

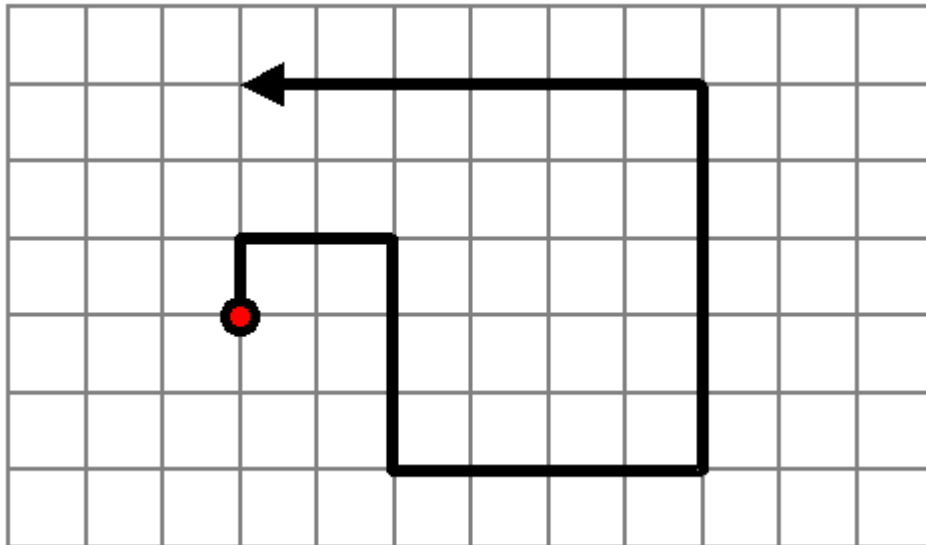
Rocket-Propelled Coyote

Coyotes demarcate their territory by peeing on bushes, rocks, shrubs, cacti, trees, and anything else that is lying around. It is tiring, never-ending work. That is why one especially intelligent coyote decided to order rocket-propelled shoes to allow the more efficient demarcation of territory and therefore leave more time for leisure activities like reading Euclid and eating birds.

The problem was that, once started, the shoes continued to accelerate, but in a funny way. The first minute, the shoes traveled 1 km, then turned left or right as the coyote commanded. The second minute the shoes traveled 2 km, then turned left or right as the coyote commanded. The third minute the shoes traveled 3 km, then turned left or right as the coyote commanded...

The only thing that would stop the shoes from accelerating was if the coyote ended a minute at the exact spot where he turned the shoes on.

Example: The coyote after the sixth minute is only 3 km from his starting place...

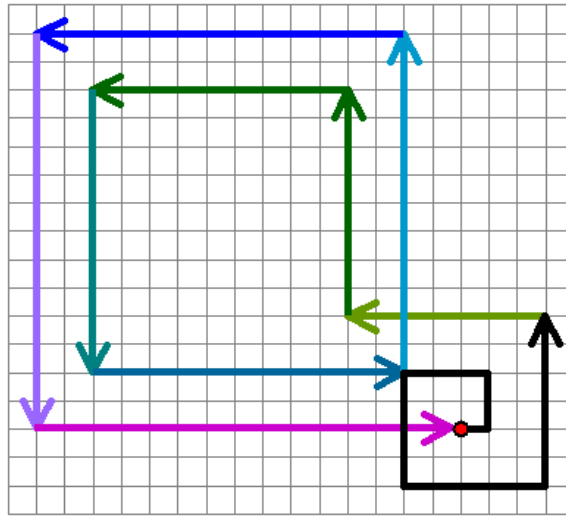


Find a series of left and right turns that will allow the coyote to get back to his starting place in 10 minutes or less. ([Hint](#))

Is this solution unique?

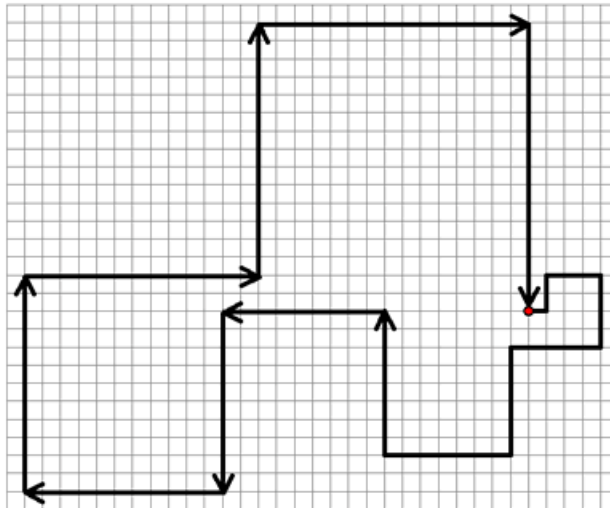
Extensions:

- The coyote must enclose a territory so the following sequence of turns is not acceptable:



One of four failed attempts to demarcate territory by the coyote that had him back in 15 minutes or less.

- Whereas this one is acceptable:



One of 98 successes that had the coyote finished in half an hour or less.

- The coyote starts his stopwatch before he begins, and checks it again when he returns. How long can it take the coyote to get home? For example, can it take him exactly an hour, a day?

The Math in This Problem:

Vectors are the basis to this math puzzle, where students will apply their knowledge of directions and lengths onto a grid. With the acceleration of each consecutive vector, students are challenged to derive a solution for finding a way back to the coyote's initial position.