Year 10/10a 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 |
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| Our School | Mathematics and sport | 10 weeks |

| Unit outline |
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| Students develop an understanding of the mathematics that can be applied in sports, including: * statistics and probability
* measurement and geometry
* ratio and proportion.

Students apply mathematical reasoning and problem solving to claims that are made about sport. They analyse scenarios in sports such as orienteering, archery, basketball, netball and darts.The big ideas of the unit include:* real-world problems can be analysed through statistics, algebraic processes and modelling
* the application of mathematics can generate an accurate assessment of a situation that is often counter to our initial intuition.

Inquiry questions for the unit include: * A feature of sports commentary is frequent reference to data and statistics. Do the commentators make mathematically valid claims?
* When testing a claim using data and mathematical techniques, how can data and probability be applied?
* How can models be used to assist in solving problems?
* What elements of trigonometry and geometry could be helpful in a sporting context, e.g. planning tactics in orienteering?
* How can we decide who the most valuable player (MVP) in a team is in different sports? Why is identifying this person tactically important?
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| Identify curriculum |
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| Content descriptions to be taught | General capabilities and cross‑curriculum priorities |
| Number and Algebra | Measurement and Geometry | Statistics and Probability |
| Patterns and algebra* Substitute values into formulas to determine an unknown [(ACMNA234)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMNA234)

Linear and non-linear relationships* Solve problems involving linear equations, including those derived from formulas [(ACMNA235)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMNA235)

Real numbers (10a)* Define rational and irrational numbers and perform operations with surds and fractional indices [(ACMNA264)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMNA264)
 | Geometric reasoning* Apply logical reasoning, including the use of congruence and similarity, to proofs and numerical exercises involving plane shapes [(ACMMG244)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMMG244)

Pythagoras and trigonometry* Solve right-angled triangle problems including those involving direction and angles of elevation and depression [(ACMMG245)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMMG245)

Pythagoras and trigonometry (10a)* Establish the sine, cosine and area rules for any triangle and solve related problems [(ACMMG273)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMMG273)
* Use the unit circle to define trigonometric functions, and graph them with and without the use of digital technologies [(ACMMG274)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMMG274)
* Solve simple trigonometric equations [(ACMMG275)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMMG275)
* Apply Pythagoras’ theorem and trigonometry to solving three-dimensional problems in right-angled triangles [(ACMMG276)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMMG276)
 | Chance* Describe the results of two- and three-step chance experiments, both with and without replacements, assign probabilities to outcomes and determine probabilities of events. Investigate the concept of independence [(ACMSP246)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMSP246)
* Use the language of ‘if ....then, ‘given’, ‘of’, ‘knowing that’ to investigate conditional statements and identify common mistakes in interpreting such language [(ACMSP247)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMSP247)

Data representation and interpretation* Use scatter plots to investigate and comment on relationships between two numerical variables [(ACMSP251)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMSP251)
* Investigate and describe bivariate numerical data where the independent variable is time [(ACMSP252)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMSP252)
* Evaluate statistical reports in the media and other places by linking claims to displays, statistics and representative data [(ACMSP253)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMSP253)

Chance (10a)* Investigate reports of studies in digital media and elsewhere for information on their planning and implementation [(ACMSP277)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMSP277)

Data representation and interpretation (10a)* Use information technologies to investigate bivariate numerical data sets. Where appropriate use a straight line to describe the relationship, allowing for variation [(ACMSP279)](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACMSP279)
 | gc_literacy Literacy* Create print, visual and digital materials
* Write reports, including an evaluation and conclusion
* Communicate using mathematical terminology

gc_numeracy Numeracy* Understand data in real-world applications

gc_ict **ICT capability*** Use spreadsheets and graphing software to model real-world data
* Use interactive manipulatives to generate experimental data

gc_critical Critical and creative thinking* Evaluate approaches to problem solving
* Design an investigation

gc_ethical Ethical behaviour* Evaluate media reports that refer to data
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| Achievement standard |
| By the end of Year 10, students recognise the connection between simple and compound interest. They solve problems involving linear equations and inequalities. They make the connections between algebraic and graphical representations of relations. Students solve surface area and volume problems relating to composite solids. They recognise the relationships between parallel and perpendicular lines. Students apply deductive reasoning to proofs and numerical exercises involving plane shapes. They compare data sets by referring to the shapes of the various data displays. They describe bivariate data where the independent variable is time. Students describe statistical relationships between two continuous variables. They evaluate statistical reports.Students expand binomial expressions and factorise monic quadratic expressions. They find unknown values after substitution into formulas. They perform the four operations with simple algebraic fractions. Students solve simple quadratic equations and pairs of simultaneous equations. They use triangle and angle properties to prove congruence and similarity. Students use trigonometry to calculate unknown angles in right-angled triangles. Students list outcomes for multi-step chance experiments and assign probabilities for these experiments. They calculate quartiles and inter-quartile ranges. |
| Proficiencies |
| Opportunities to develop proficiencies include:Understanding * finding unknowns in formulas after substitution
* making the connection between equations of relations
* determining probabilities of two and three step experiments

Fluency * using a range of strategies to solve equations
 | Problem Solving * finding unknown lengths and angles using applications of trigonometry
* modelling of mathematical situations
* investigating independence of events

Reasoning * interpreting and evaluating media statements
* interpreting and comparing data sets
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| Relevant prior curriculum | Curriculum working towards |
| **In the Australian Curriculum: Mathematics at Year 9**This unit builds upon students’ understanding of the basic concepts of probability and data representation:* linear and non-linear relationships
* Pythagoras and trigonometry
* assigning probabilities
* collecting and displaying data.
 | **In the Mathematics A senior syllabus*** elements of applied geometry
* data collection and presentation

**In the Mathematics B senior syllabus*** introduction to functions
* periodic functions and applications
* applied statistical analysis.

This unit develops students’ familiarity with the assessment required in Senior Mathematics:* modelling and problem-solving tasks
* reports
* supervised tests.
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| Bridging content |
| The Essential Learnings by the end of Year 9 provide a good foundation to this unit. In Year 9, students have engaged with theoretical and experimental probability and have gathered, displayed and analysed data. They have modelled, interpreted and evaluated algebraic relationships and related linear and non-linear equations to real-world situations. The application of technology (such as spreadsheets) to create mathematical models will not necessarily be something students have experience with, and may require modelling. |
| Links to other learning areas |
| **Australian Curriculum: Scienceat Year 10**:**Science Understanding**Physical sciences* The motion of objects can be described and predicted using the laws of physics.

**Science as a Human Endeavour**Use and influence of science* People can use scientific knowledge to evaluate whether they should accept claims, explanations or predictions.
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| Assessment | Make judgments |
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| 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 10 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. |  |
| Mathematical Investigation: Report (Written) — Peer and self-assessedStudents focus on the use of probability and statistics in real-world research. They gather primary data (in small groups) and analyse data and write a conclusion (individual). Students:* conduct an investigation into “hot streaks” in sports such as in basketball and netball
* demonstrate an understanding of the difference between dependent and independent outcomes
* collect primary data (small groups)
* write a data analysis and conclusion
* peer- and self-assess their data analysis and conclusion.

(200–300 words) | Week 4 |
| Modelling and problem-solving task (Written)Students respond to a specific sporting scenario by modelling it using mathematics. Students have the opportunity to apply mathematics to real-world applications, and provide significant evidence towards problem solving and reasoning.* Year 10 students model two scenarios in a chosen sport mathematically,e.g. find perceived displacement between goalposts from various positions on a football field; find the quickest route to take in orienteering.
 | Week 7 |
| * Year 10a students model one of the above scenarios and also look at the probabilities of hitting the various scoring areas of a dart board. They consider the areas of the sample space, from 1 to triple 20, in their analysis.
* Students complete a report containing diagrams, calculations and a discussion.

(200–300 words for each scenario). |  |  |
| Supervised assessment: Short response and multiple choice (Written)Students solve problems related to:* congruence and similarity
* angles of elevation and depression
* probabilities of events.

This can include:* short-response items that focus on Understanding and Fluency
* extended response items with a focus on Problem Solving
* response to stimulus (unseen) that focuses on Reasoning
* individual response under supervised conditions.

The following assessment packages in the QSA Assessment Bank could be used in this unit:* *501*
* *Forty years from now.*
 | End of term |

| Teaching and learning | Supportive learning environment |
| --- | --- |
| Teaching strategies and learning experiences | Adjustments for needs of learners | Resources |
| Probability, statistics and algebra Students learn about and explore the concepts of dependent and independent events through practical exercises and problems. They evaluate statistical reports in the media. In particular, students explore cases where a misunderstanding of statistics is displayed. They use relevant questions from textbooks, worksheets and other stimulus, as appropriate. * Introduce students to independent events by discussing the following statement: “I’ve just tossed 5 heads in a row. Surely the next toss is more likely to be a tail!”
* Discuss the importance of appropriate sample sizes for chance experiments.
* Construct a glossary of relevant terms, including: experimental probability, theoretical probability, trial, favourable outcome, event, relative frequency, expected frequency, replacement, independence, scatter plot, sample space, bivariate, tree diagram.
* Plan and conduct chance experiments.
* Tabulate results.
* Substitute values into formulas.
* Use sample spaces including using tables and tree diagrams to determine the probability of compound events.
* Transfer word problems into probability notation, including n(event), P(event).
* Discuss and investigate how commentators in various sports cite statistics. How accurate is their interpretation of the data? What is the significance of the statistics they cite?
* Investigate the myth of Australian batters getting out on 87 (the unlucky number) in cricket.
* Research and compare the sporting achievements of three or more champion athletes and decide who is the greatest based on their statistics.
* Begin research on the “hot streak”. (This investigation requires scaffolding and monitoring of student understanding.)
* Research the “clustering myth”, including a class discussion of the concepts involved in evaluating a “hot streak” mathematically.
 | 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*** interactive whiteboard with access to mathematics programs and websites/images (optional)
* computer access required for data analysis (spreadsheet) and report writing (word processing)

**Equipment*** relevant textbook
* worksheets
* coordination of primary data collection for report will require coordination with HPE department for access to basketball and netball courts and equipment (or other sports)
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| Measurement, geometry and algebra Students develop their understanding of the logical reasoning involved in solving geometric problems and right angles. Students use algebra to model real-world situations and extend their understanding of trigonometry. Students apply this learning to exploring the physical aspects of sport. They use relevant questions from textbooks, worksheets and other stimulus, as appropriate. Students:* explore the congruence and similarity of plane shapes using scale drawings
* investigate Thales’ use of similar triangles to find the height the Pyramids
* review trigonometry and Pythagoras from Year 9, e.g. the terms: opposite, adjacent, hypotenuse, and the trigonometric ratios
* solve problems involving bearings (direction) and elevation
* solve linear equations using graph paper and technology (graphing calculators/ spread sheet)
* use technology to determine the acceleration of an object falling freely using a linear regression (can be done theoretically or using primary data from ticker timers/strobe light/high speed camera)

Implement modelling and problem solving task Revise for supervised test |  |  |

| Use feedback |
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| 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.
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