

# Order-of-Magnitude Estimation

## Conference Escape (Level 3)

### The Question

You're trying to leave a large conference center, but keep getting stopped to shake hands as you walk. How long does it take you to find the exit across the room?

### Background

We've all been there before — you're at a professional conference, ready to leave, but you just can't seem to make it to the door! Let's assume that you're at a conference with 600 other attendees, in a 10-by-20 meter meeting hall. You know half of the people there, and it would be rude to walk past them without stopping to shake their hand. You're at the far end of the long side of the room. Also assume you're easily turned around and so after you turn to face each person, you keep walking in the new direction you're facing. How long does it take to make it out?

We won't do it here, but one can prove that the “root-mean-squared” distance traveled when taking random steps is proportional to the step size and the square-root of the number of steps. Mathematically,  $d_{\text{tot}} \sim d_{\text{step}}\sqrt{N}$ .

### The Solution

## Education Standards

This OoM Estimation problems meets the following standards in **bold**:  
*Next Generation Science Standards (NGSS)*:

- Physical Sciences
  - Matter & Its Interactions
  - **Motion and Stability: Forces and Interactions**
  - Energy
  - Waves and Their Applications in Technologies for Information Transfer
- Life Sciences
  - From Molecules to Organisms: Structures and Processes
  - **Ecosystems: Interactions, Energy, and Dynamics**
  - Heredity: Inheritance and Variation of Traits
  - Biological Evolution: Unity and Diversity
- Earth and Space Sciences
  - Earth’s Place in the Universe
  - Earth’s Systems
  - Earth and Human Activity
- Engineering, Technology, and Applications of Science
  - Engineering Design

*Common Core Standards (CSS)*:

- **Counting & Cardinality**
- **Operations & Algebraic Thinking**
- **Numbers & Operations in Base Ten**
- **Number & Operations — Fractions**
- Measurement & Data
- **Geometry**
- **Ratios & Proportional Relationships**
- The Number System
- **Expressions & Equations**
- Functions
- **Statistics & Probability**