LUNCH LAP: Sequence Overview

Summary of learning goals

Students use a range of physical and digital technologies to model and explore a problem. They use dynamic modelling and graphing techniques to model and solve two variations of the problem, then use geometric reasoning to justify their findings.

Australian Curriculum: Mathematics (Year 9)

ACMNA294: Find the midpoint and gradient of a line segment (interval) on the Cartesian plane using a range of strategies, including graphing software
ACMNA296: Graph simple non-linear relations with and without the use of digital technologies and solve simple related equations
ACMMG222: Investigate Pythagoras' Theorem and its application to solving simple problems involving right angled triangles
ACMMG224: Apply trigonometry to solve right-angled triangle problems

Summary of lessons

Who is this Sequence for?

This sequence is designed to develop conceptual understandings of geometric proofs and consolidate understandings of Pythagoras' theorem and similar triangles. The lessons assume that students have been introduced to Pythagoras' Theorem and are able to complete routine calculations to find the length of the hypotenuse or of one of the short sides, and to identify and work with similar triangles.

Lesson 1: How Far?

Students participate in an investigation to find the length of a path that touches three sides of a rectangle, starting and finishing at the same point on the fourth side. They model the problem and gather data on possible solutions.

Lesson 2: One Corner

In the previous lesson students formed the hypothesis that the shortest lunch lap possible is 400 metres. In this lesson they investigate how it might be possible to prove that a distance is the shortest possible, using a simplified problem.

Lesson 3: Reflections

Students observe that the shortest lunch lap forms a parallelogram, justify this using symmetry, and show that for any rectangle of given length and width the shortest path is always twice the length of the diagonal.

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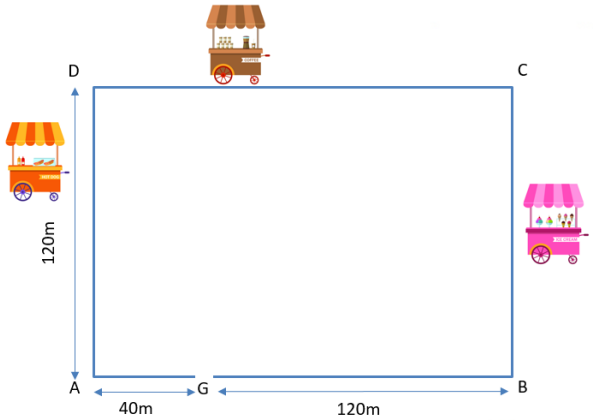
Reflection on this sequence

Rationale

The *Lunch Lap* sequence is constructed through multiple iterations of a single problem: in the diagram below, one cart is positioned on each side of a rectangle. We must construct a path that starts at G and visits each cart in order before returning to G. Where should the carts be placed to minimise the length of this path?



In the first lesson students investigate different models of the problem, using both hands-on physical models and digital geometry models. In the second lesson, they explore a simpler version of the problem, develop and graph algebraic formulas for the length of the path, and use similar triangles to justify their findings. In the final lesson they apply these findings to the original problem and use unusual geometric methods to find a solution.

reSolve Mathematics is Purposeful

- This sequence provides interesting applications of Pythagoras' Theorem aimed at building students' fluency with calculations in unorthodox contexts.
- The sequence takes an unusual approach to geometric proofs in order to expand students' understanding of how proofs can be constructed.

reSolve Tasks are Inclusive and Challenging

- The models in the first lesson can be constructed in different ways to best suit the classroom's preferred style of learning.
- Tasks build on foundational understanding of Pythagoras' Theorem but push knowledge in new directions and relate to other mathematical principles.
- Students are encouraged to construct a proof in Lesson 3 that reflects their own method of understanding and sense-making.

reSolve Classrooms Have a Knowledge Building Culture

- Lunch Lap relies on collaborative inquiry, action and reflection to reach a solution.