

# 6

## Race Track

### Purpose

To introduce the concept of constantly changing speed.

### Required Equipment/Supplies

race grid in Figure A  
colored pencil or pen  
graph paper (optional)

### Discussion

A car can accelerate to higher speed at no more than a maximum rate determined by the power of the engine. It can decelerate to lower speed at no more than a maximum rate determined by the brakes, the tires, and the road surface. This simple but fun game will quickly teach you the meaning of fixed acceleration.

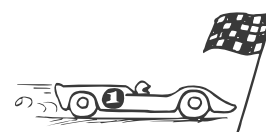
Race Track is a truly remarkable simulation of automobile racing. Its inventor is not known. It is described in the column “Mathematical Games” in the journal *Scientific American*, January 1973, p. 108.

### Procedure

**Step 1:** Each contestant should have a pencil or pen of a different color. Use the race grid in Figure A. Each player draws a tiny box just below a grid point on the starting line. The players then move in order.

**Step 2:** Contestants must obey the following rules.

- (1) The first move must be one square forward: horizontally, vertically, or both (diagonally).
- (2) On each succeeding move a car can maintain its latest velocity *or* increase or decrease its speed by *one* square per move in the horizontal or vertical direction *or both*. For example, a car going 2 squares per move vertically can change to 2 squares per move vertically *and* 1 square to the left or right; 1 or 3 squares per move vertically; or 1 or 3 squares per move vertically *and* 1 square to the left or right.
- (3) The new grid point and the straight-line segment joining it to the preceding grid point must lie entirely within the track.
- (4) No two cars may simultaneously occupy the same grid point. That is, no collisions are allowed!



*Getting started.*

*Rules of the road.*

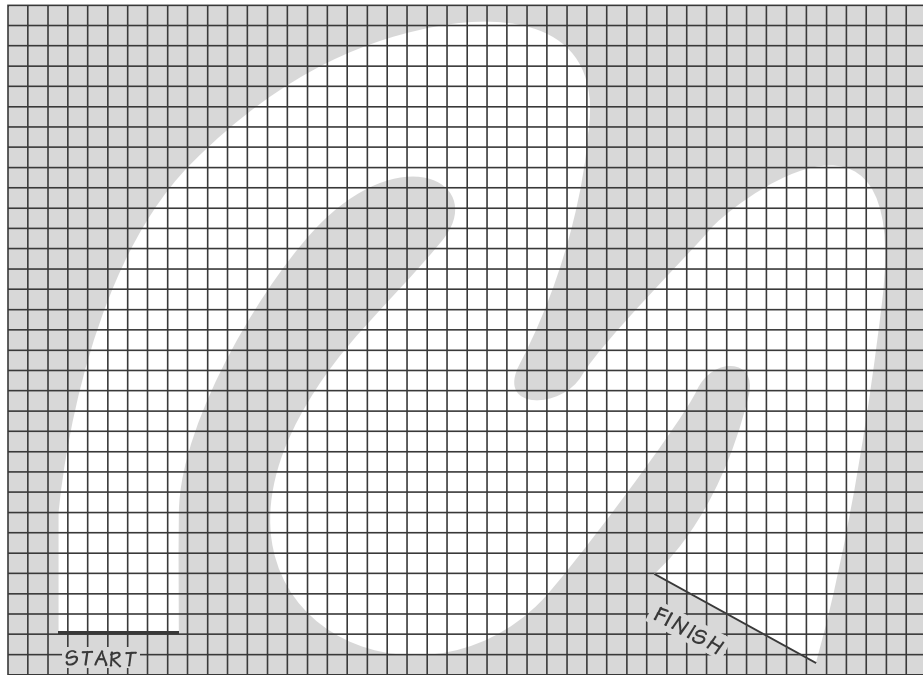


Fig. A

(5) The first player to cross the finish line wins!

To summarize, the speed in either the  $x$  or  $y$  direction can change by no more than one each turn.

*Lay out new course.*

**Step 3:** If you want to play the game again, you can draw a new race grid on a piece of graph paper. The width of the track can vary but should be at least 3 squares wider than the number of cars. To make the game interesting, the track should be strongly curved. Draw a start/finish line at a straight portion of the track.

### Analysis

1. What was the fastest any player ever went during the course of the race?

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2. Did that player win the race?

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3. Did anybody crash? If so, why do you think they did?

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