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In 1983, a new system of entrance examination was adopted. In order to be accepted to a university, the 3rd and 4th years of high school grades in mathematics, Hungarian language and literature, history, foreign language, physics, (biology, chemistry, geography, another foreign language - students choose from these) are counted toward university entrance performance.

The 'brought' points (i.e. the points comprised of final grades in high school in the subjects listed above) add up to a total of 60 points. In addition, students are assessed by written and oral examinations for a total of 60 points. So, there is a total of 120 points possible.

In Mathematics, the same exam serves as the GED and the university entrance exam. These problem sets consist of 8 problems, presented in order of difficulty (from easiest to most difficult).

This problem set is similar to such an exam. We advise the reader to work through the problem set while measuring the time. There are 180 minutes to solve and present all problems.

1. The parallel sides of trapezoid $ABCD$ are $AB = 4$ units and $DC = 1$ unit long, and its legs are $AD = 2$ units and $BC = 3$ units long. Find the area of the trapezoid.
2. In triangle ABC , $AC = 6$ units and $BC = 4$ units. The angle opposite the side AC is twice the angle opposite the side BC . Find the exact length of the side AB .
3. For what values of the real parameter m are the roots of the equation

$$2x^2 - (5m + 10)x + 2(m^2 + m - 6) = 0$$

in the interval $[-4, -3]$? In this case, is there an m for which the two roots of the equation are equal?

4. Find the largest subset of the real numbers on which the following expressions are defined.

$$\text{a) } \log(1 - 2 \sin 2x) \qquad \text{b) } \log(1 + \tan 2x)$$

5. A normal vector of the line of side AB of rectangle $ABCD$ is $\mathbf{n}(1, -3)$, and the vertex A is $A(2, 1)$. The vertex C (opposite to A) is on the line $x - y = 1$. Find the coordinates of the missing vertices of the rectangle, if the diagonals are $5\sqrt{2}$ units long.
6. Solve the given system of equations.

$$x^{\log_4 y} + y^{\log_4 x} = 4$$

$$\log_2 x - \log_2 y = 1$$

7. Depending on the value of the real number p , how many real roots does the equation

$$\sqrt{4|x| - x^2} = p$$

have?

8. Find the pairs of integers x, y for which $xy + 3x - y = 20$.