re(Solve) MATHS BY INQUIRY Tree Biomass

Y9

Summary of learning goals

- This resource addresses a practical environmental problem of the number of trees that need to be cut down to supply all the paper the school uses in one year. Students use their knowledge of similar triangles, Pythagoras' theorem and algebra to design and construct a Biltmore stick used to measure the diameter and height of a tree. They measure some trees, calculate their volume and use the density of the tree to find the dry mass of the tree. They estimate the amount of paper used in the school and, hence, estimate the number of trees that need to be cut down to supply the school's paper needs.

Australian Curriculum: Mathematics (Year 9)

ACMMG217: Calculate the surface area and volume of cylinders and solve related problems.

ACMMG221: Solve problems using ratio and scale factors in similar figures.

Summary of lessons

Who is this sequence for?

- This sequence follows the reSolve Year 8 resources <u>Circumference</u> and <u>Area of a Circle</u>. The sequence uses similar triangles and the formula for the volume of a cylinder. Significant algebraic skills are assumed when students are asked to work out the diameter markings on a Biltmore stick or they may use the d-tape from Lesson 3 of the <u>Circumference</u> sequence.

Lesson 1: A Biltmore Stick

Students make a Biltmore stick that measures both the diameter and height of a tree, using knowledge of similar triangles, Pythagoras' theorem and some challenging algebra.

Lesson 2: How Many Trees?

Students use a d-tape (see reSolve Year 8 <u>Circumference</u>) or a Biltmore stick to measure the diameter and height of a tree. They use known wood densities to calculate the biomass of a tree and, hence, estimate the number of trees needed to provide the paper that is used by their school in one year.

Australian Academy of Science

Reflection on this sequence

Rationale

Students use mathematics to investigate an environmental problem. In doing so, they combine their knowledge of several areas of mathematics, including similar triangles, volume of a cylinder, circle properties and algebra.

reSolve mathematics is purposeful

- This sequence draws on an important environmental context.
- Students use their mathematical knowledge to design and make an instrument that has traditionally been used to measure trees.

reSolve tasks are inclusive and challenging

- The task involves students collecting real data from the environment.
- All students are able to participate in a task that is meaningful and significant in their world.
- The derivation of the formula showing how to mark diameter on the Biltmore stick involves sophisticated algebraic and geometric reasoning.

reSolve classrooms have a knowledge-building culture

- The sequence builds on ideas from the reSolve Year 8 resources Circumference and Area of a Circle. Students develop a plan for working out how many trees need to be cut down to supply the school's paper and make sensible assumptions and approximations to model the real world.