

## Math Cool Games

Mathematical entertainment and games. Mathematical entertainment is usually a variety of entertaining tasks and exercises requiring ingenuity, wit, originality of thinking, ability to critically assess the conditions or raise a question: in particular - puzzles, problems to transform one piece into another by cutting and rearranging parts, tricks based on calculations, mathematical games. Mathematical games include either games dealing with numbers, pieces, etc., or games the outcome of which may be predetermined by preliminary theoretical analysis. With occurrence and development of mathematical games of theory the term "mathematical games" (in the sense of this article) gradually comes out of use.

Bachet's game. From a pile containing  $n$  (for example, 35) objects, two playing games take turns taking no more than  $m$  (for example, 5) objects. The winner is the one who takes the last items. The game theory states that if  $n$  is not divided by  $m + 1$ , the beginning game will definitely win if he leaves a partner a number of items multiple of  $m + 1$  each time (in the example - multiple of 6).

The game is "15". The game is played by one person. On the sixteen-cell board there are 15 randomly numbered checkers. Moving a checker one by one to a free cell from any of the adjacent cells, it is necessary to order the arrangement of checkers (to lead to the normal arrangement - position 1, shown in Figure 1). The theoretical analysis of the game, known since 1879, shows that the problem can be solved only if the number of inversions (i.e. the number of normal placement disturbances) formed by the checker numbers in the initial position has the same parity as the number of the line in which the free cell is. To set the number of inversions, it is necessary for each checker to calculate the number of checkers with a large number preceding it and add up all these numbers; their sum is equal to the required number of inversions. In this case, the following sequence is established in the initial arrangement of checkers: from left to right along the lines and from top to bottom when moving from one line to another. For example, in arrangement II (Fig. 1) the number of inversions is even (equal to 38), and the free cell is in even (in the 2nd) row, i.e. arrangement II can be brought to normal. On the contrary, the arrangement III cannot be normal, because the number of inversions in it is odd (equal to 1: a checker with number 15 precedes a checker with number 14), and the free cell is in the 4th line (in the line with an even number).

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Full mathematical substantiation is also available for such M. R. and I. as drawing of pieces with one stroke, labyrinths, combined problems on the chessboard and others. A large group of M. R. I. is connected with the search for original and beautiful solutions to problems that allow for an almost inexhaustible or even infinite number of solutions.

Among such entertainments is, for example, "making up the parquet" - the task of filling the plane with correctly alternating pieces of the same kind (for example, the same correct polygons) or several of these species. If a "two-colour square parquet" with the axes of symmetry  $A'A$  and  $B'B$  (see Fig. 2) is made up of  $4n^2$  equal squares, each of which is diagonally divided into white and black halves, the number of different parquettes is  $4n^2$  (this number grows rapidly with increasing  $n$ ).

### [And cool math games for kids](#)

A very large, not yet precisely defined number of solutions have also: the Euler's problem about a chess horse is to bypass the chessboard with a move of the knight, having visited each cell once, and the problem about making up multi-celled magic squares. In this kind of problems are usually interested in determining the number of solutions, the development of methods that give at once large groups of solutions. Mathematical content of some other M. R. and I. - in establishment of the smallest number of operations necessary for achievement of the set goal. Such entertainments include: zadachas like "crossings", "placements" or games similar to the game "Hanoi Tower", the essence of which is to count the number of moves required to transfer records from column A (see Fig. 3) to column C, using column B, if in one move it is possible to transfer only one record from any column to any other, but it is impossible to put a larger record above a smaller one.