Lesson 13: Designing a 5K course

Goals

- Calculate the distance of a path using the circumference and number of rotations of a trundle wheel.

- Create a scale drawing of a 5K course and present (using words and other representations) the map and course details.

- Use proportional reasoning to calculate the number of laps of a course that is equal to 5 kilometres.

Lesson Narrative

This lesson is optional. In the final lesson of this unit, students design the 5K course and use their trundle wheels to measure distances. They draw a scale drawing of the course on a map or a satellite image of the school grounds, give instructions where the start and finish of the course should be, and decide how many laps are necessary to complete the race. In this lesson students engage in many aspects of mathematical modelling, use appropriate tools and attend to precision. This lesson may take 2 days.

As with all lessons in this unit, all related topics have been addressed in prior units. This lesson provides an optional opportunity to go deeper and make connections between domains.

Addressing

- Solve problems involving scale drawings of geometric figures, including calculating actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

- Analyse proportional relationships and use them to solve real-world and mathematical problems.

- Use proportional relationships to solve multistep ratio and percentage problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percentage increase and decrease, percentage error.

Instructional Routines

- Group Presentations

- Compare and Connect

- Discussion Supports

Required Materials

Maps or satellite images of the school grounds
Tools for creating a visual display
Any way for students to create work that can be easily displayed to the class. Examples: chart paper and markers, whiteboard space and markers, shared online drawing tool, access to a document camera.

Trundle wheels

Required Preparation

Prepare to distribute the trundle wheels students built in a previous lesson. Prepare maps or printed satellite images of the school grounds, one copy per student.

Student Learning Goals

Let's map out the 5K course.

13.1 Make a Proposal

Optional: 10 minutes

In this activity students return to the context of designing a 5K walk-a-thon that was introduced in an earlier lesson. They use a map or satellite image of the school grounds to decide where the path of the 5K course could be and estimate how many laps it would take to complete 5 kilometres. Ideally, one lap should be about 500 metres, because in the next activity, students will use their trundle wheels to measure the course they have designed.

If possible, each group chooses their own course, to help them take ownership of their work and for a greater variety of solutions. Alternatively, the whole class can come to an agreement on one path, to streamline the process if time is limited.

Instructional Routines
• Discussion Supports

Launch

Keep students in the same groups of 3–4 from the previous lesson. Distribute maps or printed satellite images of the school grounds. Give students 10 minutes of group work time.

Action and Expression: Internalise Executive Functions. Provide students with a graphic organiser for data collection and organising information about methods, lengths of estimations and revisions between the two measurements of the course.
Supports accessibility for: Language; Organisation Speaking: Discussion Supports. To help students use mathematical language while reasoning about their length estimations, invite students to use a sentence frame such as: "We estimate the length of our course is ___ because . . . ." Encourage students to consider what details are important to share and to

think about how they will explain their reasoning using mathematical language. Invite students to consider and respond to the reasonableness of each others' estimates.
Design Principle(s): Support sense-making

Anticipated Misconceptions

Students may not have a good sense of scale and may be hesitant to estimate the length of their course. Encourage them to use the path they measured before as a guide. Tell them that whatever their estimate is, it will be wrong. They will get a chance to measure the course and to revise their plan.

Student Task Statement

Your teacher will give you a map of the school grounds.

1. On the map, draw in the path you measured earlier with your trundle wheel and label its length.

2. Invent another route for a walking course and draw it on your map. Estimate the length of the course you drew.

3. How many laps around your course must someone complete to walk 5 km?

Student Response

Answers vary. Sample response:

- One time around the course is about 500 metres.

- A person would have to go around the course 10 times to walk 5 km.

Activity Synthesis

Students check with the teacher about their proposed courses and then move on to the next activity.

13.2 Measuring and Finalising the Course

Optional: 30 minutes

Students measure their proposed 5K courses with their trundle wheels. They compare their measurements with their estimates and make final adjustments to their proposed courses. Then they draw a finalised version of their course on the map (or a second copy of the map) including all the details necessary to organise the race: start and finish locations, walking direction, and number of laps.

Instructional Routines

- Group Presentations

- Compare and Connect

Launch

Keep students in the same groups. Provide access to trundle wheels. Tell students to measure their proposed race course twice, record their measurements, and then to come back to the classroom to finish the calculations and revisions.

Student Task Statement

1. Measure your proposed race course with your trundle wheel at least two times. Decide what distance you will report to the class.

2. Revise your course, if needed.

3. Create a visual display that includes:

    – A map of your final course

    – The starting and ending locations

    – The number of laps needed to walk 5 km

    – Any other information you think would be helpful to the race organisers

Student Response

Answers vary. Possible solution:

- One time around the course is actually 625 metres.

- We have to go around the course 8 times to complete the race.

Are You Ready for More?

The map your teacher gave you didn't include a scale. Create one.

Student Response

Answers vary. Sample response: 1 cm represents 12 m or 1 cm to 12 m.

Activity Synthesis

Ask students to display their maps and explain their proposed race courses. Consider doing a gallery walk. Encourage students to discuss any assumptions they made to complete their calculations as well as any revisions they made to their plan after measuring their proposed course.

Representing, Conversing: Compare and Connect. Use this routine to help students consider audience when preparing a visual display of their work. Ask students to consider how to display their proposed race courses so that another student can interpret them. Groups may wish to add notes or details to their drawings to help communicate their thinking. Provide 2–3 minutes of quiet think time for students to read and interpret each other's displays before they discuss any assumptions they made to complete their calculations as well as any revisions they made to their plan after measuring their proposed course. *Design Principle(s): Cultivate conversation; Maximise meta-awareness*