

The Ultimate Throw

Mathematics Objectives

- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of math models.
- Explain why the results may not align exactly with the problem situation.

Language Objective Explain, orally and in writing, how to apply a mathematical model to solve a real-world problem involving comparing rational numbers and absolute value.

Essential Understanding Many real-world problem situations can be represented with a mathematical model, but that model may not represent a real-world situation exactly.

Earlier in this topic, students:

- identified opposites and absolute values of rational numbers.

In this lesson, students:

- develop a mathematical model to represent a problem situation involving comparing rational numbers and absolute value and then propose a solution to the problem.

Later in this course, students will:

- refine their mathematical modeling skills.

Additional Connections Comparing and ordering rational numbers and understanding absolute value connects to work in Topic 8 when students draw a polygon in a coordinate plane to find its area.

Conceptual Understanding Students draw on their understanding of rational numbers and absolute value concepts to develop a representative model.

Application Students apply their mathematical model to test and validate its applicability to similar problem situations.

Materials

Provide manipulatives and other tools that students request.



Student Resources

 Family Engagement

Teacher Resources

 Editable Lesson Plan

 enVision on the Go: Planning Support



Notes

Act 1

The Ultimate Throw

I can ... use mathematical modeling to solve problems.

Let's Model in 3 Acts

Lesson 2-4

ACT 1

- After watching the video, what is the first question that comes to mind?
- Write the Main Question you will answer.
- Predict an answer to this Main Question.
The person who threw the flying disc farther is .
- Construct Arguments** Explain how you arrived at your prediction.

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Students are tasked with determining how far each person threw a disc and who threw their disc farther.

Play the Video

Take advantage of your students' reactions to watching the video. Ask: *What did you notice? What do you wonder?*

Brainstorm Questions WHOLE CLASS

Have students complete **Question 1**. Encourage them to ask any question that comes to mind. Listen for both mathematical and non-mathematical questions. Ask students what makes each question interesting.

- *What questions do you have?* [Sample questions: Why are they throwing discs? In which direction were they supposed to throw? How long will each disc stay in the air? Whose throw is straighter?]

ETP Pose the Main Question WHOLE CLASS

After the question brainstorming, pose the Main Question students will be tasked with answering. Have students complete **Question 2**.

Main Question

- **Who threw his or her disc farther? By how much?**

Ask About Predictions WHOLE CLASS

Have students complete **Questions 3** and **4**. Survey the class about their predictions.

- *Why do you think your prediction is the solution to the Main Question?*
- *Who had predictions that are close?*
- *How many of you agree with that prediction?*
- *Who has a different prediction?*

Act 2 The Model



20-30 min

Act 2

ACT 2

5. What information in this situation would be helpful to know? How would you use that information?

6. **Use Appropriate Tools** What tools can you use to solve the problem? Explain how you would use them strategically.

7. **Model with Math** Represent the situation using mathematics. Use your representation to answer the Main Question.

8. What is your answer to the Main Question? Does it differ from your prediction? Explain.

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Possible Student Solutions

Boy: close to 83 Girl: close to -88
 $|83| = 83$ feet $|-88| = 88$ feet

$$88 - 83 = 5$$

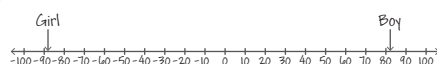
The girl threw farther by 5 feet.

Yvette's Work

Yvette estimates each throwing distance and uses absolute value to compare the distances.

Reese's Work

Reese rounds each throwing distance to the nearest 10 feet and uses the opposite of the negative value to compare distances.



about 80 feet for boy
about -90 feet for girl

The opposite of -90 is 90, so the girl's disc is farther by 10 feet.

Identify Important Information WHOLE CLASS

Have students complete **Question 5**.

- What information do you need to know to solve the problem? [where each disc lands; in which direction the people are supposed to throw; where each person threw from]
- How could you get that information?
- Why do you need that information?

Reveal the Information WHOLE CLASS

As students identify needed information, you can use the online interactivity to estimate, reveal, and share the information.

Boy's disc: between 80 and 90; between 83 and 84

Girl's disc: between 80 and 90; between 88 and 89

Both throws started from the same point.

ETP Develop a Model SMALL GROUPS

For **Question 6**, students might select pencil and paper, concrete models, a ruler, a calculator, a spreadsheet, digital software, or other grade-appropriate tools to solve the problem.

As students answer **Questions 7** and **8**, look at how students are using the information and prompt them to think about more precise solutions.

- Why does the number line shown include negative numbers? [The starting point is at 0. It tells you which direction the disc was thrown.]

ETP Share Solution Strategies WHOLE CLASS

After students answer **Questions 7** and **8**, use the Sample Student Work as you facilitate a discussion about solution methods.

Act 3 The Solution



15-30 min

Act 3

ACT 3

9. Write the answer you saw in the video.

10. **Reasoning** Does your answer match the answer in the video? If not, what are some reasons that would explain the difference?

11. **Make Sense and Persevere** Would you change your model now that you know the answer? Explain.



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Reflect

12. **Model with Math** Explain how you used a mathematical model to represent the situation. How did the model help you answer the Main Question?

13. **Make Sense and Persevere** When did you struggle most while solving the problem? How did you overcome that obstacle?

Build G.R.I.T. Resilience
Overcoming obstacles is part of your journey to success!



Create a Problem

14. Write your own problem related to the video in Act 1. Include any information needed to solve your problem. Explain how you would use a mathematical model to represent the situation. Then solve your problem.

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Use the Video to Reveal the Answer

WHOLE CLASS

The video shows the throwing distances and the difference between them. Have students complete **Question 9**.

Main Question Answer

The girl, by 5.4 feet

ETP Validate Conclusions SMALL GROUPS

After **Questions 10** and **11**, discuss possible sources of error inherent in using math to model real-world situations. Point out that the models are still useful even though they are not perfect.

- **Why does your answer not match the answer in the video?**
[The number line is only marked every 10 feet, then every foot. The actual throwing distances were to the nearest tenth.]
- **How useful was your model at predicting the answer?**
- **How could your model better represent the situation?**

Reflect on Thinking SMALL GROUPS

Have students complete **Questions 12** and **13** as an extension. Discuss how students applied mathematical processes.

Create a Problem INDIVIDUAL

Use **Question 14** as an opportunity for students to revisit other questions they had during **Question 1** brainstorming.

Possible Student Solution

Each person walks to the other person's disc and throws it toward the starting point. Where will each disc land?

Needed information:

- The discs are about 83 feet and about -88 feet from the starting point.

The boy's disc will land $-88 + 83 = -5$ feet from the starting point, and the girl's disc will land $83 - 88 = -5$ feet from the starting point.