Order-of-Magnitude Estimation
Home Run (Level 1)

The Question
How fast is a baseball traveling (in m/s, on average) on a home run hit?

Background
Baseball pitchers can throw fastballs about 45 m/s (100 mph). How fast is a home run hit traveling?

Guiding Questions
Here are some things you may need to consider:

• How far does a ball have to travel to be a home run?
• How long is a home run hit in the air?

The Solution
From home plate to the wall in a typical baseball stadium is approximately 400 ft. This corresponds to:

\[ \frac{400 \text{ ft}}{3 \text{ ft}} \times \frac{1 \text{ m}}{3 \text{ ft}} = 130 \text{ m} \tag{1} \]

Think about watching a home run hit. How long is the ball in the air? Let’s assume it’s about 5 seconds. Therefore, the ball is traveling:

\[ v = \frac{d}{t} = \frac{130}{5} = 25 \text{ m/s} \tag{2} \]
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