

# MANY CHEERFUL FACTS

presents

## Many Cheerful Problems

a talk by Greta Panova

11:10 am - 12:00 on Wednesday, February 8th, in room 1015.

No facts this time. In fact, just the opposite - it's about how to solve math problems without using deep facts from any theory and higher math in general. Since there is no theory about that either, we will demonstrate "problem solving" by solving problems. The examples are chosen from olympiads and will include problems in number theory, algebra, combinatorics, and geometry (Euclidean!).

To give some flavor of what we will do, here are two samples:

1. Find all pairs of integers  $m > 2$ ,  $n > 2$  such that there are infinitely many positive integers  $k$  for which  $(k^n + k^2 - 1)$  divides  $(k^m + k - 1)$ .
2. Given an  $n \times n$  square board, with  $n$  even. Two distinct squares of the board are said to be adjacent if they share a common side, but a square is not adjacent to itself. Find the minimum number of squares that can be marked so that every square (marked or not) is adjacent to at least one marked square.

*I am the very model of a modern Major General,  
I've information vegetable, animal, and mineral,  
I know the kings of England, and I quote the fights historical  
From Marathon to Waterloo, in order categorical;  
I'm very well acquainted, too, with matters mathematical,  
I understand equations, both the simple and quadratical,  
About binomial theorem I'm teeming with a lot o' news,  
With many cheerful facts about the square of the hypotenuse!*

- Gilbert & Sullivan  $P \circ P$