

Year 5. Problem Set 115 (2009-2010 school year).

1. How many possible routs there exist to relocate a chess rook from the square $a1$ to the square $h6$? Assume that the rook is allowed to move in the right and down directions only.



2. There are x boys and y girls in the Neverever Math Circle. At the Circle's Christmas party these boys and girls together consumed 1770 candies. Every girl munched down 21 candies and every boy gobbled up 31 candies. How many boys and how many girls attend the Neverever Math Circle? (Find all possible answers).

3. A brother and a sister went blueberry picking. Both had started at the same time with empty 2-gallon baskets. The brother was picking berries twice as fast as his sister was. Therefore, after a while he decided to help her out and switched baskets with her. The kids filled their containers at the same time. How much berries did they together have at the moment when they switched the baskets?



4. Construct a curve on a two-dimensional plane using a series of iterations. On the first iteration, draw an equilateral triangle. On the second iteration, divide each side of the triangle into three equal parts. On each of the center parts, erect another equilateral triangle facing the outside of the existing figure. Erase the center parts of the original triangle. The result is the figure that looks like a star. On the third iteration, construct a triangle on the center third part of each side of the new figure and erase the center parts of the original sides. Assume that you repeat and repeat this operation. The resulting figures look pricklier and pricklier. What happens with boundary length of these figures? Does it go to infinity? (If you repeat this operation infinite number of times, the resulting figure is a fractal. It is called the Koch snowflake.)
5. A rectangular table contains natural numbers. It is allowed to perform two operations on this table. The first operation is to subtract 1 from all the entries of any single row. The second operation is to multiply all entries of a column by 2. Prove that you can transform any table to a table that contains zeroes using just these two operations.