PYTHAGORAS QUEST

National Final

Part 2. Time : **30 min – 6 questions**   Max: **12 points** (2p/question).

Allowed tools: Only paper, pencil and rubber

Write your team name on all sheets of paper.

Answers only are required for Part 2.

1. Simon's PYTH socks

Simon has a sock drawer. In the drawer there are 10 socks with a P on, 9 socks with a Y on, 8 socks with a T on and 7 socks with an H on. Nothing else is in the drawer. He tries to find a pair of socks with the same letter on. He chooses socks at random without looking and wihout putting them pack in the drawer again after taking them out.

What is the least number of socks he needs to take out before being sure that he has at least one pair of socks with the same letter on?

2. Svetlana's number

Svetlana thought of a positive two-digit number. She multiplied it by 3 and added 11. Then she switched the digits of the result, obtaining a number between 71 and 75, inclusive.

What was Svetlana's number?

3. Eight horses

There are 8 horses, named Horse 1, Horse 2, **. . .**, Horse 8. They get their names from how many minutes it takes them to run one lap around a circular race track: Horse i runs one lap in exactly i minutes. At time 0 all the horses are together at the starting point on the track. The horses start running in the same direction, and they keep running around the circular track at their constant speeds.

What will be the least time (greater than zero) in minutes, at which *at least* 6 horses will simultaneously be at the starting point again?

4. Zero Product?

What is the last non-zero digit (the one furthest to the right) in the produkt $2^2 \cdot 3^3 \cdot 4^4 \cdot 5^5$?
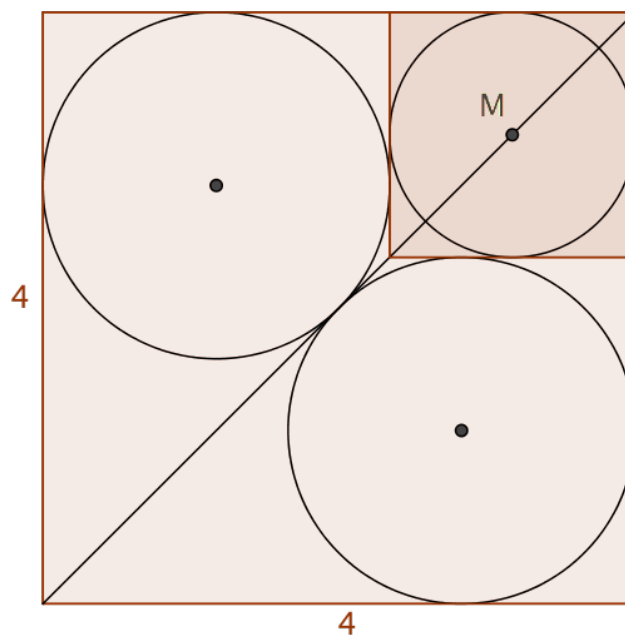
(e.g. in 7123100 that last non-zero digit is 1)

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5. All Aboard the PYTHQU Train

6 train carriages, P, Y, T, H, Q and U, must be coupled in such a way that P must always be in front of Y.

How many possible combinations are there?

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6. Sangaku number 2

The side of the large square is 4 units. Each of the two large circles, just touches the square's diagonal and two of its sides. The smallest circle is just touching a square which in turn is just touching both the larger circles.

Find the exact value of the radius of the smallest circle.