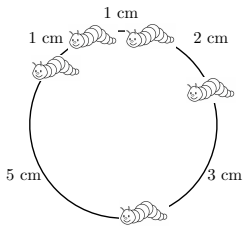
WISCONSIN MATHEMATICS, SCIENCE & ENGINEERING TALENT SEARCH

PROBLEM SET I (2019-2020) **October 2019**

1. Seven friends who share an apartment also share a dog. They want to create a schedule so that each of the friends takes care of the dog on one day of the week. Each of the friends submits a list of the days they are willing to care for the dog. Each list has a different number of days from 1 to 7. Show that the friends can always create a schedule where each one takes care of the dog on a day on their list.

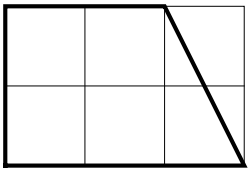
2. Five caterpillars are sitting around the rim of a circular leaf, so that successive distances between neighboring caterpillars (measured along the perimeter) are 1, 1, 2, 3, and 5 cm. The caterpillars would like to conduct a meeting, which requires them to crawl around the rim of the leaf to a single predetermined point. What is the optimal location of the meeting, which minimizes the total distance required by all five caterpillars to travel?



3. Are there 6 natural numbers such that none of them is divisible by any of the others, but the square of each is divisible by all of the others?

4. There are N lights along a one-mile long straight path, not necessarily at the same distance from each other. Each (dim) light illuminates a two-yard long stretch of the path: one yard both ways counted from the position of the lamp. Somebody noticed that the the entire path is illuminated, but if any light goes out, this will no longer be true. What is the largest possible value of N? (1 mile is 1760 yards.)

5. The trapezoid on the right was drawn in a 2×3 grid. Is it possible to cut this trapezoid into three parts so that the parts can be reassembled into a square?



You are invited to submit a solution even if you get just one problem. Please do not write your solutions on this problem page. Remember that solutions require a proof or justification.

Find old and current problems and information about the talent search at: `http://www.math.wisc.edu/talent`

Find an introduction to techniques for solving problems like these at: `https://goo.gl/pqq32m`

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