Session 4 - Let's Do Some Maths! v.2

UCAS Program 2020

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1 After the last "Let's Do Some Maths!"...

What have you benefited from it? Did you try **thinking out loud**? Did you practice with more Mathematical Problems?

Today we will continue with some interesting Mathematical problems, but in a way more interesting manner.

2 Let's Do Some Maths! - With A Twist

So you've tried writing out all your thinking processes, then constructing an explanation to your peers, now, I would like you to solve the questions in pairs.

In each pair, one student would have to attempt one question out of the two, with their full thinking process laid out. The other student would be leading the student and making sure the student's words makes sense.

You will be given 15 minutes per task, with a 5 minute reflection time on how well you have explained your own train of thoughts.

2.1 MAT 2008, Q5

The Millennium school has 1000 students and 1000 student lockers. The lockers are in a line in a long corridor and are numbered from 1 to 1000.

Initially all the lockers are closed (but unlocked).

The first student walks along the corridor and opens every locker.

The second student then walks along the corridor and closes every second locker, i.e. closes lockers 2, 4, 6, etc. At that point there are 500 lockers that are open and 500 that are closed.

The third student then walks along the corridor, changing the state of every third locker. Thus s/he closes locker 3 (which had been left open by the first student), opens locker 6 (closed by the second student), closes locker 9, etc.

All the remaining students now walk by in order, with the kth student changing the state of every kth locker, and this continues until all 1000 students have walked along the corridor.

(i) How many lockers are closed immediately after the third student has walked along the corridor? Explain your reasoning.

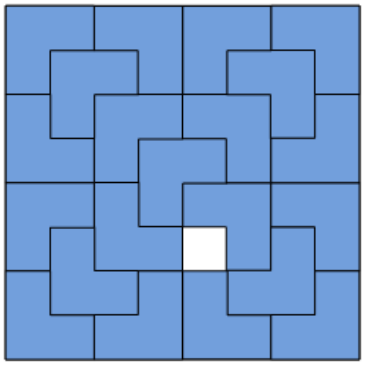
(ii) How many lockers are closed immediately after the fourth student has walked along the corridor? Explain your reasoning.

(iii) At the end (after all 1000 students have passed), what is the state of locker 100? Explain your reasoning.

(iv) After the *hundredth* student has walked along the corridor, what is the state of locker 1000? Explain your reasoning.

Space for some scribbling:

2.2 Underground Mathematics, Triominoes



A board is divided into squares the same size as of the $\frac{1}{3}$ tiles. A triomino is 3-squared, L-shaped. The board is 2^n by 2^n squares.

One square, anywhere on the board, is coloured white.

We can put triominoes on the board, but they must not overlap and must not cover the blue square.

Is it possible to cover the board (apart from the blue square) with triominoes? Does it depend on where the blue square is, or on the n that determines the size of the board? Justify your answer.

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