- Be familiar with the basic notions of sets and functions and operations with sets (union, intersection, complement, subset, cartesian product) and functions (addition, multiplication, composition, graph of a function).
- Efficient work with expressions – expanding, factoring, reducing, etc. Be familiar with binomial formula and similar formulae, e.g.

$$(a + b)^n = \sum_{k=0}^{n} \binom{n}{k} a^k b^{n-k},$$

$$a^n - b^n = (a - b) \sum_{k=0}^{n-1} a^{n-1-k} b^k.$$

- Know how to work with trigonometric functions, exponential function and logarithm. It is not necessary to know the formulae for $\sin(\alpha + \beta)$ and similar by heart, but it is important to know that they exist and in which situations they may help. Know the geometric significance of trigonometric functions and their basic values ($\sin 0$, $\sin \frac{\pi}{6}$, $\sin \frac{\pi}{4}$, $\sin \frac{\pi}{3}$, $\sin \frac{\pi}{2}$, etc.).
- Know how to work with an absolute value.
- Be able to solve equations and inequations linear, quadratic, with rational functions, with an absolute value, and simple equations and inequations with elementary functions. All of them also with a parameter.
    - Find all real solutions of the following equations:

$$x^2 - 3x - 3 = 0, \tag{1}$$

$$4^{x-1} + 4^{2-x} = 5, \tag{2}$$

$$\log_3^2 x + \log_3 9^3 = \log_3 x^5, \tag{3}$$

$$\sin x - \sin(\pi + x) = 2\sin^2 x. \tag{4}$$

    - Find all real solutions of the following inequations:

$$\frac{x-1}{x-4} > \frac{x-2}{x-3}, \tag{5}$$

$$\frac{x^2 - x - 4}{x + 1} \geq 0, \tag{6}$$

$$\left| 2 - |1 - 4x| \right| > 1, \tag{7}$$

$$|x + 1| + |x + 3| < 4, \tag{8}$$

$$\log_2(x^2 + x + 1) > 0, \tag{9}$$

$$x^2 + 1 - |x + 2| > 0, \tag{10}$$

$$\cos^2 x + \frac{3}{2} \cos x - 1 < 0. \tag{11}$$

    - Depending on a parameter $c \in \mathbb{R}$ find all real x for which the following holds:

$$cx^2 + x + 1 > 0, \tag{12}$$

$$ce^x \in (-1, 0], \tag{13}$$

$$\log |x| + c \in (-\pi/2, \pi/2), \tag{14}$$

$$|\cos x| - c > 0, \tag{15}$$

$$e^{\sin x} - c \in (0, +\infty). \tag{16}$$

- Be able to solve a system of two linear equations with two variables.
- Be able to sketch graphs of linear rational functions, simple polynomials, roots, trigonometric functions, exponential function and logarithm (also under shifting and scaling of the argument and with an absolute value).
    Sketch the graphs of the following functions:

$$\left| \frac{3x + 3}{2x - 4} \right|, \quad |\text{tg}(-\pi x)|, \quad |\sin(2 - x) - 1|, \quad \left| \log |x - 1| \right|.$$

- Very elementary analytic geometry: working with vectors, various equations of a line or a plane, distance of a point from a line or a plane. Equations for a circle, an ellipse, a hyperbola, and a parabola.
- Be acquainted with complex numbers. Know what is its real and imaginary part, absolute value, conjugate number, trigonometric form and its geometric interpretation, de Moivre's formula.

(1) $x = \frac{3+\sqrt{21}}{2}$ or $x = \frac{3-\sqrt{21}}{2}$

(2) $x = 1$ or $x = 2$

(3) $x = 9$ or $x = 27$

(4) $x = k\pi$ or $x = \frac{\pi}{2} + 2k\pi$, $k \in \mathbb{Z}$

(5) $x \in (\frac{5}{2}, 3) \cup (4, +\infty)$

(6) $x \in \left[\frac{1-\sqrt{17}}{2}, -1\right) \cup \left[\frac{1+\sqrt{17}}{2}, +\infty\right)$

(7) $x \in (-\infty, -\frac{1}{2}) \cup (0, \frac{1}{2}) \cup (1, +\infty)$

(8) $x \in (-4, 0)$

(9) $x \in (-\infty, -1) \cup (0, +\infty)$

(10) $x \in \left(-\infty, \frac{1-\sqrt{5}}{2}\right) \cup \left(\frac{1+\sqrt{5}}{2}, +\infty\right)$

(11) $x \in \bigcup_{k\in\mathbb{Z}} (\frac{\pi}{3} + 2k\pi, \frac{5}{3}\pi + 2k\pi)$

(12)
- $c < 0$: $x \in \left(\frac{-1+\sqrt{1-4c}}{2c}, \frac{-1-\sqrt{1-4c}}{2c}\right)$
- $c = 0$: $x > -1$
- $c \in (0, \frac{1}{4}]$: $x \in \left(-\infty, \frac{-1-\sqrt{1-4c}}{2c}\right) \cup \left(\frac{-1+\sqrt{1-4c}}{2c}, +\infty\right)$
- $c > \frac{1}{4}$: $x \in \mathbb{R}$

(13)
- $c > 0$: no solution
- $c = 0$: $x \in \mathbb{R}$
- $c < 0$: $x < \log(-\frac{1}{c})$

(14) $x \in \left(-e^{\frac{\pi}{2}-c}, -e^{-\frac{\pi}{2}-c}\right) \cup \left(e^{-\frac{\pi}{2}-c}, e^{\frac{\pi}{2}-c}\right)$

(15)
- $c < 0$: $x \in \mathbb{R}$
- $c \in [0, 1)$: $x \in \bigcup_{k\in\mathbb{Z}} (-\arccos c + k\pi, \arccos c + k\pi)$
- $c \geq 1$: no solution

(16)
- $c < \frac{1}{e}$: $x \in \mathbb{R}$
- $c \in [\frac{1}{e}, e)$: $x \in \bigcup_{k\in\mathbb{Z}} (\arcsin\log c + 2k\pi, \pi - \arcsin\log c + 2k\pi)$
- $c \geq e$: no solution