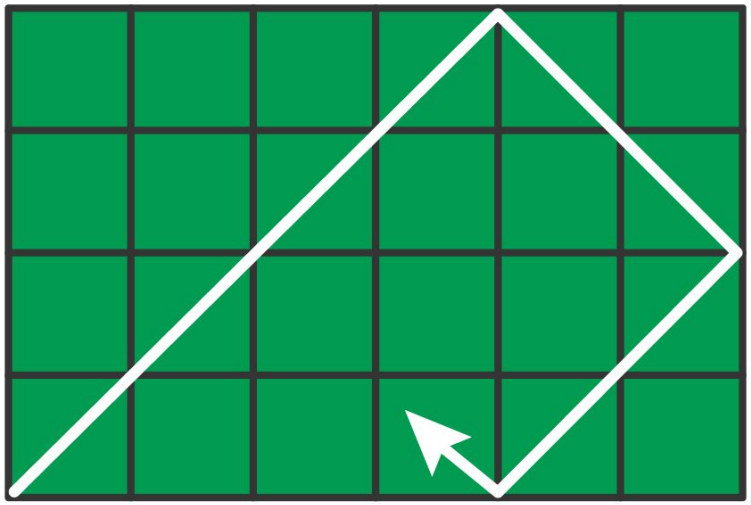
Billiards Geometry



Julia Robinson Mathematics Festival

San Francisco Math Circle at San Francisco State University

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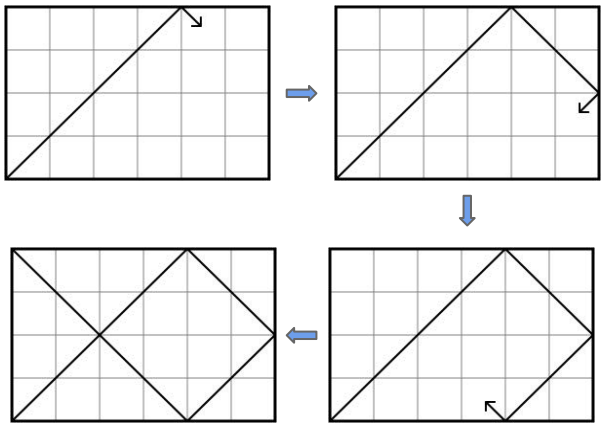
Instructions

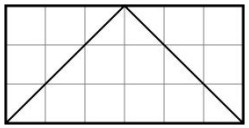
Billiards Paths

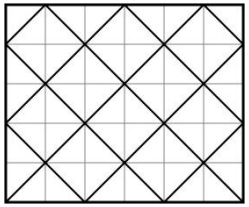
If you shoot a billiards ball at a 45° angle from the bottom left corner of a 4 x 6 pool table with pockets in each of the corners, the ball will follow the path shown below:



Eventually ending in the top left pocket.

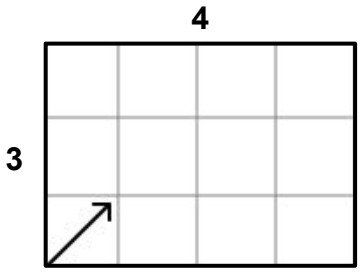
For comparison, here are the paths of a ball on a 3 x 6 table and on a 5 x 6 table:

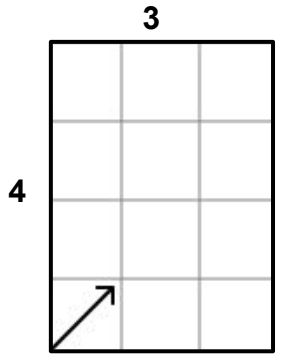




Challenges

1. Use your graph paper to draw a 3 x 4 sized pool table. Can you predict in which pocket the ball's path will end? Can you predict the ending pocket for a 4 x 3 pool table?
2. Try drawing several different sized pool tables. Can you predict the ending pocket for each of these tables?
3. Can you predict the ending pocket for the following tables: 2 x 3, 2 x 4, 2 x 5. Can you predict it for any 2 x n table?
4. Can you predict the ending pocket for any m x n table?
5. As seen on the examples to the left, sometimes the final path results in different patterns. How do the dimensions m x n relate to the final pattern of the billiard ball's path?
6. Can you determine the number of bounces the billiard ball will make on its path for any m x n pool table? Can you determine the total length of the path?





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