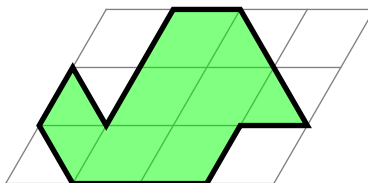


MATH PROBLEMS OF THE MONTH

September 2018 (Fall Series I of IV)

1. Bisection. The small, yet verdant state of Moosylvania, shown on the map below, is undergoing a schism. Show how a single new boundary line can be drawn in (not necessarily a straight line, but drawn with one stroke of your pen) to divide the territory perfectly fairly, into two congruent¹ regions.



2. Triangulation. In a 3–4–5 right triangle, the sum of the legs is two more than the hypotenuse. Find a right triangle with integer sides in which the sum of the legs is *three* more than the hypotenuse, or prove that this is impossible.

3. Integration. Let $f(x, y)$ denote the distance from (x, y) to the nearest point on the square $\max(|x|, |y|) = 1$. Evaluate

$$\int_0^5 \int_0^4 f(x, y) dx dy,$$

giving your answer in the form $a + b \ln 2 + c \ln 3$, where a , b , and c are rational numbers.

Problems are open to everyone! Each month's solvers will be announced along with a running scoreboard for the Fall Series. Prizes of \$125 (first place) and \$50 (runner up) will be awarded to the top student solvers at the end of the Fall Series; students who have solved at least three problems during the Fall Series are eligible for the prizes. To enter the contest:

- (1) Email solutions to jsiehler@gustavus.edu, or
- (2) Submit written solutions to Professor Siehler's mailbox (by the door of Olin Hall 310).

Please include your email address with written solutions. Points will be awarded for each correct, complete solution received during the month of September, 2018. Find the problems online at <https://mcs.blog.gustavus.edu/>.

¹exactly the same size and shape