Lesson 11

Using a Trundle Wheel to Measure Distances

Goals

- Calculate the distance of a path using the circumference and number of rotations of a trundle wheel.
- Compare measurement calculations and express differences between measurements as a percentage.
- Critique (orally) methods for measuring a long distance.

Lesson Narrative

In this optional lesson, students use their trundle wheels to re-measure the distance they measured previously. By returning to the earlier problem with new tools, students make sense of and persevere in solving the problem. After students have had experience using their trundle wheels, they can connect their observations of how the wheel works with the distance computations and discuss the sources of errors in a more meaningful way. Students compare their previous measurements with their new measurements using the trundle wheel. This comparison allows them to refine their model by reconciling how to report the different measurements from each way of measuring.

Student Learning Goal

Let's use our trundle wheels.

Lesson Timeline

40 min

Activity 1

Access for Students with Diverse Abilities

- Action and Expression (Activity 1)

Access for Multilingual Learners

- MLR2: Collect and Display (Activity 1)

Instructional Routines

- MLR2: Collect and Display

Required Materials

Materials to Gather

- Trundle wheels: Activity 1

Activity 1:
Prepare to distribute the trundle wheels students built in the previous lesson. Make sure students can still get to the path (between 50 and 100 meters) that they measured the other day.

For the digital version of the activity, acquire devices that can run the applet.

Activity 1

Measuring Distances with the Trundle Wheel

40 min

Activity Narrative

There is a digital version of this activity.

In this activity, students use the trundle wheels they made to measure a longer path of about 50–100 meters. This is the same path that they measured during an earlier lesson with a different method. As they return to measure the same path with a new approach, students make sense of and persevere in solving the problem.

After students measure, they spend the remainder of the lesson on computations and sharing results. Students get a chance to connect the mathematical formulas and computations with the aspects of the hands-on experience they had in making and using the wheels. They model with mathematics by deciding how to report their results after taking multiple measurements.

This activity works best when each student has access to a path to measure with a trundle wheel. If a path to measure is unavailable, consider using the digital version of the activity. In the digital version, students use an applet to measure a path with a trundle wheel. The applet allows students to count the rotations to determine the distance.

Launch

Keep students in the same groups from the previous lesson. Remind students of the path they should measure. Instruct them to come back to the classroom to finish their calculations as soon as they have recorded their measurements.

If several groups are sharing a trundle wheel, they each measure the given path once and compare their data with each other.

Give students 10–20 minutes to take turns measuring and 10 minutes of group work time to finish their calculations, followed by whole-class discussion.

Use *Collect and Display* to direct attention to words collected and displayed from an earlier lesson. Invite students to borrow language from the display as needed, and update it throughout the lesson.

Instructional Routines

MLR2: Collect and Display

ilclass.com/r/10690754
Please log in to the site before using the QR code or URL.

Access for Multilingual Learners (Activity 1, Narrative)

MLR2: Collect and Display
This activity uses the *Collect and Display* math language routine to advance conversing and reading as students clarify, build on, or make connections to mathematical language.

Access for Students with Diverse Abilities (Activity 1, Launch)

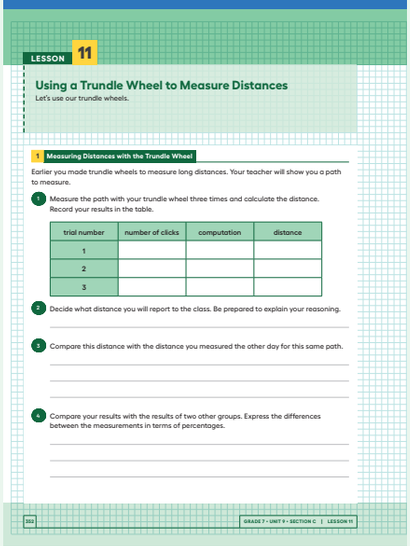
Action and Expression: Provide Access for Physical Action.
Support effective and efficient use of tools and assistive technologies. To use the trundle wheel, some students may benefit from access to step-by-step instructions or modeling a systemic way to record the number of clicks to calculate an example distance.
Supports accessibility for: Organization, Memory, Attention

Building on Student Thinking

If students lose track of the number of rotations along the path, consider asking:

"Explain how your trundle wheel helps you measure distance."
"How can you use your team to help you keep track of the number of rotations?"

Student Workbook



LESSON 11

Using a Trundle Wheel to Measure Distances

Let's use our trundle wheels.

1 Measuring Distances with the Trundle Wheel

Earlier you made trundle wheels to measure long distances. Your teacher will show you a path to measure.

1. Measure the path with your trundle wheel three times and calculate the distance. Record your results in the table.

trial number	number of clicks	computation	distance
1			
2			
3			

2. Decide what distance you will report to the class. Be prepared to explain your reasoning.

3. Compare this distance with the distance you measured the other day for this same path.

4. Compare your results with the results of two other groups. Express the differences between the measurements in terms of percentages.

Student Task Statement

Earlier you made trundle wheels to measure long distances. Your teacher will show you a path to measure.

1. Measure the path with your trundle wheel three times and calculate the distance. Record your results in the table.

trial number	number of clicks	computation	distance
1	63	$25\pi \cdot 63$	4,945.5 cm, 49.5 m
2	65	$25\pi \cdot 65$	5,102.5 cm, 51.0 m
3	63.5	$25\pi \cdot 63.5$	4,984.75 cm, 49.9 m

2. Decide what distance you will report to the class. Be prepared to explain your reasoning.

Sample response: Distance to report: 50 m

3. Compare this distance with the distance you measured the other day for this same path.

Answers vary.

4. Compare your results with the results of two other groups. Express the differences between the measurements in terms of percentages.

Sample response: If Group A's measurement is 50 m and Group B's measurement is 51 m, then Group B's measurement is 2% larger than Group A's since $51 \div 50 = 1.02$.

Activity Synthesis

Direct students' attention to the reference created using *Collect and Display*. Ask students to share their process for measuring the path. Invite students to borrow language from the display as needed, and update the reference to include additional phrases as they respond.

Ask each group to report their measurement for the length of the path and record their answers for all to see. Guide students to compare these answers by asking questions like these:

- *"Do all of these answers seem reasonable? Do any of these answers seem unreasonable? Explain your reasoning."*

  "Why are these answers not all exactly the same? What are some sources of error?"

  Not going in a straight line, the wheel wobbles, the ground is uneven, only counting number of clicks but not parts of rotations, etc.

- *"What units did you use? What units would be most convenient for designing the course of a 5K walk-a-thon?"*

  Metric since we are designing a 5 kilometer course.

- *"What degree of precision is appropriate to report?"*

  To the closest 1 meter at most. Reporting in centimeters or millimeters for such long distances using a tool like a trundle wheel would imply a degree of precision that would not be appropriate.

If time permits, consider asking,

- *"If you could choose your own diameter for a trundle wheel, what would it be?"*

  A diameter that creates a circumference of 1 meter would be convenient, about 32 centimeters.

Collect and store students' trundle wheels so they will have access to them again in the next lesson.