

## Summary of learning goals

- Students learn how statistical techniques that rely on randomly generated data can be used to solve problems that have a defined solution that is difficult to solve using traditional methods.

### Australian Curriculum: Mathematics (Year 9)

**ACMMG216:** Calculate areas of composite shapes.

**ACMMG222:** Investigate Pythagoras' theorem and its application to solving simple problems using right-angled triangles.

**ACMSP226:** Calculate relative frequencies from given or collected data to estimate probabilities of events involving 'and' or 'or'.

**ACMSP283:** Compare data displays using mean, median and range to describe and interpret numerical datasets in terms of location (centre) and spread.

## Summary of lessons

### Who is this sequence for?

- This sequence is for students who are familiar with proportions, area formulae for trapezia, triangles and circles, and Pythagoras' theorem. It links different mathematical concepts through the generation of random points to estimate irregular areas and  $\pi$ .

### Lesson 1: Oil Spills

Students compare the efficiency and accuracy of different methods for calculating the area of an irregular shape, using the context of oil spill maps. They are introduced to the concept of the Monte Carlo method for calculating area.

### Lesson 2: Estimating $\pi$

Students use the Monte Carlo method to estimate the area of a quadrant of a circle. By comparing this with the formula for the area of a circle, students estimate the value of  $\pi$ .

## Reflection on this sequence

### Rationale

The sequence of lessons provides an unusual and engaging context that takes advantage of the variation inherent in random data. They tie together ideas from geometry, including areas of irregular shapes, trapezia, triangles and circles, with Pythagoras' theorem and proportional reasoning. Lesson 1: Oil Spills introduces the trigonometric formula for the area of a triangle for those students who are ready; Lesson 2: Estimating  $\pi$  can be used to introduce the distance formula in the Cartesian plane.



#### reSolve mathematics is purposeful

- This sequence provides interesting historical and environmental applications of Monte Carlo methods in mathematics.



#### reSolve tasks are inclusive and challenging

- The different contexts will appeal to a wide range of students and show clearly how mathematics is used in real-life problems of interest to students.
- The tasks include a variety of technologies that can be used to generate random numbers and solve the related problems.



#### reSolve classrooms have a knowledge-building culture

- In Lesson 1: Oil Spills students work collaboratively to compare a variety of methods for calculating area.
- The lessons builds on students' prior knowledge, thus providing an ideal context in which to revise key ideas from measurement and geometry.