## Year 5. Problem Set 114 (2009-2010 school year).

1. A big treasure chest contains 10 smaller treasure chests. Some of these smaller treasure chests are empty, and some contain 10 even smaller treasure chests each. And so on, and so on. As a result, there are 222 nonempty treasure chests total. How many treasure chests are empty?



- 2. Construct a set of circumferences on the plane that has the cardinality of continuum.
- 3. Calculate the value of the expression: 1! \* 3 2! \* 4 + 3! \* 5 4! \* 6+... 2000! \* 2002 + 2001!
- 4. Prove that for any pair of irrational points there exist a rational point that is located between these two irrational points.
- 5. A dynamite stick comes with a long fuse. This fuse is to be connected to the stick on one end, and ignited on the other end. It is known that it takes 1 minute for a fuse to completely burn through, though the rate of burn is not uniform. How could one measure 45 seconds using two of these fuses?



6. We have 1001 different natural numbers less than 2000. Prove that is it possible to select three of these numbers in such a way that the first two add up to the third one. Would the same statement hold true if number 1000 replaces number 1001?