

**MATHEMATICS Exam, High School entrance (8th grade), nationwide, june
2005**

Every subject is required. You have 10 points for attending the exam: maximum grade 100. Work time is 2 hours. No calculators!

Part I (45 points)- Write only results on the exam paper

1. a) The double of the number 50 is equal to (3 pnts)
- b) A quarter of the number 88 is equal to ... (3 pnts)
- c) The result of the calculation $3^2 - 2^3$ is equal to ... (3 pnts)
2. a) A natural divisor of the number 15 is equal to (3 pnts)
- b) Decomposed in prime factors, the number 18 is equal to ... (3 pnts)
- c) The greatest common divisor of the numbers 15 and 18 is equal to ... (3 pnts)
3. Assume the proportion $\frac{2}{b} = \frac{a}{10}$.
 - a) $a \cdot b = \dots$ (3 pnts)
 - b) The result of the calculation $a \cdot b - 20 : 4$ is equal to ... (3 pnts)
 - c) If $b = 40$, then $a = \dots$ (3 pnts)
4. In fig.1, points M and N are the middles of the segments [BC] and [CD], respectively, and $MN=3\text{cm}$, $AN=7\text{cm}$ and $BN=4\text{cm}$.
 - a) The length of the segment AB is equal to ... cm (3 pnts)
 - b) The length of the segment BC is equal to cm (3 pnts)
 - c) The length of the segment CD is equal to ... cm (3 pnts)
5. The right angle prism $ABCA'B'C'$ in fig. 2 has the base an equilateral triangle of side $AB=6\text{cm}$ and $AA'=10\text{ cm}$.
 - a) The perimeter of the base is equal to ... cm (3 pnts)
 - b) The height of the prism is equal to ... cm (3 pnts)
 - c) The lateral area of the prism is equal to ... cm^2 . (3 pnts)

Part II (45 points) - Write complete solutions on the exam paper

1. Consider the numbers \bar{ab} , written in base 10, with $a \neq 0$ and $b \neq 0$, which satisfy the condition $\bar{ab} - \bar{ba} = a \cdot b - a$.
 - a) Show that $a \cdot (10 - b) = 9 \cdot b$ (4 pnts)
 - b) Determine all the numbers \bar{ab} that satisfy the given condition. (6 pnts).
2. Consider the function $f : \mathbf{R} \rightarrow \mathbf{R}$, $f(x) = 2ax - 3a + 1$, where a is a real number.
 - a) Solve, in the set of real numbers, the equation $f(a) = 0$ (5 pnts)
 - b) For $a = 1$, represent graphically the function f , in the system of orthogonal axis xOy . (4 pnts)
 - c) For $a = 1$, M and N are the projections of the points $A(-1; f(-1))$ and $D(2; f(2))$ respectively, on the Ox axis of the system of orthogonal axis xOy . Calculate the area of the quadrilateral with vertices at the points M, D, N, A. (6 pnts)
3. The axial section of the section of a right angle circular cone of fig.3 is an isosceles trapeze ABCD for which the value of the angle ACB is 90° , $BC= 30\text{ cm}$ and the perpendicular height $OO'=24\text{ cm}$.
 - a) Complete on the exam paper the drawing in fig. 3 with the diagonal AC. (5 pnts)
 - b) Show that the radius of the large base, OB, has the length of 25 cm. (5 pnts)
 - c) Calculate the volume of the cone the object is a section of. (5 pnts)

d) Calculate the sine of the angle between the lines AD and BC (5 pnts).