

Teacher Guide: Cannonball Clowns



Learning Objectives

Students will...

- Identify an object's location on a number line.
- Develop strategies for estimating distances.
- Estimate distances using various measurement units.
- Convert from one measurement unit to another.



Vocabulary

approximate, estimate

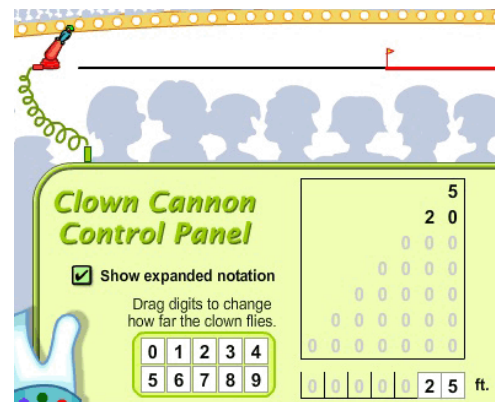


Lesson Overview

The *Cannonball Clowns Gizmo*™ lets students estimate distances on a number line. Students use a cannon to launch a clown a given distance in an attempt to land the clown (safely) inside the target.

The Student Exploration sheet contains three activities:

- Activity A – Students practice estimation skills by launching the clown along 0–100 and 0–1000 number lines.
- Activity B – Students launch clowns across a football field. Distances are measured in yards, feet, and inches.
- Activity C – Students estimate real-world distances using various units.



Suggested Lesson Sequence

1. **Pre-Gizmo activity** (🕒 10 – 15 minutes)
Have students estimate the width of their desks in paperclips. Then have students make paperclip chains and measure their desks. How did their estimates compare to the actual measurements? Now ask students to estimate their height in paper clips. How did they use the width of their desk to inform their estimates? You can ask similar questions using other strange measurement units. How wide is the classroom measured in skateboards? Say we know that classroom is 24 feet wide. How would you revise your skateboard estimate based on that information?
2. **Prior to using the Gizmo** (🕒 10 – 15 minutes)
Before students are at the computers, pass out the Student Exploration sheets and ask students to complete the Prior Knowledge Questions. Discuss student answers as a class. Students may need some encouragement in making estimates. Remind them that they shouldn't be afraid of "being wrong" when making estimates. But also tell them that a good estimate should be more than a random guess. Have students share their strategies for estimating the height of their classroom.

3. **Gizmo activity** (🕒 15 – 20 minutes per activity)
Assign students to computers. Students can work individually or in small groups. Have students work part of the Student Exploration sheet using the Gizmo. Alternatively, you can use a projector and do the Exploration as a teacher-led activity.

It may be overwhelming for students to do all of the activities in the Student Exploration in one sitting. We recommend starting with the first page of the Student Exploration sheet (Prior Knowledge Questions and Gizmo Warm-up) plus one of the three activities. Extend the lesson if you want using the extensions below. Return to the Gizmo and the unused activities in future class periods to reinforce the concepts.

4. **Extending the Gizmo** (🕒 15 – 20 minutes)
Here are some suggestions for extending the activities in the Student Exploration sheet:

Activity A Extension – Revisit the questions found in this activity, only use the 0–10,000 and 0–1,000,000 number lines instead of the 0–100 and the 0–1000 number lines. After students have worked with the two larger number lines, draw all four on the board. As a class, draw and label the midpoints of each number line.

Activity B Extension – Do more work with converting units. Measure various distances and objects around the school in centimeters, meters, yards, feet, and inches. For example, the classroom is 21 feet long. How many yards is this? How many inches? What is your height in centimeters and meters? You could also do unit conversion with weight (ounces, pounds, kilograms) and volume (liters, cups, gallons).

Activity C Extension – Have students use a map of the United States to explore and estimate distances. Challenge them to find towns or landmarks that are 100, 500, and 1000 miles away from where they live. Encourage them to use the map scale to make rough estimates, e.g., if one centimeter represents 100 miles, then a map distance of about 6 centimeters is roughly 600 miles in real life.

Wrap up the unit with a class discussion. After students are done with the three activities, discuss the following questions:

- What strategies did you use to find the location of a target zone?
- A target zone is 94 yards away. Roughly how many feet away is this? How did you get your answer?
- A target zone is 94 yards away. Calculate how many feet away is this (1 yard = 3 feet). How does your answer compare to your estimate?

5. **Follow-up activity: Class number line** (🕒 15– 20 minutes)
On the chalkboard, draw a line 6 inches long. Place a tick mark at the end of the line. Tell students that the line is a 0–100 number line. Then ask them what the largest number on this number line would be if it were extended the full length of the chalkboard. After students have shared their predictions, extend the number line, measure it, and determine the end point. Ask students how long the number line would need to be in real life to extend it to 1,000,000. They will probably be surprised to learn that the number line would need to be 60,000 inches long. That's 5000 feet – almost one mile.



Mathematical Background

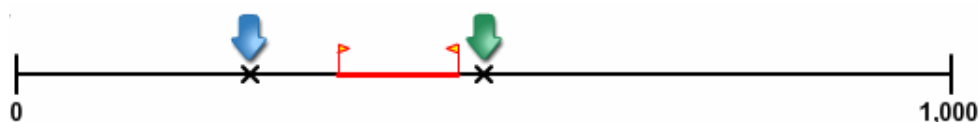
An important goal in elementary math is to develop estimation skills and basic number sense. Estimating distances on number lines is a worthwhile activity because it forces students to think about place value and the relationships between numbers.

The *Cannonball Clowns* Gizmo helps students build number sense in two ways. The first is by asking students to estimate distances on a number line where only the endpoints are labeled. The second is by asking students to estimate real-world distances using a variety of measurement units.

Students sometimes have trouble estimating values on number lines, particularly when the values are large. For example, on a 0–10,000 number line, students will often place a number like 6,000 at the far right end of the number line because the number “looks big.” Repeated exposure to number lines and estimation tasks can help students overcome this misconception.

The *Cannonball Clowns* Gizmo provides an engaging scenario for making number line estimations. Students can discover and share several strategies for estimating distances on a number line that only has the endpoints labeled. For example, they can use the draggable arrows (found in the purple bar on the left side of the Gizmo) to mark the halfway point and the one-quarter and three-quarter points.

In the image below, the green arrow is near 500 and the blue arrow is near 250. The target zone therefore must be greater than 250 and less than 500.



The Gizmo also allows students to practice unit conversions. Start with a simple conversion, such as from yards to feet. Launch the clown a certain distance in yards, and then ask students how far that is in feet. Point out that when converting to a smaller unit (such as from yards to feet), the number of that unit increases.

As your students work through the different locations in the Gizmo, emphasize the importance of choosing an appropriate distance unit. Yards or meters are appropriate for measuring the length of a circus tent or a bunch of school buses, but are not very useful for large distances like the distance from New York to Paris. Students should familiarize themselves with metric units of distance (centimeters, meters, and kilometers). These units are used internationally and are much easier to convert than customary units.



Selected Web Resources

Printable number lines: http://www.helpingwithmath.com/resources/oth_number_lines.htm

Find numbers on a number line: <http://www.webmath.com/k8numlineuse.html>

Number line estimation: <http://www.oswego.org/ocsd-web/games/Estimate/estimate.html>

Estimation worksheet: <http://www.mathworksheetscenter.com/mathskills/estimation/numberline/>

Research on estimation: <http://www.psychologicalscience.org/observer/getArticle.cfm?id=1988>

Human cannon balls: <http://www.cannon-mania.com/human-cannon.htm>