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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. Find the smallest value of the function defined on the real numbers by

$$f(x) = \frac{(x^2 - 8x + 8)^2 - 100}{x^2 - 8x + 18}$$

2. In triangle ABC , $AB = 13$, $BC = 14$, $CA = 15$. Let M be the midpoint of the side AB , and T the foot of the altitude to the side BC . Find the length of the segment MT .
3. Two vehicles move back and forth between the places A and B , with speeds v_1 and v_2 . They start at the same time from A and from B , towards each other. After how much time do they meet exactly at the midpoint of the road for the second time, if $AB = 150$ km, $v_1 = 50$ km/h, and $v_2 = 30$ km/h?
4. In triangle ABC , the angle CBA is 72° . Let F be the midpoint of the side AC , and let D be the point dividing the side BC into thirds that is closer to B . The segments AD and BF intersect at P . Find the ratio of the areas of the triangle BDP and the quadrilateral $PDCF$.
5. The hypotenuse of a right triangle is 10 cm, and the bisector of the right angle is $\frac{24\sqrt{2}}{7}$ cm long. Find the perimeter of the triangle.
6. Solve the given equation over the real numbers.

$$\sin 3x \cdot \sin 5x + 2 \sin 5x - 2 \sin 3x - 3 = 0$$

7. A line through the vertex A of a parabola is rotated around A ; its second intersection point with the parabola is M . Find the set of the points P on the chords AM for which

$$AP^2 = AM \cdot PM$$

8. Find all pairs of integers (x, y) that satisfy the given equation.

$$xy + \frac{x}{y} + 2x = 75$$