Year 9 unit overview — Australian Curriculum: Mathematics

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA), *Australian Curriculum v3.0: Mathematics for Foundation–10*, <www.australiancurriculum.edu.au/Mathematics/Curriculum/F-10>.

| School name | Unit title | Duration of unit |
| --- | --- | --- |
| Our School | Pythagoras’ Theorem, linear graphs and direct proportion | 10 Weeks |

| Unit outline |
| --- |
| Students develop an understanding of Pythagoras’ Theorem and direct proportion and build on their learning about linear graphs from Year 8. Students use linear functions in the context of the fare structures for two taxi companies and represent and use the relationship between the cost and distance in various ways. Students also explore some applications of mathematics in forensics. Students investigate, create, evaluate and manipulate mathematical models showing the relationship between the height of a person and the major bones of humerus, femur, radius and tibia. Students identify the ownership of a set of bones by comparing the results of their calculations to descriptions of missing persons. The big ideas of the unit include: * algebraic processes can be used to model real-world events and solve problems
* proportionate reasoning underpins many mathematical concepts.

Inquiry questions for the unit include: * How do we decide which algebraic techniques will be most useful in a given situation?
* What is the link between ratio, proportion and rate?
* What is the link between proportionate reasoning and the gradient of a linear relationship?
* What are the key differences between linear and non-linear relationships?
 |

| Identify curriculum |
| --- |
| Content descriptions to be taught | General capabilities and cross‑curriculum priorities |
| Number and Algebra | Measurement and Geometry | Statistics and Probability |
| Real numbers* Solve problems involving direct proportion. Explore the relationship between graphs and equations corresponding to simple rate problems [(ACMNA208)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMNA208)

Patterns and algebra* Extend and apply the index laws to variables, using positive integer indices and the zero index [(ACMNA212)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMNA212)
* Apply the distributive law to the expansion of algebraic expressions, including binomials, and collect like terms where appropriate [(ACMNA213)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMNA213)

Linear and non-linear relationships* Find the midpoint and gradient of a line segment (interval) on the Cartesian plane using a range of strategies, including graphing software [(ACMNA294)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMNA294)
* Sketch linear graphs using the coordinates of two points and solve linear equations [(ACMNA215)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMNA215)
* Graph simple non-linear relations with and without the use of digital technologies and solve simple related equations [(ACMNA296)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMNA296)
 | Pythagoras and trigonometry* Investigate Pythagoras’ Theorem and its application to solving simple problems involving right angled triangles [(ACMMG222)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMMG222)
 |  | gc_literacy Literacy* Create print, visual and digital materials
* Write a conclusion to an investigation
* Communicate using mathematical terminology

gc_numeracy Numeracy* Identify mathematics in real world applications

gc_ict **ICT capability*** Use spreadsheets and graphing software to model real-world data

gc_critical Critical and creative thinking* Evaluate approaches to problem solving
 |

|  |
| --- |
| Achievement standard |
| By the end of Year 9, students solve problems involving simple interest. They interpret ratio and scale factors in similar figures. Students explain similarity of triangles. They recognise the connections between similarity and the trigonometric ratios. Students compare techniques for collecting data in primary and secondary sources. They make sense of the position of the mean and median in skewed, symmetric and bi-modal displays to describe and interpret data.Students apply the index laws to numbers and express numbers in scientific notation. They expand binomial expressions. They find the distance between two points on the Cartesian plane and the gradient and midpoint of a line segment. They sketch linear and non-linear relations. Students calculate areas of shapes and the volume and surface area of right prisms and cylinders. They use Pythagoras’ Theorem and trigonometry to find unknown sides of right-angled triangles. Students calculate relative frequencies to estimate probabilities, list outcomes for two-step experiments and assign probabilities for those outcomes. They construct histograms and back-to-back stem-and-leaf plots. |
| Proficiencies |
| Opportunities to develop proficiencies include:Understanding * simplifying a range of algebraic expressions

Fluency * applying the index laws to expressions with integer indices
* developing familiarity with calculations involving the Cartesian plane
 | Problem Solving * solving problems involving right-angle trigonometry
* collecting data from secondary sources to investigate an issue

Reasoning * following mathematical arguments
* evaluating media reports
 |

|  |  |
| --- | --- |
| Relevant prior curriculum | Curriculum working towards |
| **In the Australian Curriculum: Mathematics at Year 8**Number and Algebra Number and place value* index notation with numbers

Real numbers* irrational numbers
* rates and ratios

Patterns and algebra* simplifying algebraic expressions including the distributive law

Linear and non-linear relationships* plotting linear relationships on the Cartesian plane
* solving linear equations using algebraic and graphical techniques
 | **In the Australian Curriculum: Mathematics at Year 10**Number and AlgebraPatterns and algebra* expanding binomial products

Linear and non-linear relationships* solving and sketching linear and non-linear relationships

Measurement and GeometryPythagoras and trigonometry* solving right-angle triangle problems
 |
| Bridging content |
| The Essential Learnings, by the end of Year 9 are aligned to the content descriptions identified in this unit. The assessment in this unit requires students to be familiar with report writing and will require scaffolding. It also asks them to apply their mathematical understandings in a very specific context, which will need to be modelled. |
| Links to other learning areas |
| **Links to the Australian Curriculum: Science at Year 9****Science Inquiry Skills**Communicating* Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations.
 |

| Assessment | Make judgments |
| --- | --- |
| Describe the assessment | Assessment date | Teachers gather evidence to make judgements about the following characteristics of student work:Understanding* selection and application of mathematical concepts and information to solve problems
* description of choices made, strategies used and conclusions reached, and checks of the reasonableness of solutions
* mathematical modelling and representation

Skills* application of problem solving strategies to investigate situations
* description of results of mathematical investigations
* use of mathematical procedures and calculations to find solutions
* communication of explanations, solutions and calculations, using mathematical language, conventions and symbols

For further advice and guidelines on constructing guides to making judgments refer to the Learning area standard descriptors: [www.qsa.qld.edu.au](http://www.qsa.qld.edu.au) |
| Students are given opportunities to demonstrate their knowledge, skills and understanding through both formative and summative assessment. The assessment is collated in student folios and allows for ongoing feedback to students on their learning.Year 9 teachers make decisions about the length of time required to complete the tasks and the conditions under which the assessment is to be conducted.The teaching and learning experiences throughout the term provide opportunities for students to develop the understanding and skills required to complete these assessments. As students engage with these learning experiences the teacher can provide feedback on specific skills. | Week 4 |
| Supervised Assessment: Short response (Written) Students work with linear functions in the context of the fare structures for two taxi companies. Students represent and use the relationship between the cost and distance in a variety of ways.The assessment is based on a modified version of *Taxi fares*, available from the QSA Assessment Bank <[www.qsa.qld.edu.au](http://www.qsa.qld.edu.au)>.Note: The assessment package *Building design and Pythagoras’ Theorem,* due to be published in June 2012, could be used with this unit. |
| Modelling and problem-solving task (Written): Crime scene investigation Students use mathematical models showing the relationship between the height of a person and the major bones of humerus, femur, radius and tibia to identify the possible identity of a missing person. Students:* develop and evaluate a protocol to help the police to match evidence to the profile of a missing person
* determine the possible identity of the missing person
* use a research journal to document research and findings
* prepare a report presenting the conclusion/s, containing diagrams, calculations and a discussion.

(300–400 words) | Week 9 |

| Teaching and learning | Supportive learning environment |
| --- | --- |
| Teaching strategies and learning experiences | Adjustments for needs of learners | Resources |
| Introduce Pythagoras’ Theorem and direct proportion Build upon students’ understanding of linear graphs, and rates and ratio by introducing Pythagoras’ Theorem and direct proportion. Prepare students for their culminating activity — the mathematics of forensics. Students investigate, create, evaluate and manipulate mathematical models showing the relationship between two variables. They use relevant questions from textbooks, worksheets and other stimulus, as appropriate. Students:* construct a glossary of relevant terms, including: coordinate, intercept, slope, gradient, variable, constant, independent variable, dependent variable, like terms, Cartesian plane, y-axis, x-axis, origin, ordered pair
* plot linear equations and explore the general equation of a straight line, including with the use of technology, e.g. a graphing calculator, spreadsheet
* sketch simple non-linear graphs for a range of scenarios, e.g. the speed of a bike going up and down a hill, the changing height of a bouncing ball
* solve word problems with linear equations, including some real-world situations.

Prepare for supervised test: Taxi fares Students:* investigate right-angled triangles to become familiar with Pythagoras’ Theorem
* investigate Pythagoras and his other mathematical breakthroughs
* solve simple right-angled triangle problems using Pythagoras’ Theorem
* expand and factorise algebraic expressions
* prove Pythagoras’ Theorem using the “area of a square” method
* solve problems of direct proportion
* sketch graphs of direct proportion
* investigate the “golden ratio”, including:
* using a spreadsheet to show how this relates to the Fibonacci sequence (Term 2 : Term 1 | Term 3 : Term 2 | Term 4 | Term 3 …)
* the perfect rectangle
* a series paper.

Implement Modelling and problem-solving task: Crime scene investigation | Section 6 of the *Disability Standards for Education* (The Standards for Curriculum Development, Accreditation and Delivery) states that education providers, including class teachers, must take reasonable steps to ensure a course/program is designed to allow any student to participate and experience success in learning. The *Disability Standards for Education 2005* (Cwlth) is available from: <www.ag.gov.au> select Human rights and anti-discrimination > Disability standards for education. | **ICT*** computer access required for data analysis (spreadsheet) and report writing (word-processing)
* QSA Assessment Bank: <[www.qsa.qld.edu.au](http://www.qsa.qld.edu.au)>
* interactive whiteboard with access to mathematics programs and websites/images (optional)

**Equipment*** relevant textbook
* worksheets
 |

| Use feedback |
| --- |
| Ways to monitor learning and assessment | Teachers meet to collaboratively plan the teaching, learning and assessment to meet the needs of all learners in each unit.Teachers create opportunities for discussion about levels of achievement to develop shared understandings; co-mark or cross mark at key points to ensure consistency of judgments; and participate in moderating samples of student work at school or cluster level to reach consensus and consistency. |
| Feedback to students | Teachers strategically plan opportunities and ways to provide ongoing feedback (both written and informal) and encouragement to students on their strengths and areas for improvement.Students reflect on and discuss with their teachers or peers what they can do well and what they need to improve.Teachers reflect on and review learning opportunities to incorporate specific learning experiences and provide multiple opportunities for students to experience, practise and improve. |
| Reflection on the unit plan | Identify what worked well during and at the end of the unit, including:* activities that worked well and why
* activities that could be improved and how
* assessment that worked well and why
* assessment that could be improved and how
* common student misconceptions that need, or needed, to be clarified.
 |