Annex

$$\log_a b + \log_a c = \log_a(bc)\,,\ a \in \mathbb{R}_+^* \setminus \{1\},\ b, c \in \mathbb{R}_+^*$$

$$\log_a b - \log_a c = \log_a\left(\frac{b}{c}\right),\ a \in \mathbb{R}_+^* \setminus \{1\},\ b, c \in \mathbb{R}_+^*$$

$$\lim_{x \to 0} \frac{\sin x}{x} = 1$$

$$(x^\alpha)' = \alpha\, x^{\alpha-1}, \qquad \alpha \in \mathbb{R}$$

$$(\sin x)' = \cos x$$

$$\int x^\alpha dx = \frac{x^{\alpha+1}}{\alpha+1} + C, \qquad \alpha \in \mathbb{R} \setminus \{-1\}$$

$$\int \sin x\, dx = -\cos x + C$$

$$\frac{a}{\sin\alpha} = \frac{b}{\sin\beta} = \frac{c}{\sin\gamma} = 2R$$

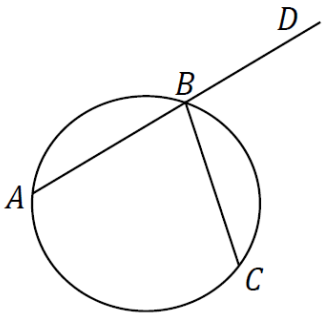
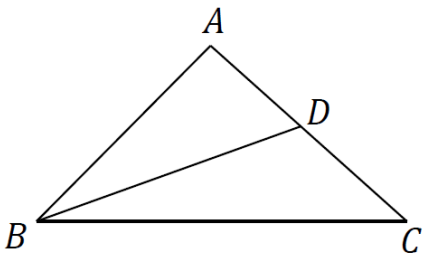
$$(a+b)^n = C_n^0 a^n + C_n^1 a^{n-1} b + C_n^2 a^{n-2} b^2 + \cdots + C_n^k a^{n-k} b^k + \cdots + C_n^n b^n$$

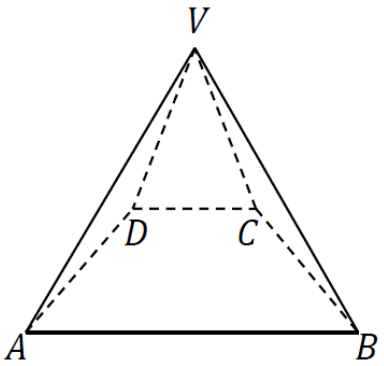
$$T_{k+1} = C_n^k a^{n-k} b^k, k \in \{0, 1, 2, \ldots, n\}$$

$$C_n^k = \frac{n!}{k!\,(n-k)!}, \qquad 0 \le k \le n$$

No.	Items	Score	
	ALGEBRA		
1.	Calculate the value of the expression: $-\frac{5}{3}+\left(\frac{16}{81}\right)^{0,25}$. *Solution:* *Answer:*_____.	L 0 1 2 3 4 5	L 0 1 2 3 4 5
2.	Consider the polynomial $P(X)=\begin{vmatrix} X & 3 & 0 \\ -1 & X & 3 \\ 2X & 6 & X-2 \end{vmatrix}$. Show that $P(X)$ is divisible by $X-2$. *Solution:*	L 0 1 2 3 4 5	L 0 1 2 3 4 5
3.	Solve in the set $\mathbb{R}$ the equation $\log_2(x-1)+\log_2(x-2)=1$. *Solution:* *Answer:*_____.	L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8

4.	Determine the real values of m, such that the non-zero complex number $z = a + ai, a \in \mathbb{R}, i^2 = -1,$ is a solution of the equation $z^2 - 6z + m = 0.$ *Solution:* *Answer:*_____.	L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8
5.	Solve in the set $\mathbb{R}$ the inequality $(3 \cdot 9^x - 4 \cdot 3^x + 1)\sqrt{1 - x} \leq 0.$ *Solution:* *Answer:*_____.	L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8

GEOMETRY			
6.	Points A, B, C lie on a circle, and the point D lies on the straight line AB, so that $B \in (AD)$ and $m(\angle CBD) = 100°$. Determine the degree measure of the minor arc AC. *Solution:*  *Answer:*_____.	L 0 1 2 3 4 5	L 0 1 2 3 4 5
7.	In the isosceles triangle ABC with the base BC, the bisector BD determines on the side AC the line segments $AD = 8$ cm and $DC = 12$ cm. Determine the length of the height of the triangle ABC, corresponding to the side BC. *Solution:*  *Answer:*_____.	L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8

8.	The base of the pyramid $VABCD$ is the isosceles trapezoid $ABCD$, where the small base is 6 cm, the congruent sides are of $\sqrt{2}$ cm, and the longer base angles are of $45°$. Determine the length of the height of the pyramid, if it is known that the lateral edges are of 13 cm. *Solution:*  *Answer:*_____.	L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8
	MATHEMATICAL ANALYSIS		
9.	Find the parity of the function $f: \mathbb{R}^* \to \mathbb{R}, f(x) = x^3 + \frac{1}{x}$. *Solution:* *Answer:*_____.	L 0 1 2 3 4 5	L 0 1 2 3 4 5

10.	Consider the function $f: \left[-\frac{\pi}{2}; \frac{\pi}{4}\right] \to \mathbb{R}, \quad f(x) = \sin(2x) - x.$		
	a) Calculate: $\lim\limits_{x \to 0} \frac{f(x)}{x^2+x}$. *Solution:* *Answer:*_____.	L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8
	b) Determine the antiderivative F of the function f, whose graph passes through the origin of the coordinate system. *Solution:* *Answer:* $F: \left[-\frac{\pi}{2}; \frac{\pi}{4}\right] \to \mathbb{R}, F(x) =$ _____.	L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8
	c) Determine the global extrema of the function f on the interval $\left[-\frac{\pi}{2}; 0\right]$. *Solution:* *Answer:* _____.	L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8

ELEMENTS OF COMBINATORICS. NEWTON'S BINOMIAL THEOREM. ELEMENTS OF PROBABILITY THEORY AND MATHEMATICAL STATISTICS			
11.	Seven children, including Ana and Maria, participate in a marathon. Children reach the finish line at different moments of time. Determine the probability that Ana will reach the finish line the next after Maria. *Solution:* *Answer:* _____.	L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8
12.	The sum of the second and the penultimate binomial coefficients in the binomial expansion $\left(x^6+\frac{1}{\sqrt[3]{x^2}}\right)^n$ is equal to 40. Determine the term, which does not contain x. *Solution:* *Answer:*_____.	L 0 1 2 3 4 5 6 7 8	L 0 1 2 3 4 5 6 7 8