

INFORMATION FOR FOREIGN CANDIDATES TAKING THE ENTRANCE EXAM OF BASIC MATHEMATICAL KNOWLEDGE

Foreigners applying for admission to first cycle studies or single master's studies on the basis of a document issued abroad, which is not a document confirming the right to apply for admission to studies, referred to art.326a (1) of the Law on Higher Education and Science - **shall take an entrance exam of basic mathematical knowledge.**

The exam will be held in remote form in synchronous mode on the Teams platform.

July 8th and 9th, 2025 (Tuesday and Wednesday).

- The exact date and time of the exam will be announced a few days before the exam.
- No registration is required for the exam.
- The list of candidates for the exam will be prepared on the basis of educational documents, which candidates **must compulsorily** upload in the IRK system.

For detailed information about the exam, please contact the Unit for Teaching Administration by writing to studiainfo@uek.krakow.pl

I. BASIC INFORMATION

1. The exam consists of 50 tasks.
2. Each task has exactly one correct answer.
3. Number of points for a correct answer: 4p.
4. Maximum number of points to obtain: 200p.
5. Test duration: 60 minutes.
6. The number of points qualifying for admission to each major programme will be published in the Online Candidate Admission platform on July 17, 2025.

Notice - Before the exam, prepare a calculator, paper, and something to write with (some tasks require short calculations).

II. PROCEDURE AND RULES FOR CONDUCTING REMOTE EXAMS

– *document in preparation, will be published soon*

III. SCOPE OF TOPICS FOR THE ENTRANCE EXAM

- *Mandatory mathematical knowledge*

1. Operations on real numbers

- knowledge of the concepts: natural number, integer, rational number, irrational number,
- knowledge of basic operations on numbers and their properties: addition, subtraction, multiplication, division, raising to the power, square root, absolute value of a number,
- algebraic transformations,
- short multiplication formulas,
- knowledge of percentage calculations.

2. Properties of functions of one variable

- knowledge of the concepts: domain, set of values, zeros, increasing function, decreasing function,
- knowledge of graphs and basic properties of functions: linear, quadratic, rational $f(x) = \frac{a}{x}$, exponential $f(x) = a^x$, logarithmic $f(x) = \log_a x$,
- determining the domain of a rational function and a function with a square root.

3. Equations and inequalities

- solving simple equations and inequalities: linear, quadratic, rational,
- solving simple polynomial equations (polynomial in product form),
- knowledge of Viete's formulas for quadratic function,
- solving a system of linear equations.

4. Arithmetic and geometric sequences - formula for the n-th term.

5. Planimetry

- knowledge of the concepts: side, area, radius of a circle, diameter,
- knowledge of formulas for area of: square, rectangle, triangle, circle.

6. Probability calculus

- arithmetic and geometric mean,
- median, dominant,
- calculation of the number of elementary events,
- classical probability.

IV. SELECTED MATHEMATICAL SYMBOLS AND NOTATIONS

- *tab. below (pp. 3-4)*

(the following mathematical symbols and notations may be used in the tasks)

Sets			
\emptyset	empty set; null set		
$a \in A$	a belongs to A ; a is an element of set A		
$a \notin A$	a does not belong to A ; a is not an element of set A		
$A \subset B$	A is a subset of B		
$\{a, b, c\}$	set containing elements a, b and c		
\mathbb{N}	set of natural numbers (positive integers) $\mathbb{N} = \{1, 2, 3, \dots\}$		
\mathbb{Z}	set of integers $\mathbb{Z} = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$		
\mathbb{Q}	set of rational numbers $\mathbb{Q} = \{\frac{a}{b} : a \in \mathbb{Z} \wedge b \in \mathbb{Z} \setminus \{0\}\}$		
\mathbb{R}	set of real numbers		
Absolute Value of Number			
$ x $	the absolute value of a number $x \in \mathbb{R}$; interpreted as a distance of x from 0 on a number line; $ x \geq 0$; $ x = \begin{cases} x, & \text{for } x \geq 0; \\ -x, & \text{for } x < 0; \end{cases}$		
Mathematical Constant			
π	3.141592 653589793 . . .		
Basic Algebra Formulas			
Binomial formulas: <ul style="list-style-type: none">$(a + b)^2 = a^2 + 2ab + b^2$$(a - b)^2 = a^2 - 2ab + b^2$$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$		Difference of two squares: <ul style="list-style-type: none">$a^2 - b^2 = (a - b)(a + b)$ The Sum and Difference of Two Cubes: <ul style="list-style-type: none">$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$	
Intervals			
(a, b)	open interval	$(a, b) = \{x \in \mathbb{R} : a < x < b\}$	
$[a, b]$	closed interval	$[a, b] = \{x \in \mathbb{R} : a \leq x \leq b\}$	
$[a, b)$	half-closed interval	$[a, b) = \{x \in \mathbb{R} : a \leq x < b\}$	
$(a, b]$	half-closed interval	$(a, b] = \{x \in \mathbb{R} : a < x \leq b\}$	
Equality and Inequalities			
$=$	equal to	$a = b$	a is equal to b
\neq	not equal to	$a \neq b$	a is not equal to b , a is different from b
$< >$	strong inequalities		
$\leq \geq$	weak inequalities		
$<$	less than	$a < b$	a is less than b , b is greater than a
$>$	greater than	$a > b$	a is greater than b , b is less than a
\leq	less than or equal to	$a \leq b$	a is less than or equal to b
\geq	greater than or equal to	$a \geq b$	a is greater than or equal to b

Exponents		
$a^n = a \cdot a \cdot \dots \cdot a$	n factor of a , where $n \in \mathbb{N}$ is an <i>exponent</i> , $a \in \mathbb{R}$ is a <i>base</i>	
Basic properties of exponents:		
<ul style="list-style-type: none">$a^n \cdot a^m = a^{n+m}$$\frac{a^n}{a^m} = a^{n-m}$$(a^n)^m = a^{n \cdot m}$$(a \cdot b)^n = a^n \cdot b^n$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$	<ul style="list-style-type: none">$a^0 = 1$$a^1 = a$$a^{-1} = \frac{1}{a}$$a^{-n} = \frac{1}{a^n}$	<ul style="list-style-type: none">$a^{\frac{1}{n}} = \sqrt[n]{a}$$a^{\frac{m}{n}} = \sqrt[n]{a^m}$
Logarithms		
$\log_a b$	logarithm to the base a of b ($\log_a b = c \Leftrightarrow b = a^c$)	
$\log b = \log_{10} b$	common logarithm, decimal logarithm	
Basic properties of logarithms:		
For $a, b \in (0, 1) \cup (1, +\infty)$, $x, y \in (0, +\infty)$, $n \in \mathbb{R}$:		
<ul style="list-style-type: none">$\log_a a = 1$$\log_a 1 = 0$$\log_a a^n = n$$n = a^{\log_a n}$	<ul style="list-style-type: none">$\log_a x + \log_a y = \log_a (x \cdot y)$ product property$\log_a x - \log_a y = \log_a \left(\frac{x}{y}\right)$ quotient property$\log_a x^n = n \log_a x$ power property$\log_a x = \frac{\log_b x}{\log_b a}$ change-of-base formula	<p>inverse property</p>