A MATHEMATICIAN AT PLAY

The billiard ball problem

Witnessing billiard balls ricochet off the cushion of a pool table, strike each other, and sink into the pocket on the table is one of the great satisfactions of life. Mathematicians and many others have been great pool or billiard fans, and no wonder! The game requires skill and finesses, but also indulges our pattern-seeking sensibilities. Join **Daniel Finkel** as he introduces you to a puzzle based on a billiard ball.

I've designed a new pool table and invite you to play. It has four pockets, one in each corner of the table, and no pockets anywhere else.

You set a cue ball down right in front of the pocket in the bottom left corner of the table, and shoot it at a 45 degree angle across the table. It will continue rolling until it drops into one of the corner pockets. (see figure 1)

Can you predict what corner the ball will end up in?

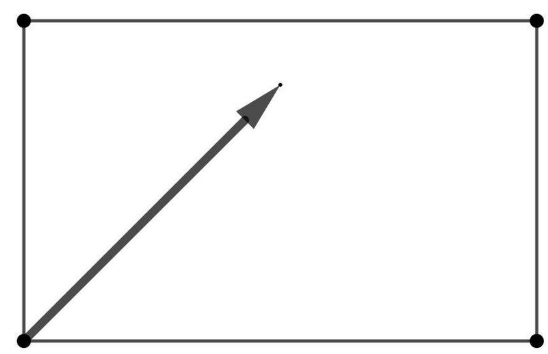
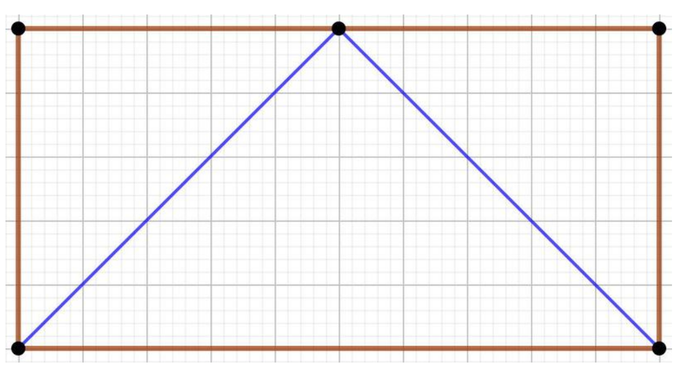
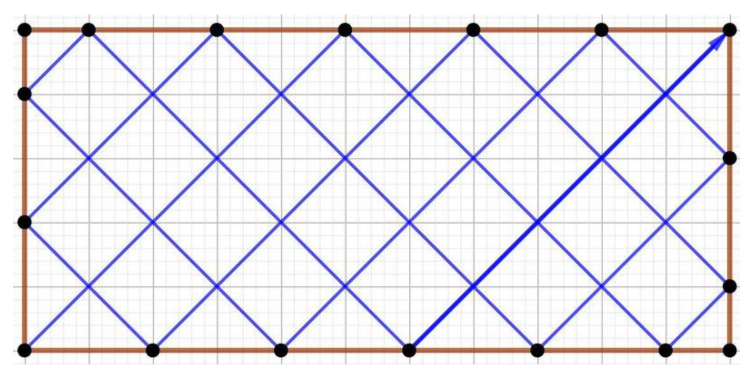


Figure 1

Now there's a problem here, of course, since we don't have enough information: I never told you the dimensions of the table. And the dimensions matter.



If the table was 5 by 10, for example, the ball would end up in the bottom right corner.



On the other hand, extend the width of the table from 10 to 11, and we have a totally different path, and a totally different ending pocket: the top right.

So what's going on? That's the puzzle. Given the dimensions of the table, can you predict the final corner the ball ends up in?

A big hint on how to get started: try out this problem with a bunch of tables.

Here are some specific tables to try out.

- 2 by 6
- 2 by 7
- 3 by 4
- 3 by 5
- 3 by 6
- 3 by 7
- 4 by 6
- 4 by 7
- 4 by 10

If you can do all those, can you find a pattern that will help you predict what corner the ball will end up in for these big tables?

- 26 by 47
- 35 by 99
- 501 by 998
- 600 by 10,000

Dan Finkel is the founder of Math for Love, an organisation devoted to transforming how math is taught and learned. He is the creator of mathematical puzzles, curriculum, and games, including the best-selling Prime Climb and Tiny Polka Dot.