

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:

$$400 \text{ ft} \times \frac{1 \text{ m}}{3 \text{ ft}} = 130 \text{ m} \quad (1)$$

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:

$$v = \frac{d}{t} = \frac{130}{5} = 25 \text{ m/s} \quad (2)$$

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