

PYTHAGORAS QUEST
National Final



Part 1. Time: **60 min – 7 questions** Max: **21 points** (3p/question).

Allowed tools: Paper, pencil and rubber (no calculator).

Use a new sheet for each question. Write your team's name on all sheets of paper!

Fully worked solutions are required for Part 1.

1. Weekday

Suppose July of year N has five Mondays. Which weekday must occur five times in the August of year N? (Note: Both months have 31 days.)

2. Mow Mow Mow

Milosz's lawn has twice as much area as Stuart's lawn and three times as much as Uffe's lawn. Uffe's lawn mower cuts half as fast as Stuart's mower and one third as fast as Milosz's mower. If they all start to mow their lawns at the same time, who will finish first?

3. Carol's Estate

Carol walks completely around the boundary of a square whose sides are each 5 km long. From any point on her path she can see exactly 1 km horizontally in all directions. What is the exact area of the region consisting of all points Carol can see during her walk, expressed in square kilometers?

4. Summer School

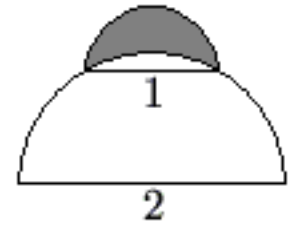
At Malmö Borgarskola Summer School, 60% of the children play soccer, 30% of the children swim, and 40% of the soccer players swim. To the nearest whole percent, what percent of the non-swimmers play soccer?

5. Question of the year

For how many integers a , where $1 \leq a \leq 10$, is $a^{2014} + a^{2015}$ divisible by 5?

6. Going Luney?

A semicircle of diameter 1 sits at the top of a semicircle of diameter 1, as shown. The shaded area inside the smaller semicircle and outside the larger semicircle is called a *lune*. Determine the exact area of this lune.

**7. The Naked Swimmer**

Erik is swimming up a river against the current when he notices that he is drawing attention to himself from passers by at the bank of the river. He realises that he has been swimming naked for the past 10 minutes and immediately turns round and swims with the current to catch up with his missing bathing suit. His bathing suit has been travelling down the river at the same speed of the current. He catches up with his bathing suit 1 km from the place where he first dropped them. Assume that Erik swims at the same speed (number of strokes per minute) the whole time and that the turn does not add any extra time. How fast is the river flowing?