Unit Overview: Angles and Lines

Summary of learning goals

These lessons provide an opportunity for students to look at geometry in a dynamic way, with movement as a key feature. They investigate side lengths and angles, supported by using physical models and computer simulation. There are opportunities to develop geometric language and to highlight how mathematical structures such as points, lines and angles can be seen in real objects, linking geometry diagrams with real things.

Australian Curriculum: Mathematics (Year 7)

ACMMG164: Investigate conditions for two lines to be parallel and solve simple numerical problems using reasoning.

- Defining and identifying the relationships between alternate, corresponding and co-interior angles for a pair of parallel lines cut by a transversal.

ACMMG165: Classify triangles according to their side and angle properties and describe quadrilaterals.

- Describing squares, rectangles, rhombuses, parallelograms, kites and trapeziums.

Summary of lessons

Who is this unit for?

Lesson 1 requires very little knowledge of geometry, as the key to the investigations lies only in relationships between side lengths. Lesson 2 can accompany or follow learning about angles made by a transversal cutting parallel lines.

Lesson 1: Folding Quadrilaterals

Students make models of triangles and quadrilaterals, using strips hinged with paper fasteners. In a series of five challenges, they investigate the lengths of set of strips that can make triangles and quadrilaterals and contrast the rigidity of triangles with the flexibility of quadrilaterals. They then investigate what quadrilaterals fold neatly. An introduction to mechanical linkages can be included.

Lesson 2: An Extended Protractor

Students explore the unique design of an extended protractor that has a rhombus linkage attached to it. This award-winning design (CCKL-Creator) enables easy measuring of inside and outside angles in both two-dimensional and three-dimensional situations. Students construct a physical model of the extended protractor and observe angle sizes in a computer simulation. They identify the relationships between angles formed by the parallel lines in the protractor, and use the equalities to explain how the extended protractor works.

Reflection on this sequence

Rationale

When devising these tasks in deductive reasoning in geometry, the guiding principles have been:

- providing rich visual imagery, both static and dynamic
- providing an opportunity for students to use the language of geometry
- providing meaningful context that can motivate argumentation and conjecturing
- highlighting the need for deductive reasoning as an answer to the question 'why'
- providing links with other STEM subjects, in particular, engineering and technology
- providing links with history through historical inventions

A strong feature of these lessons is that students are able to see and manipulate physical models. They make physical models out of plastic strips or light card, and for lesson 2, they use a pre-prepared dynamic geometry computer simulation.

The tactile experience of operating the actual tool or a physical model of the linkage provides an instant sense of satisfaction and gives insight into the way in which the linkage moves. The provided dynamic geometry computer simulation shows the geometry more clearly, and enables accurate measurements to be made. Students can observe what stays the same and what varies as the dynamic geometry models are operated.

reSolve Mathematics is Purposeful

Mathematics is both a way of modelling the real world and an abstract discipline. The linkages are used in practical everyday tools, and analysis of the tools leads to conjecture, argumentation and proof. There are clear links to STEM, including engineering.

reSolve Tasks are Challenging Yet Accessible

For many students, motivation for this unit will come from interest in making and manipulating the physical models. Using models assists students to visualise the motion and they can use them to develop and test conjectures. The expectations for the deductive reasoning and the way it is expressed can be moderated by the teacher.

reSolve Classrooms Have a Knowledge Building Culture

Students work together to build models, make and test conjectures and develop and test argumentation.