text{Increasing on } \left\langle \frac{-3}{2 \cdot 9}, \infty \right\rangle = \left\langle -\frac{1}{6}, \infty \right\rangle$$

$$\text{Decreasing on } \left(-\infty, -\frac{1}{6} \right)$$

$$\text{Bounded from below; pointed minimum at } \frac{-3}{2 \cdot 9} = -\frac{1}{6}$$

$$x_{1,2} = \frac{-3 \pm \sqrt{189}}{18} = \frac{-3 \pm 17}{18}$$

