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INTERNATIONAL MATHEMATICS AND SCIENCE OLYMPIAD FOR PRIMARY SCHOOLS (IMSO) 2007

Mathematics Contest (Second Round) in Taiwan, Essay Problems

Name:_____ School:_____ Grade:_____ ID number:_____

Answer the following 10 questions, and show your detailed solution in the space provided after each question. Each question is worth 4 points.
Time limit: 60 minutes.

1. The 400-digit number 123456789012345678901⋯890 is given.
   Step 1: Cross out all the digits in odd-numbered places.
   Step 2: Cross out all the digits in odd-numbered places of the remaining digits.
   ⋯
   Continue until no digits remain. What is the last digit to be crossed out?

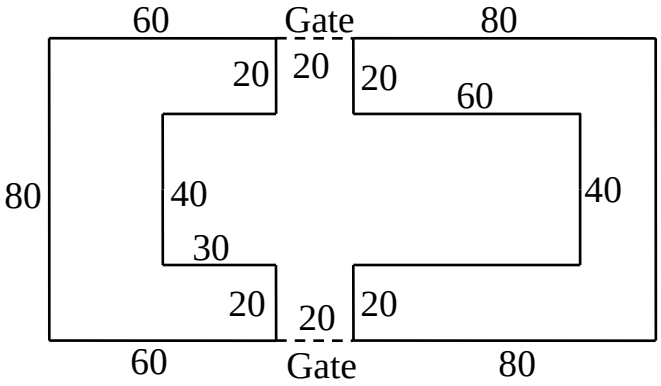
2. A street of houses numbered from 1 to 302 inclusive is to be numbered with new brass numerals. How many of the digits “2” would be needed to complete the job?

3. Articles *X*, *Y* and *Z* are for sale. Article *X* can be bought at the rate of eight for $1. Article *Y* costs $1 each and Article *Z* costs $10 each. You buy a selection of all three types and find that you have to purchased exactly 100 articles at a cost of $100. How many articles of type *Y* did you buy?

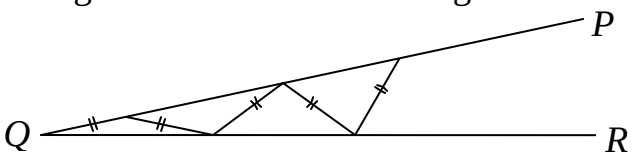
4. Two candles have different lengths and thicknesses. The longer one can burn for 7 hours and the shorter one for 10 hours. After 3 hours' burning, both candles have the same length. What was the shorter candle's length divided by the longer candle's length?

5. John had a summer job on a farm. He had four bags of potatoes to weight but each bag weighed more than 60 kg and less than 100kg , the scale only weighed in excess of 100kg. He solved the problem by weighing the bags two at a time. He found the weightings to be 124, 132, 134, 138, 140, 148. What was the weight of the lightest bag, in kilograms?

6. Here is the plan of a building which has a courtyard with two entrance gates. Passers-by can look through the gates but may not enter. Dimensions of the building are give in metres, and all corners are right angles. What is the area, in square metres, of that part of the courtyard which cannot be seen by passers-by?



7. In the diagram $\angle PQR=6^\circ$, and a sequence of isosceles triangles is drawn as shown. What is the largest number of such triangles that can be drawn?



8. Let $n=9+99+999+\ldots+99\ldots9$, where the last number to be added consists of 99 digits of 9. How many times will the digit 1 appear in n?

9. The following multiplication example, including the answer, uses each number from 0 to 9 once and once only. Four of the numbers are filled in for you. Can you fill in the rest?

$$\begin{array}{rcccc} & & \square & 0 & 2 \\ \times & & & 3 & \square \\ \hline & \square & 5 & \square & \square \end{array}$$

10. The four circles represent cinder paths. The four cyclists started at noon. Each person rode round a different circle, one at the rate of six miles an hour, another at the rate of nine miles an hour, another at the rate of twelve miles an hour, and the fourth at the rate of fifteen miles an hour. They agreed to ride until all met at the center, from which they started, for the fourth time. The distance round each circle was exactly one-third of a mile. When did they finish their ride?

