Mathematics Sample Program: Year 7



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Abbreviations

ABS Australian Bureau of Statistics

AMSI Australian Mathematical Sciences Institute

CIMT Centre for Innovation in Mathematical Teaching (Plymouth, United Kingdom)

DET Department of Education and Training

ESA Educational Services Australia

NCTM National Council Teachers of Mathematics

NLVM National Library of Virtual Manipulatives

MAV Mathematical Association of Victoria

Hyperlinks

At the time of publication the URLs (website addresses) cited were checked for accuracy and appropriateness of content. However, due to the transient nature of material placed on the web, their continuing accuracy cannot be verified. Teachers are strongly advised to prepare their own indexes of sites that are suitable and applicable to the courses they teach, and to check these addresses prior to allowing student access.

Overview

This Mathematics Sample Program: Year 7 is an example of how the Mathematics curriculum could be organised into a teaching and learning program.

This sample program provides comprehensive coverage of content descriptions from the three strands of the mathematics curriculum and is sequenced to develop knowledge and skills; however, there are many other ways that the curriculum content can be arranged to suit the learning needs of students.

Topics, suggested time allocations and sequencing

|  |  |  |
| --- | --- | --- |
| **Week\*** | **Semester 1** | **Semester 2** |
| 1 | [*7.1.1 Surveys and displaying data*](#_Topic_7.1.1_Surveys)  Strand: Statistics and Probability  Sub-strand: Data representation and interpretation | *[7.2.1 Fractions](#_Topic_7.2.1_Fractions)*  Strand:Number and Algebra  Sub-strand: Real numbers |
| 2 |
| 3 | [*7.1.2 Whole numbers, factors and multiples*](#_Topic_7.1.2_Whole)  Strand: Number and Algebra  Sub-strands: Number and place value; Patterns and algebra | [*7.2.2 Patterns, rules and equations*](#_Topic_7.2.2_Patterns,)  Strand: Number and Algebra  Sub-strands: Patterns and algebra; Linear and non-linear relationships |
| 4 |
| 5 | *[7.2.3 Statistical data](#_Topic_7.2.3_Statistical)*  Strand: Statistics and Probability  Sub-strand: Data representation and interpretation |
| 6 | [*7.1.3 Angles, lines and shapes*](#_Topic_7.1.3_Angles,)  Strand: Measurement and Geometry  Sub-strand: Geometric reasoning |
| 7 |
| 8 | *[7.2.4 Decimals, percentages and simple ratios](#_Topic_7.2.4_Decimals)*  Strand: Number and Algebra  Sub-strand: Real numbers |
| 9 | [*7.1.4 Length and area*](#_Topic_7.1.4_Length)  Strand: Measurement and Geometry  Sub-strand: Using units of measurement |
| 10 |
| 11 | *[7.2.5 Coordinates, graphs and transformations](#_Topic_7.2.5_Coordinates,)*  Strand: Number and Algebra  Sub-strand: Linear and non-linear relationships  Strand: Measurement and Geometry  Sub-strand: Location and transformation |
| 12 | [*7.1.5 Number puzzles and patterns*](#_Topic_7.1.5_Number)  Strand: Number and Algebra  Sub-strand: Patterns and algebra |
| 13 |
| 14 | [*7.1.6 Integers, fractions and number lines*](#_Topic_7.1.6_Integers,)  Strand: Number and Algebra  Sub-strand: Number and place value | [*7.2.6 Time and money*](#_Topic_7.2.6_Time)  Strand: Measurement and Geometry  Sub-strand: Using units of measurement  Strand: Number and Algebra  Sub-strand: Money and financial mathematics |
| 15 |
| 16 | [*7.1.7 Probability and proportion*](#_Topic_7.1.7_Proportion)  Strand: Statistics and Probability  Sub-strand: Chance | [*7.2.7 Solids, volume, capacity and mass*](#_Topic_7.2.7_Solids,)  Strand: Measurement and Geometry  Sub-strands: Using units of measurement; Shape |
| 17 |
| 18 |

\* Based on 3 hours teaching time per week

Content descriptions coverage within each topic

|  |  |
| --- | --- |
| **Level 7 content descriptions** | **Topic/s** |
| **Strand: Number and Algebra** | |
| **Sub-strand: Number and place value** | |
| Investigate index notation and represent whole numbers as products of powers of prime numbers [(VCMNA238)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA238) | [7.1.2](#_Topic_7.2.1_Fractions_1) |
| Investigate and use square roots of perfect square numbers [(VCMNA239)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA239) | [7.1.2](#_Topic_7.1.2_Whole)  [7.1.6](#_Topic_7.1.6_Integers,) |
| Apply the associative, commutative and distributive laws to aid mental and written computation and make estimates for these computations [(VCMNA240)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA240) | [7.1.2](#_Topic_7.1.2_Whole) |
| Compare, order, add and subtract integers [(VCMNA241)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA241) | [7.1.2](#_Topic_7.1.2_Whole)  [7.1.6](#_Topic_7.1.6_Integers,) |
| **Sub-strand: Real numbers** | |
| Compare fractions using equivalence. Locate and represent positive and negative fractions and mixed numbers on a number line [(VCMNA242)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA242) | [7.1.6](#_Topic_7.1.6_Integers,) |
| Solve problems involving addition and subtraction of fractions, including those with unrelated denominators [(VCMNA243)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA243) | [7.2.1](#_Topic_7.2.1_Fractions_1) |
| Multiply and divide fractions and decimals using efficient written strategies and digital technologies [(VCMNA244)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA244) | [7.2.1](#_Topic_7.2.1_Fractions_1)  [7.2.4](#_Topic_7.2.4_Decimals,) |
| Express one quantity as a fraction of another, with and without the use of digital technologies [(VCMNA244)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA244) | [7.2.1](#_Topic_7.2.1_Fractions_1) |
| Round decimals to a specified number of decimal places [(VCMNA246)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA246) | [7.2.4](#_Topic_7.2.4_Decimals) |
| Connect fractions, decimals and percentages and carry out simple conversions [(VCMNA247)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA247) | [7.2.5](#_Topic_7.2.5_Coordinates,) |
| Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies [(VCMNA248)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA248) | [7.2.5](#_Topic_7.2.5_Coordinates,) |
| Recognise and solve problems involving simple ratios [(VCMNA249)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA249) | 7.2.5 |
| **Sub-strand: Money and financial mathematics** | |
| Investigate and calculate 'best buys', with and without digital technologies [(VCMNA250)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA250) | 7.2.6\* |
| **Sub-strand: Patterns and algebra** | |
| Introduce the concept of variables as a way of representing numbers using letters [(VCMNA251)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA251) | 7.1.5  7.2.2 |
| Create algebraic expressions and evaluate them by substituting a given value for each variable [(VCMNA252)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA252) | 7.2.2 |
| Extend and apply the laws and properties of arithmetic to algebraic terms and expressions [(VCMNA253)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA253) | 7.2.2 |
| Design and implement mathematical algorithms using a simple general purpose programming language [(VCMNA254)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA254) | 7.1.2  7.1.5  7.2.2  7.2.6 |
| **Sub-strand: Linear and non-linear relationships** | |
| Given coordinates, plot points on the Cartesian plane, and find coordinates for a given point [(VCMNA255)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA255) | 7.2.5 |
| Solve simple linear equations [(VCMNA256)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA256) | 7.2.2 |
| Investigate, interpret and analyse graphs from real life data, including consideration of domain and range [(VCMNA257)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA257) | 7.2.5 |

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| **Strand: Measurement and Geometry** | |
| **Sub-strand: Using units of measurement** | |
| Establish the formulas for areas of rectangles, triangles and parallelograms and use these in problem solving [(VCMMG258)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG258) | 7.1.4 |
| Calculate volumes of rectangular prisms [(VCMMG259)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG259) | 7.2.7 |
| **Sub-strand: Shape** | |
| Draw different views of prisms and solids formed from combinations of prisms [(VCMMG260)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG260) | 7.2.7 |
| **Sub-strand: Location and transformation** | |
| Describe translations, reflections in an axis, and rotations of multiples of 90° on the Cartesian plane using coordinates. Identify line and rotational symmetries [(VCMMG261)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG261) | 7.2.5 |
| **Sub-strand: Geometric reasoning** | |
| Identify corresponding, alternate and co-interior angles when two straight lines are crossed by a transversal [(VCMMG264)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG264) | 7.1.3 |
| Investigate conditions for two lines to be parallel and solve simple numerical problems using reasoning [(VCMMG265)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG265) | 7.1.3 |
| Demonstrate that the angle sum of a triangle is 180° and use this to find the angle sum of a quadrilateral [(VCMMG263)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG263) | 7.1.3 |
| Classify triangles according to their side and angle properties and describe quadrilaterals [[(VCMMG262)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG262)](http://ausvels.vcaa.vic.edu.au/Mathematics/Curriculum/F-10) | 7.1.3 |
| **Strand: Statistics and Probability** | |
| **Sub-strand: Chance** |  |
| Construct sample spaces for single-step experiments with equally likely outcomes [(VCMSP266)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMSP266) | 7.1.7 |
| Assign probabilities to the outcomes of events and determine probabilities for events [(VCMSP267)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMSP267) | 7.1.7 |
| **Sub-strand: Data representation and interpretation** | |
| Identify and investigate issues involving numerical data collected from primary and secondary sources [(VCMSP268)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMSP268) | 7.1.1  7.2.3 |
| Construct and compare a range of data displays including stem-and-leaf plots and dot plots [(VCMSP269)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMSP269) | 7.1.1  7.2.3 |
| Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data [(VCMSP270)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMSP270) | 7.2.3 |

\* This unit plan/topic also addresses one content description from Level 6 and one from Level 8.

Achievement standards (for three levels to support planning for a continuum of learning)

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| **Level 6** | **Level 7** | **Level 8** |
| **Number and Algebra**  Students recognise the properties of prime, composite, square and triangular numbers and determine sets of these numbers. They solve problems that involve all four operations with whole numbers and describe the use of integers in everyday contexts. Students locate fractions and integers on a number line and connect fractions, decimals and percentages as different representations of the same number. They solve problems involving the addition and subtraction of related fractions. Students calculate a simple fraction of a quantity and calculate common percentage discounts on sale items, with and without the use of digital technology. They make connections between the powers of 10 and the multiplication and division of decimals. Students add, subtract and multiply decimals and divide decimals where the result is rational. Students write number sentences using brackets and order of operations, and specify rules used to generate sequences involving whole numbers, fractions and decimals. They use ordered pairs of integers to represent coordinates of points and locate a point in any one of the four quadrants on the Cartesian plane. | **Number and Algebra**  Students solve problems involving the order, addition and subtraction of integers. They make the connections between whole numbers and index notation and the relationship between perfect squares and square roots. They solve problems involving all four operations with fractions, decimals, percentages and their equivalences, and express fractions in their simplest form. Students compare the cost of items to make financial decisions, with and without the use of digital technology. They make simple estimates to judge the reasonableness of results. Students use variables to represent arbitrary numbers and connect the laws and properties of number to algebra and substitute numbers into algebraic expressions. They assign ordered pairs to given points on the Cartesian plane and interpret and analyse graphs of relations from real data. Students develop simple linear models for situations, make predictions based on these models, solve related equations and check their solutions. | **Number and Algebra**  Students use efficient mental and written strategies to make estimates and carry out the four operations with integers, and apply the index laws to whole numbers. They identify and describe rational and irrational numbers in context. Students estimate answers and solve everyday problems involving profit and loss rates, ratios and percentages, with and without the use of digital technology. They simplify a variety of algebraic expressions and connect expansion and factorisation of linear expressions. Students solve linear equations and graph linear relationships on the Cartesian plane. |

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| **Level 6** | **Level 7** | **Level 8** |
| **Measurement and Geometry**  Students relate decimals to the metric system and choose appropriate units of measurement to perform a calculation. They solve problems involving length and area, and make connections between capacity and volume. Students interpret a variety of everyday timetables. They solve problems using the properties of angles and investigate simple combinations of transformations in the plane, with and without the use of digital technology. Students construct simple prisms and pyramids. | **Measurement and Geometry**  Students use formulas for the area and perimeter of rectangles. They classify triangles and quadrilaterals and represent transformations of these shapes on the Cartesian plane, with and without the use of digital technology. Students name the types of angles formed by a transversal crossing parallel lines and solve simple numerical problems involving these lines and angles. They describe different views of three-dimensional objects, and use models, sketches and digital technology to represent these views. Students calculate volumes of rectangular prisms. | **Measurement and Geometry**  Students convert between units of measurement for area and for volume. They find the perimeter and area of parallelograms, rhombuses and kites. Students name the features of circles, calculate circumference and area, and solve problems relating to the volume of prisms. They make sense of time duration in real applications, including the use of 24-hour time. Students identify conditions for the congruence of triangles and deduce the properties of quadrilaterals. They use tools, including digital technology, to construct congruent shapes. |
| **Statistics and Probability**  Students interpret and compare a variety of data displays, including displays for two categorical variables. They analyse and evaluate data from secondary sources. Students compare observed and expected frequencies of events, including those where outcomes of trials are generated with the use of digital technology. They specify, list and communicate probabilities of events using simple ratios, fractions, decimals and percentages. | **Statistics and Probability**  Students identify issues involving the collection of discrete and continuous data from primary and secondary sources. They construct stem-and-leaf plots and dot-plots. Students identify or calculate mean, mode, median and range for data sets, using digital technology for larger data sets. They describe the relationship between the median and mean in data displays. Students determine the sample space for simple experiments with equally likely outcomes, and assign probabilities outcomes. | **Statistics and Probability**  Students explain issues related to the collection of sample data and discuss the effect of outliers on means and medians of the data. They use various approaches, including the use of digital technology, to generate simple random samples from a population. Students model situations with Venn diagrams and two-way tables and explain the use of 'not', 'and' and 'or'. Students choose appropriate language to describe events and experiments. They determine complementary events and calculate the sum of probabilities. |

Learning in Mathematics

The proficiencies of Understanding, Fluency, Problem Solving and Reasoning are fundamental to learning mathematics and working mathematically, and are applied across all three strands Number and Algebra, Measurement and Geometry, and Statistics and Probability.

Understanding refers to students building a robust knowledge of adaptable and transferable mathematical concepts and structures. Students make connections between related concepts and progressively apply the familiar to develop new ideas. They develop an understanding of the relationship between the ‘why’ and the ‘how’ of mathematics. Students build understanding when they:

* connect related ideas
* represent concepts in different ways
* identify commonalities and differences between aspects of content
* describe their thinking mathematically
* interpret mathematical information.

Fluency describes students developing skills in choosing appropriate procedures, carrying out procedures flexibly, accurately, efficiently and appropriately, and recalling factual knowledge and concepts readily. Students are fluent when they:

* make reasonable estimates
* calculate answers efficiently
* recognise robust ways of answering questions
* choose appropriate methods and approximations
* recall definitions and regularly use facts,
* can manipulate expressions and equations to find solutions.

Problem solving is the ability of students to make choices, interpret, formulate, model and investigate problem situations, select and use technological functions and communicate solutions effectively. Students pose and solve problems when they:

* use mathematics to represent unfamiliar or meaningful situations
* design investigations and plan their approaches
* apply their existing strategies to seek solutions
* verify that their answers are reasonable.

Reasoning refers to students developing an increasingly sophisticated capacity for logical, statistical and probabilistic thinking and actions, such as conjecturing, hypothesising, analysing, proving, evaluating, explaining, inferring, justifying, refuting, abstracting and generalising. Students are reasoning mathematically when they:

* explain their thinking
* deduce and justify strategies used and conclusions reached
* adapt the known to the unknown
* transfer learning from one context to another
* prove that something is true or false
* make inferences about data or the likelihood of events
* compare and contrast related ideas and explain their choices.

Year 7 Semester 1



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| Topic 7.1.1 Surveys and displaying data | | |
| Strand:  Statistics and Probability | Sub-strand:  Data representation and interpretation | Recommended teaching time:  2 weeks (approx. 6 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content descriptions** | | |
| * Construct and compare a range of data displays including stem-and-leaf plots and dot plots [(VCMSP269)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMSP269). | | |
| **Achievement standard (excerpt in bold)** | | |
| Level 6 | Level 7 | Level 8 |
| Students interpret and compare a variety of data displays, including displays for two categorical variables. They analyse and evaluate data from secondary sources. Students compare observed and expected frequencies of events, including those where outcomes of trials are generated with the use of digital technology. They specify, list and communicate probabilities of events using simple ratios, fractions, decimals and percentages. | **Students identify issues involving the collection of discrete and continuous data from primary and secondary sources.** They construct stem-and-leaf plots and dot-plots. Students identify or calculate mean, mode, median and range for data sets, using digital technology for larger data sets. They describe the relationship between the median and mean in data displays. Students determine the sample space for simple experiments with equally likely outcomes, and assign probabilities outcomes. | Students explain issues related to the collection of sample data and discuss the effect of outliers on means and medians of the data. They use various approaches, including the use of digital technology, to generate simple random samples from a population. Students model situations with Venn diagrams and two-way tables and explain the use of 'not', 'and' and 'or'. Students choose appropriate language to describe events and experiments. They determine complementary events and calculate the sum of probabilities. |

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| **Activities** | **Proficiencies** |
| * Simple survey(s) involving categorical data that is nominal data, for example, eye colour, ordinal data or preferences of class members. Deciding what data is required to answer specific questions, planning ways to collect, organise and display data, presentation of findings, summary statement. * Use an online [survey process tool](https://www.scootle.edu.au/ec/search?accContentId=ACMSP169&learningarea=%22Mathematics%22&userlevel=%287%29&from=6820238477dc13d4f6d49c5b84a9ce4afcd9fa6bbd6b85439e2b53701dfc4e0baa6c9ad39406fe7fcef6117e61797e6bc192f477a2104d94) on Scootle (e.g. Healthy Life Survey or Skateboard Survey). * Univariate data to be presented in graphical forms by hand and through use of technology. * Use spreadsheets or [data graphers](http://illuminations.nctm.org/Activity.aspx?id=4091) to enter data and create appropriate displays of the data (e.g. NCTM Illuminations). * Critique categorical statistics that are presented in advertisements, newspapers and the like. * Review of equivalent common fractions, decimals and percentages, including familiarity with special cases  (e.g. ), through expressing survey results as fractions and percentages (e.g. the percentage and fraction of circle occupied by particular sectors of a pie chart). * Use interactive fraction model tools (e.g. [NCTM Illuminations](http://illuminations.nctm.org/ActivityDetail.aspx?ID=11) and [NLVM](http://nlvm.usu.edu/en/nav/category_g_3_t_1.html)). | * **Understanding** through identifying appropriate ways of displaying particular sets of data. * **Fluency** through accurately creating data displays and calculating survey results and pie graph sectors as fractions and percentages. * **Problem solving** through carrying out and making appropriate choices in the survey investigation, and communicating the results using the language and conventions of statistics. * **Reasoning** through interpreting and critically appraising data displays. |

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| **Considering different levels** |
| Level 6  Students who are working at this level could:   * discuss the interpretation of secondary data obtained from digital and other media.   Level 8  Students who are working at this level could:   * explore the practicality of obtaining data from primary sources through observation or sampling, or from secondary sources, and the strengths and limitations of obtaining data in these ways. |

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| **Assessment ideas** |
| Students:   * carry out a survey investigation * formulate questions that can be addressed with data * collect, organise, and display relevant data * interpret and evaluate the displays to answer the questions. |

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| **Resources** |
| ABS  [Census at school](http://www.abs.gov.au/censusatschool) (see classroom activities and resources section)  [Categorical data activity](http://www.abs.gov.au/websitedbs/CaSHome.nsf/Home/CaSQ+3C+CATEGORICAL+DATA:+WHAT'S+THE+DIFFERENCE+BETWEEN+NOMINAL+AND+ORDINAL)  AMSI  [Data investigation and interpretation](http://www.amsi.org.au/teacher_modules/Data_Investigation_and_interpretation7.html)  NCTM Illuminations  [Data graphers](http://illuminations.nctm.org/Activity.aspx?id=4091)  [Fraction models](http://illuminations.nctm.org/ActivityDetail.aspx?ID=11)  FUSE: Discover resources aligned to the Victorian Curriculum  [Construct and compare a range of data displays including stem-and-leaf plots and dot plots](http://fuse.education.vic.gov.au/VCAA/VCMSP269) |

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| **Notes** |
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| Topic 7.1.2 Whole numbers, factors and multiples | | |
| Strand:  Number and Algebra | Sub-strands:  Number and place value  Patterns and algebra | Recommended teaching time:  3 weeks (approx. 9 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content descriptions** | | |
| * Investigate index notation and represent whole numbers as products of powers of prime numbers [(VCMNA238)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA238). * Investigate and use square roots of perfect square numbers [(VCMNA239)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA239).Apply the associative, commutative and distributive laws to aid mental and written computation and make estimates for these computations [(VCMNA240)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA240). * Compare, order, add and subtract integers [(VCMNA241)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA241) * Design and implement mathematical algorithms using a simple general purpose programming language [(VCMNA254)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA254) | | |
| **Achievement standard (excerpt in bold)** | | |
| Level 6 | Level 7 | Level 8 |
| Students recognise the properties of prime, composite, square and triangular numbers and determine sets of these numbers. They solve problems that involve all four operations with whole numbers and describe the use of integers in everyday contexts. Students locate fractions and integers on a number line and connect fractions, decimals and percentages as different representations of the same number. They solve problems involving the addition and subtraction of related fractions. Students calculate a simple fraction of a quantity and calculate common percentage discounts on sale items, with and without the use of digital technology. They make connections between the powers of 10 and the multiplication and division of decimals. Students add, subtract and multiply decimals and divide decimals where the result is rational. Students write number sentences using brackets and order of operations, and specify rules used to generate sequences involving whole numbers, fractions and decimals. They use ordered pairs of integers to represent coordinates of points and locate a point in any one of the four quadrants on the Cartesian plane. | Students solve problems involving the order, addition and subtraction of integers. **They make the connections between whole numbers and index notation and the relationship between perfect squares and square roots.** They solve problems involving all four operations with fractions, decimals, percentages and their equivalences, and express fractions in their simplest form. Students compare the cost of items to make financial decisions, with and without the use of digital technology. **They make simple estimates to judge the reasonableness of results.** Students use variables to represent arbitrary numbers and connect the laws and properties of number to algebra and substitute numbers into algebraic expressions. They assign ordered pairs to given points on the Cartesian plane and interpret and analyse graphs of relations from real data. Students develop simple linear models for situations, make predictions based on these models, solve related equations and check their solutions. | Students use efficient mental and written strategies to make estimates and carry out the four operations with integers, and apply the index laws to whole numbers. They identify and describe rational and irrational numbers in context. Students estimate answers and solve everyday problems involving profit and loss rates, ratios and percentages, with and without the use of digital technology. They simplify a variety of algebraic expressions and connect expansion and factorisation of linear expressions. Students solve linear equations and graph linear relationships on the Cartesian plane. |

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| **Activities** | **Proficiencies** |
| * Review of whole number place value. * Order of operations. * Mental computation and estimation strategies for the four arithmetic operations, including using the commutative, associative and distributive properties, and other techniques, such as the empty number line method. * Operations with natural numbers using a variety of methods including mental, ‘by hand’ and calculator; estimating and checking the reasonableness of the solution. * Index notation and prime factors. Use factor trees and the like to find the prime factors of composite numbers. * Express the composite numbers as products of powers of prime factors. * Find prime numbers, prime factors and common factors using, for example, NLVM’s Sieve of Eratosthenes and Factor tree virtual manipulatives and NCTM’s Factor game lesson and learning object. * Algorithms and coding activities: * Write a program to explore the Goldbach Conjecture: whether every even number greater than 2 can be expressed as the sum of two primes. The activity ‘[Goldbach Conjecture](https://education.ti.com/en-au/australiancurriculumnspired/aus-nz/year-7/stem)’ can be adapted to the desired programming language or device. * Using the primality test of technology, write a program that uses a loop structure to find all prime numbers in a given range. The activity ‘[Finding Primes](https://education.ti.com/en-au/australiancurriculumnspired/aus-nz/year-7/stem)’ can be adapted to the desired programming language or device. Alternatively, unpick the logic of a supplied program in a selected programming language and modify the program in some way.  |  | | --- | |  | |  | | * **Understanding** through the use of estimation strategies to check the reasonableness of the results of arithmetic calculations performed by calculator, mental or ‘by hand’ methods. * **Fluency** through the successful use of a variety of efficient mental computation strategies for arithmetic calculations. * **Problem solving** through the use of highest common factor and lowest common multiple to solve problems and carry out investigations, including writing and coding algorithms. * **Reasoning** through explaining and justifying their computational and estimation strategies, and through designing and testing algorithms and programs. |

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| **Considering different levels** |
| Level 6  Students who are working at this level could:   * investigate the geometric pattern of square numbers and how the next square number is obtained from the current square number.   Level 8  Students who are working at this level could:   * investigate the distribution of prime numbers among the natural numbers, and the identification of large prime numbers. |

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| **Assessment ideas** |
| * Students respond to a set of multiple-choice items involving whole number computation that require them to use estimation to select and justify which option is closest to the actual answer. * Students carry out an investigation, such as the NCTM [paper pool](http://illuminations.nctm.org/unit.aspx?id=6042) activity, where they apply ideas of highest common factor and lowest common multiple to solve a problem. |

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| **Resources** |
| AMSI  [Mental computation](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_1c.html)  [Multiples, factors and powers](http://www.amsi.org.au/teacher_modules/Multiples_factors_and_powers.html)  [Primes and prime factorisation](http://www.amsi.org.au/teacher_modules/Primes_and_Prime_Factorisation.html)  NCTM Illuminations  [Factor game lesson and learning object](http://illuminations.nctm.org/LessonDetail.aspx?ID=L620)  Paper pool investigation  Australian Curriculum Nspired  [Counting Factors](https://education.ti.com/en-au/australiancurriculumnspired/aus-nz/year-7/stem)  [Finding Primes](https://education.ti.com/en-au/australiancurriculumnspired/aus-nz/year-7/stem)  FUSE: Discover resources aligned to the Victorian Curriculum  [Investigate index notation and represent whole numbers as products of powers of prime numbers](http://fuse.education.vic.gov.au/VCAA/VCMNA238)  [Investigate and use square roots of perfect square numbers](http://fuse.education.vic.gov.au/VCAA/VCMNA239)  [Compare, order, add and subtract integers](http://fuse.education.vic.gov.au/VCAA/VCMNA241) |

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| Topic 7.1.3 Angles, lines and shapes | | |
| Strand:  Measurement and Geometry | Sub-strand:  Geometric reasoning | Recommended teaching time:  3 weeks (approx. 9 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content descriptions** | | |
| * Identify corresponding, alternate and co-interior angles when two straight lines are crossed by a transversal [(VCMMG264)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG264). * Investigate conditions for two lines to be parallel and solve simple numerical problems using reasoning [(VCMMG265)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG265). * Demonstrate that the angle sum of a triangle is 180° and use this to find the angle sum of a quadrilateral [(VCMMG263)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG263). * Classify triangles according to their side and angle properties and describe quadrilaterals [[(VCMMG262)](http://ausvels.vcaa.vic.edu.au/Mathematics/Curriculum/F-10)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG262). | | |
| **Achievement standard (excerpt in bold)** | | |
| Level 6 | Level 7 | Level 8 |
| Students relate decimals to the metric system and choose appropriate units of measurement to perform a calculation. They solve problems involving length and area, and make connections between capacity and volume. Students interpret a variety of everyday timetables. They solve problems using the properties of angles and investigate simple combinations of transformations in the plane, with and without the use of digital technology. Students construct simple prisms and pyramids. | Students use formulas for the area and perimeter of rectangles. **They classify triangles and quadrilaterals** and represent transformations of these shapes on the Cartesian plane, with and without the use of digital technology. **Students name the types of angles formed by a transversal crossing parallel lines and solve simple numerical problems involving these lines and angles.** They describe different views of three-dimensional objects, and use models, sketches and digital technology to represent these views. Students calculate volumes of rectangular prisms. | Students convert between units of measurement for area and for volume. They find the perimeter and area of parallelograms, rhombuses and kites. Students name the features of circles, calculate circumference and area, and solve problems relating to the volume of prisms. They make sense of time duration in real applications, including the use of 24-hour time. Students identify conditions for the congruence of triangles and deduce the properties of quadrilaterals. They use tools, including digital technology, to construct congruent shapes. |

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| **Activities** | **Proficiencies** |
| * Geometric constructions, such as those in AMSI’s [Construction](http://www.amsi.org.au/teacher_modules/Construction.html), using compass and ruler, and using dynamic geometry software, such as [GeoGebra](http://www.geogebra.org/cms/en/). * Making and measuring angles to within 2 degrees of a specified size. * Estimating the size of angle (e.g. NRICH’s [estimating angles](http://nrich.maths.org/1235) games). * Angles at a point and vertically opposite, supplementary and complimentary angles. * Identifying parallel and perpendicular line and planes (in 2 and 3 dimensions). * Parallel lines and transversals. * Problems involving corresponding, alternate, co-interior, vertically opposite and supplementary angles. * Investigate the angle sum of triangles and quadrilaterals using a variety of methods, including the use of dynamic geometry software. * Classify triangles by angle and side properties. * Hierarchy of triangles and the relationship between properties (e.g. every equilateral triangle is isosceles). * Classify and describe quadrilaterals. * Hierarchy of simple quadrilaterals and the relationship between properties (e.g. every square is a rectangle and a rhombus). * Other polygons, for example tessellating regular hexagons into honeycomb patterns, using dynamic geometry software. * Investigating interior and exterior angles of polygons using dynamic geometry software. | * **Understanding** through the ability to see how geometric properties are related and how some properties are dependent on others. * **Fluency** through choosing and accurately applying appropriate angle properties (supplementary, co-interior etc.) to solve geometric problems. * **Problem solving** through using knowledge of angle properties to solve problems and justify their solution method (e.g. because the angles are vertically opposite). * **Reasoning** through the ability to demonstrate if-then deductive thinking (e.g. *if* it is a right-angled triangle *then* it is scalene or isosceles, but not equilateral). |

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| **Considering different levels** |
| Level 6  Students who are working at this level could:   * use technology to investigate how quadrilaterals can be constructed from connecting triangles.   Level 8  Students who are working at this level could:   * investigate classifying quadrilaterals according to relations between their diagonals with the assistance of dynamic geometry technology. |

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| **Assessment ideas** |
| * Students respond to a set of numerical geometry problems and justify their solution method (e.g. the angles are equal because they are corresponding). * Students formulate and plan geometric constructions using compass and ruler methods and dynamic geometry software. |

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| **Resources** |
| AMSI  [Introduction to plane geometry](http://www.amsi.org.au/teacher_modules/introduction_to_plane_geometry.html)  [Construction](http://www.amsi.org.au/teacher_modules/Construction.html)  [Geometric reasoning](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_2c.html)  [Geometry professional learning handout](http://calculate.org.au/wp-content/uploads/sites/15/2014/02/GeometryPD-20151.pdf) (PDF)  CIMT  [*Geometric Explorations with Dynamic Geometry: International Journal for Mathematics Teaching and Learning*](http://www.cimt.org.uk/journal/olkun.pdf)(PDF).  NCTM Illuminations  [Sorting polygons](http://illuminations.nctm.org/Lesson.aspx?id=1072)  [Angle sums](http://illuminations.nctm.org/Activity.aspx?id=3546) |

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| Topic 7.1.4 Length and area | | |
| Strand:  Measurement and Geometry | Sub-strand:  Using units of measurement | Recommended teaching time:  3 weeks (approx. 9 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content descriptions** | | |
| * Establish the formulas for areas of rectangles, triangles and parallelograms and use these in problem solving [(VCMMG258)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG258). | | |
| **Achievement standard (excerpt in bold)** | | |
| Level 6 | Level 7 | Level 8 |
| Students relate decimals to the metric system and choose appropriate units of measurement to perform a calculation. They solve problems involving length and area, and make connections between capacity and volume. Students interpret a variety of everyday timetables. They solve problems using the properties of angles and investigate simple combinations of transformations in the plane, with and without the use of digital technology. Students construct simple prisms and pyramids. | **Students use formulas for the area and perimeter of rectangles.** They classify triangles and quadrilaterals and represent transformations of these shapes on the Cartesian plane, with and without the use of digital technology. Students name the types of angles formed by a transversal crossing parallel lines and solve simple numerical problems involving these lines and angles. They describe different views of three-dimensional objects, and use models, sketches and digital technology to represent these views. Students calculate volumes of rectangular prisms. | Students convert between units of measurement for area and for volume. They find the perimeter and area of parallelograms, rhombuses and kites. Students name the features of circles, calculate circumference and area, and solve problems relating to the volume of prisms. They make sense of time duration in real applications, including the use of 24-hour time. Students identify conditions for the congruence of triangles and deduce the properties of quadrilaterals. They use tools, including digital technology, to construct congruent shapes. |

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| **Activities** | **Proficiencies** |
| * Metric units of length: common prefixes, conversions (e.g. cm into m, mm into m). * Using a variety of methods and tools to estimate and measure a wide range of lengths, heights and distances (indoors and outdoors). * Choosing appropriate instruments and units for making measurements and appropriate methods for recording them (e.g. length of a table, height of a hill). * Choosing levels of accuracy according to context. * Perimeters of rectangles and shapes based on rectangles. * Metric units of area derived from common units of length (noting that 100cm = 1m but 100cm2 ≠ 1m2). * Areas of rectangles and shapes based on rectangles, including right-angled triangles: calculation and estimation (indoors and outdoors). * Investigate perimeters of rectangles of constant area and the areas of rectangles of constant perimeter. * Use a variety of methods, including dynamic geometry software, to establish area formulas for parallelograms and triangles using the concept of conservation of area (non-rectangular parallelograms and triangles can be rearranged into rectangles of dimensions  and, respectively). * Using perimeter and area concepts to solve problems (e.g. the cost of fencing and paving around a rectangular-shaped swimming pool). * Checking reasonableness of answers, and appropriateness of degree of accuracy of answers. | * **Understanding** through the ability to see how area formulas are connected by the concept of conservation of area. * **Fluency** through choosing and accurately applying appropriate procedures to find areas of regular, irregular and composite shapes. * **Problem solving** through using area and perimeter concepts flexibly to solve non-routine problems. * **Reasoning** through the ability to evaluate the reasonableness of answers, and appropriateness of degree of accuracy of answers. |

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| **Considering different levels** |
| Level 6  Students who are working at this level could:   * use personal benchmarks for frequently used units to help them increase their accuracy in estimating measurements and increase familiarity with those units.   Level 8  Students who are working at this level could:   * use dynamic geometry software to explore perimeters of shapes of constant area and the areas of shapes of constant perimeter, for some shapes other than rectangles. |

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| **Assessment ideas** |
| * Students carry out an investigation of the perimeters of rectangles of fixed area (e.g. rectangles made from 36 congruent square tiles), and the areas of rectangles of fixed perimeter (e.g. rectangles formed by a loop of 40 cm of string on a geoboard that has a 1cm grid pattern). * Students respond to a set of questions that require them to calculate perimeters and areas to solve problems (e.g. the cost of fencing and paving around a rectangular-shaped swimming pool). |

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| **Resources** |
| AMSI  [Introduction to measurement](http://www.amsi.org.au/teacher_modules/introduction_to_measurement.html)  [Measurement Professional learning handout](http://calculate.org.au/wp-content/uploads/sites/15/2014/02/Measurement-Length-Area-Volume.pdf) (PDF)  NCTM Illuminations  [Finding the area of parallelograms](http://illuminations.nctm.org/Lesson.aspx?id=1882)  [Discovering the area formula for triangles](http://illuminations.nctm.org/Lesson.aspx?id=1874)  [Finding the area of irregular figures](http://illuminations.nctm.org/Lesson.aspx?id=1902)  NLVM  (Note: Some web browsers may not support the NLVM Java plug-in. An off-line NLVM app is available for download)  [Geoboard activities: area and perimeter explorations](http://nlvm.usu.edu/en/nav/frames_asid_282_g_3_t_3.html?open=activities&from=category_g_3_t_3.html)  FUSE: Discover resources aligned to the Victorian Curriculum  [Establish the formulas for areas of rectangles, triangles and parallelograms and use these in problem solving](http://fuse.education.vic.gov.au/VCAA/VCMMG258) |

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| Topic 7.1.5 Number puzzles and patterns | | |
| Strand:  Number and Algebra | Sub-strand:  Patterns and algebra | Recommended teaching time:  2 weeks (approx. 6 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content descriptions** | | |
| * Introduce the concept of variables as a way of representing numbers using letters [(VCMNA251)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA251) * Design and implement mathematical algorithms using a simple general purpose programming language [(VCMNA254)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA254) | | |
| **Achievement standard (excerpt in bold)** | | |
| Level 6 | Level 7 | Level 8 |
| Students recognise the properties of prime, composite, square and triangular numbers and determine sets of these numbers. They solve problems that involve all four operations with whole numbers and describe the use of integers in everyday contexts. Students locate fractions and integers on a number line and connect fractions, decimals and percentages as different representations of the same number. They solve problems involving the addition and subtraction of related fractions. Students calculate a simple fraction of a quantity and calculate common percentage discounts on sale items, with and without the use of digital technology. They make connections between the powers of 10 and the multiplication and division of decimals. Students add, subtract and multiply decimals and divide decimals where the result is rational. Students write number sentences using brackets and order of operations, and specify rules used to generate sequences involving whole numbers, fractions and decimals. They use ordered pairs of integers to represent coordinates of points and locate a point in any one of the four quadrants on the Cartesian plane. | Students solve problems involving the order, addition and subtraction of integers. They make the connections between whole numbers and index notation and the relationship between perfect squares and square roots. They solve problems involving all four operations with fractions, decimals, percentages and their equivalences, and express fractions in their simplest form. Students compare the cost of items to make financial decisions, with and without the use of digital technology. They make simple estimates to judge the reasonableness of results. **Students use variables to represent arbitrary numbers** and connect the laws and properties of number to algebra and substitute numbers into algebraic expressions. They assign ordered pairs to given points on the Cartesian plane and interpret and analyse graphs of relations from real data. Students develop simple linear models for situations, make predictions based on these models, solve related equations and check their solutions. | Students use efficient mental and written strategies to make estimates and carry out the four operations with integers, and apply the index laws to whole numbers. They identify and describe rational and irrational numbers in context. Students estimate answers and solve everyday problems involving profit and loss rates, ratios and percentages, with and without the use of digital technology. They simplify a variety of algebraic expressions and connect expansion and factorisation of linear expressions. Students solve linear equations and graph linear relationships on the Cartesian plane. |

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| **Activities** | **Proficiencies** |
| * Generating patterns, given rules (in words). * Using technology (e.g. calculator or computer spreadsheet) to generate sequences, given rules in words. * Writing instructions to generate invented sequences, using words, diagrams (e.g. flowcharts) or computer applications. * Exploring classical number puzzles, including developing and coding appropriate algorithms for selected problems. Examples of possible number puzzles to explore: * [Supreme court handshake](http://illuminations.nctm.org/LessonDetail.aspx?ID=L630) or [mystic rose](http://nrich.maths.org/6703) puzzle * [Triangular numbers](http://illuminations.nctm.org/LessonDetail.aspx?ID=L631) puzzle and square numbers as the sum of consecutive triangular numbers * [Tower of Hanoi](http://illuminations.nctm.org/ActivityDetail.aspx?id=40) puzzle (predict the number of moves for towers of 4, 5 and 6 disks) * [Chairs around the table](http://illuminations.nctm.org/LessonDetail.aspx?ID=L627) puzzle * Algorithms and coding activities could be drawn from: * Use a loop structures to develop an algorithm to generate the first 10 triangular numbers by continued summation of the natural numbers (1 + 2 = 3, 1 + 2 + 3 = 6, etc.). Code and test the algorithm. Modify so that the program requests the value of *n* to generate the first *n* triangular numbers. Extension: modify and test the code to also find sums of consecutive triangular numbers. * Write a program to automatically count the quantity of factors for a selected number. The activity ‘[Counting Factors](https://education.ti.com/en-au/australiancurriculumnspired/aus-nz/year-7/stem)’ can be adapted to the desired programming language or device. Alternatively, unpick the logic of a supplied program and modify the program in some way | * **Understanding** through multiple representations of patterns, such as a description in words, a list or table of values and diagrams. * **Fluency** through efficiently using spreadsheets to generate sequences from given rules in words. * **Problem solving** through formulating a systematic approach to find patterns and coding and testing algorithms. * **Reasoning** through describing the rule in words, generalising patterns, designing algorithms and explaining and justifying predictions. |

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| **Considering different levels** |
| Level 6  Students who are working at this level could:   * explore simpler growing patterns and use simple one-step-to-the-next recursion to predict later iterations of a pattern.   Level 8  Students who are working at this level could:   * move from observing step-to-step recursion in patterns to observing simple functional relationships to predict, say, the 20th iteration of a pattern. They could check their predictions by inputting and filling down simple recursive formulas using technology. |

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| **Assessment ideas** |
| * Students investigate several classical number puzzles and describe and justify the patterns found, the predictions made, and how the predictions were tested. |

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| **Resources** |
| AMSI  [Introduction to algebra](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_1a.html)  Australian Curriculum Nspired  [Counting Factors](https://education.ti.com/en-au/australiancurriculumnspired/aus-nz/year-7/stem)  NCTM Illuminations  [Supreme court handshake](http://illuminations.nctm.org/LessonDetail.aspx?ID=L630)  [Triangular numbers](http://illuminations.nctm.org/LessonDetail.aspx?ID=L631)  [Tower of Hanoi](http://illuminations.nctm.org/ActivityDetail.aspx?id=40)  [Chairs around the table](http://illuminations.nctm.org/LessonDetail.aspx?ID=L627)  FUSE: Discover resources aligned to the Victorian Curriculum  [Introduce the concept of variables as a way of representing numbers using letters](http://fuse.education.vic.gov.au/VCAA/VCMNA251) |

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| Topic 7.1.6 Integers, fractions and number lines | | |
| Strand:  Number and Algebra | Sub-strand:  Number and place value | Recommended teaching time:  2 weeks (approx. 6 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content descriptions** | | |
| Number and place value   * Investigate and use square roots of perfect square numbers [(VCMNA239)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA239). * Compare, order, add and subtract integers [(VCMNA241)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA241).   Real numbers   * Compare fractions using equivalence. Locate and represent positive and negative fractions and mixed numbers on a number line [(VCMNA242)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA242). | | |
| **Achievement standard (excerpt in bold)** | | |
| Level 6 | Level 7 | Level 8 |
| Students recognise the properties of prime, composite, square and triangular numbers and determine sets of these numbers. They solve problems that involve all four operations with whole numbers and describe the use of integers in everyday contexts. Students locate fractions and integers on a number line and connect fractions, decimals and percentages as different representations of the same number. They solve problems involving the addition and subtraction of related fractions. Students calculate a simple fraction of a quantity and calculate common percentage discounts on sale items, with and without the use of digital technology. They make connections between the powers of 10 and the multiplication and division of decimals. Students add, subtract and multiply decimals and divide decimals where the result is rational. Students write number sentences using brackets and order of operations, and specify rules used to generate sequences involving whole numbers, fractions and decimals. They use ordered pairs of integers to represent coordinates of points and locate a point in any one of the four quadrants on the Cartesian plane. | **Students solve problems involving the order, addition and subtraction of integers. They make the connections between whole numbers and index notation and the relationship between perfect squares and square roots. They** solve problems involving all four operations with fractions, decimals, percentages and their equivalences, and **express fractions in their simplest form.** Students compare the cost of items to make financial decisions, with and without the use of digital technology. They make simple estimates to judge the reasonableness of results. Students use variables to represent arbitrary numbers and connect the laws and properties of number to algebra and substitute numbers into algebraic expressions. They assign ordered pairs to given points on the Cartesian plane and interpret and analyse graphs of relations from real data. Students develop simple linear models for situations, make predictions based on these models, solve related equations and check their solutions. | Students use efficient mental and written strategies to make estimates and carry out the four operations with integers, and apply the index laws to whole numbers. They identify and describe rational and irrational numbers in context. Students estimate answers and solve everyday problems involving profit and loss rates, ratios and percentages, with and without the use of digital technology. They simplify a variety of algebraic expressions and connect expansion and factorisation of linear expressions. Students solve linear equations and graph linear relationships on the Cartesian plane. |

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| **Activities** | **Proficiencies** |
| * Square numbers and square roots of perfect square. * Estimation of the position on a number line of square roots of non-perfect squares (for example, lies between 3 and 4 because ). * Order integers and represent integers on a number line. * Add and subtract integers, with and without modelling these operations on a number line, as described in the AMSI’s [the Integers](http://amsi.org.au/teacher_modules/Integer.html). * Represent common proper and improper fractions and mixed numbers on a number line. * Model equivalent fractions on a number line, as described in AMSI’s [equivalent fractions and the use of the number line](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_1d.html) * Represent decimal fractions on a number line and use number line to compare decimals, as described in AMSI’s [decimals and percentages](http://www.amsi.org.au/teacher_modules/decimals_and_percentages.html#Comparing_decimals). | * **Understanding** through modelling addition and subtraction of integers and fractions on a number line. * **Fluency** through accurately locating positive and negative integers and fractions on a line and by estimating the position on a number line of the square root of non-perfect squares. * **Problem solving** through making appropriate choice of strategies to model operations on integers and fractions. * **Reasoning** through the ability to explain and justify strategies and judge the reasonableness of the result. |

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| **Considering different levels** |
| Level 6  Students who are working at this level could:   * use a fraction model, such as an area model, with concrete materials or virtual manipulatives, to assist in identifying more complex equivalent fractions and developing a robust equivalent fractions algorithm.   Level 8  Students who are working at this level could:   * use a range of strategies to solve challenging magic square puzzles involving integers, such as filling each of the integers −15, −12, −9, −6, −3, 0, 3, 6 and 9 in a 3×3 grid so that every row, column and diagonal has the same sum. |

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| **Assessment ideas** |
| * Students respond to problems that require them to locate common and decimal fractions and square roots of non-perfect squares on number lines. |

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| **Resources** |
| AMSI  [The](https://www.scootle.edu.au/ec/search?accContentId=ACMNA133&learningarea=%22Mathematics%22&userlevel=%286%29&from=6820238477dc13d4f6d49c5b84a9ce4afcd9fa6bbd6b85439e2b53701dfc4e0baa6c9ad39406fe7fcef6117e61797e6bc192f477a2104d94) [Integers](http://amsi.org.au/teacher_modules/Integer.html)  [Equivalent fractions and the use of the number line](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_1d.html)  [Decimals and percentages](http://www.amsi.org.au/teacher_modules/decimals_and_percentages.html#Comparing_decimals)  NCTM Illuminations  [In search of perfect squares](http://illuminations.nctm.org/LessonDetail.aspx?ID=L832)  [Fraction game](http://illuminations.nctm.org/ActivityDetail.aspx?ID=18)  [Fractional clothesline](http://illuminations.nctm.org/LessonDetail.aspx?id=L784)  NLVM  (Note: Some web browsers may not support the NLVM Java plug-in. An off-line NLVM app is available for download)  [Colour chips subtraction](http://nlvm.usu.edu/en/nav/frames_asid_162_g_3_t_1.html?from=category_g_3_t_1.html)  [Circle zero](http://nlvm.usu.edu/en/nav/frames_asid_122_g_3_t_1.html?open=instructions&from=category_g_3_t_1.html)  [Diffy](http://nlvm.usu.edu/en/nav/frames_asid_326_g_3_t_1.html?from=category_g_3_t_1.html)  [Number line bounce](http://nlvm.usu.edu/en/nav/frames_asid_107_g_3_t_1.html?from=category_g_3_t_1.html)  FUSE: Discover resources aligned to the Victorian Curriculum  [Investigate and use square roots of perfect square numbers](http://fuse.education.vic.gov.au/VCAA/VCMNA239)  [Compare, order, add and subtract integers](http://fuse.education.vic.gov.au/VCAA/VCMNA241)  [Compare fractions using equivalence. Locate and represent positive and negative fractions and mixed numbers on a number line](http://fuse.education.vic.gov.au/VCAA/VCMNA242) |

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| Topic 7.1.7 Probability and proportion | | |
| Strand:  Statistics and Probability | Sub-strand:  Chance | Recommended teaching time:  3 weeks (approx. 9 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content descriptions** | | |
| * Construct sample spaces for single-step experiments with equally likely outcomes [(VCMSP266)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMSP266). * Assign probabilities to the outcomes of events and determine probabilities for events [(VCMSP267)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMSP267). | | |
| **Achievement standard (excerpt in bold)** | | |
| Level 6 | Level 7 | Level 8 |
| Students interpret and compare a variety of data displays, including displays for two categorical variables. They analyse and evaluate data from secondary sources. Students compare observed and expected frequencies of events, including those where outcomes of trials are generated with the use of digital technology. They specify, list and communicate probabilities of events using simple ratios, fractions, decimals and percentages. | Students identify issues involving the collection of discrete and continuous data from primary and secondary sources. They construct stem-and-leaf plots and dot-plots. Students identify or calculate mean, mode, median and range for data sets, using digital technology for larger data sets. They describe the relationship between the median and mean in data displays. **Students determine the sample space for simple experiments with equally likely outcomes, and assign probabilities outcomes.** | Students explain issues related to the collection of sample data and discuss the effect of outliers on means and medians of the data. They use various approaches, including the use of digital technology, to generate simple random samples from a population. Students model situations with Venn diagrams and two-way tables and explain the use of 'not', 'and' and 'or'. Students choose appropriate language to describe events and experiments. They determine complementary events and calculate the sum of probabilities. |

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| **Activities** | **Proficiencies** |
| * Ratios and proportions expressed as common and decimal fractions, and as percentages; using and interpreting symbolic expressions of numerical concepts. * Determining proportions from data provided in tables or databases or displayed graphically. Using percentages to compare two data sets involving different populations. * Describing probabilities of events on a continuum from 0 (impossible) to 1 (certain). * Single step experiments; listing equally likely outcomes. * Distinguishing between equally likely outcomes and outcomes that are not equally likely. * Examining outcomes of simple experiments to determine relative probabilities. * Determining theoretical probabilities (in fraction form) of simple events involving dice and spinners. * Designing simple random devices to give specified probabilities (e.g. [NCTM adjustable spinner](http://illuminations.nctm.org/ActivityDetail.aspx?ID=79)). * Determining how a larger sample size affects approximations of theoretical probability in long run probability experiments. * Using long-run proportion to estimate probabilities (e.g. the probability that a drawing pin, [bottle top](http://www.nzmaths.co.nz/resource/top-drop) or paper cup will land ‘pointing up’ when dropped). * Comparing experimental and theoretical probabilities; testing probabilities by trialing and observing how a larger sample size or number of trials affects the approximation of the theoretical probability. * Using simulation of a real-world event to settle an argument, such as: ‘What is the probability that a three-child family contains exactly two girls?’ or the [birth month paradox](http://www.abs.gov.au/websitedbs/CaSHome.nsf/Home/CaSQ+9C+BIRTH+MONTH+PARADOX+IWB). | * **Understanding** through calculating probabilities from sample spaces and estimating probabilities from relative frequencies in simple experiments. * **Fluency** through accurately describing chance events and finding theoretical probabilities of chance events from their sample space. * **Problem solving** through planning a simulation to model a real-world situation, and communicating the results of the simulation. * **Reasoning** through interpreting and evaluating the results of a chance experiment, and reaching appropriate conclusions about the situation being modelled. |

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| **Considering different levels** |
| Level 6  Students who are working at this level could:   * develop strategies to solve a range of simple practical comparison and equivalence problems to reinforce proportional reasoning. Comparison problems require two ratios to be evaluated and compared to ascertain which represents the greater amount. Equivalence problems require the finding of a missing value, such as: I played a game of chance and won 18 out of 25 times. How many times could I expect to win if I played 60 times?   Level 8  Students who are working at this level could:   * use their knowledge of probability concepts to justify the results of a simulation that they have carried out. For example, endeavouring to explain the birth month paradox in terms of the compounding nature of exponents. |

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| **Assessment ideas** |
| * Students plan and carry out a probability simulation of an authentic situation (e.g. number of girls in a three-child family, [birth month paradox](http://www.abs.gov.au/websitedbs/CaSHome.nsf/Home/CaSQ+9C+BIRTH+MONTH+PARADOX+IWB)), including a statement of the problem, assumptions made, the random device used, what a single trial consists of and the number of trials carried out. They display the data sensibly and draw appropriate conclusions. * Students respond to sets of problems requiring them to apply their knowledge of probability concepts. |

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| **Resources** |
| ABS  [Probability activities](http://www.abs.gov.au/websitedbs/CaSHome.nsf/Home/Mathematics.es)  [Census at school](http://www.abs.gov.au/censusatschool) (see classroom activities and resources section)  AMSI  [Probability](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_3a.html#intro)  [Chance](http://www.amsi.org.au/teacher_modules/Chance_year_7.html)  [Professional learning handout: Probability](http://amsi.org.au/wp-content/uploads/sites/15/2014/07/Probability-PD-2014.pdf) (PDF)  NCTM Illuminations  Stick or switch?  [Adjustable spinner](http://illuminations.nctm.org/ActivityDetail.aspx?ID=79)  FUSE: Discover resources aligned to the Victorian Curriculum  [Construct sample spaces for single-step experiments with equally likely outcomes](http://fuse.education.vic.gov.au/VCAA/VCMSP266)  [Assign probabilities to the outcomes of events and determine probabilities for events](http://fuse.education.vic.gov.au/VCAA/VCMSP267) |

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Year 7 Semester 2



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| Topic 7.2.1 Fractions | | |
| Strand:  Number and Algebra | Sub-strand:  Real numbers | Recommended teaching time:  2 weeks (approx. 6 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content descriptions** | | |
| * Solve problems involving addition and subtraction of fractions, including those with unrelated denominators [(VCMNA243)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA243). * Multiply and divide fractions and decimals using efficient written strategies and digital technologies [(VCMNA244)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA244). * Express one quantity as a fraction of another, with and without the use of digital technologies [(VCMNA244)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA244). | | |
| **Achievement standard (excerpt in bold)** | | |
| Level 6 | Level 7 | Level 8 |
| Students recognise the properties of prime, composite, square and triangular numbers and determine sets of these numbers. They solve problems that involve all four operations with whole numbers and describe the use of integers in everyday contexts. Students locate fractions and integers on a number line and connect fractions, decimals and percentages as different representations of the same number. They solve problems involving the addition and subtraction of related fractions. Students calculate a simple fraction of a quantity and calculate common percentage discounts on sale items, with and without the use of digital technology. They make connections between the powers of 10 and the multiplication and division of decimals. Students add, subtract and multiply decimals and divide decimals where the result is rational. Students write number sentences using brackets and order of operations, and specify rules used to generate sequences involving whole numbers, fractions and decimals. They use ordered pairs of integers to represent coordinates of points and locate a point in any one of the four quadrants on the Cartesian plane. | Students solve problems involving the order, addition and subtraction of integers. They make the connections between whole numbers and index notation and the relationship between perfect squares and square roots. **They solve problems involving all four operations with fractions, decimals, percentages and their equivalences, and express fractions in their simplest form.** Students compare the cost of items to make financial decisions, with and without the use of digital technology. They make simple estimates to judge the reasonableness of results. Students use variables to represent arbitrary numbers and connect the laws and properties of number to algebra and substitute numbers into algebraic expressions. They assign ordered pairs to given points on the Cartesian plane and interpret and analyse graphs of relations from real data. Students develop simple linear models for situations, make predictions based on these models, solve related equations and check their solutions. | Students use efficient mental and written strategies to make estimates and carry out the four operations with integers, and apply the index laws to whole numbers. They identify and describe rational and irrational numbers in context. Students estimate answers and solve everyday problems involving profit and loss rates, ratios and percentages, with and without the use of digital technology. They simplify a variety of algebraic expressions and connect expansion and factorisation of linear expressions. Students solve linear equations and graph linear relationships on the Cartesian plane. |

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| **Activities** | **Proficiencies** |
| * Ordering and comparing common fractions. * Developing strategies for **addition** and **subtraction** of common fractions, including those with unrelated denominators, using, for example, fraction walls, rectangular arrays and the like. * Developing a sense of magnitude of fractions (e.g. is closest to 0, 1, 2, 3 or 4?) * Developing efficient strategies for fraction **multiplication** and **division**, including the ability to draw appropriate diagrams to represent problems and their solutions (e.g. draw a picture to illustrate each of these problems and their solution: ,  (how many  fit into )). * Expressing one quantity as a fraction of another. * Solving worded application problems involving fractions. | * **Understanding** through recognising equivalent fractions and illustrating fraction problems and their solution with diagrams and number lines. * **Fluency** through accurately calculating with fractions and representing fractions in different ways. * **Problem solving** through formulating and solving application problems involving fractions. * **Reasoning** through explaining the solution method used to in solving application problems involving fractions. |

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| **Considering different levels** |
| Level 6  Students who are working at this level could:   * use concrete or virtual manipulative models of fractions to strengthen fraction concepts and help them add and subtract fractions with related and unrelated denominators (without needing to change fractions to a common denominator). From here, they could move forward to developing the standard algorithm for adding and subtracting fractions by getting a common denominator.   Level 8  Students who are working at this level could:   * use area models of fractions to develop different strategies for understanding division of fractions. For example:  means ‘how many sets of are in ?’. The problem could be restated ‘how many sets ofare in ?’. From the area model it can be seen that the answer is , leading to the common-denominator algorithm:  . They could develop efficient invented mental computation strategies for fraction multiplication to solve practical problems. |

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| **Assessment ideas** |
| Assessment of procedural fluency can include questions which also assess understanding and reasoning.  For example:   * Sense of magnitude:  is closest to 0, 1, 2, 3 or 4? * Chloe is on a walking path. When she has walked km she is onlyof the way to the end of the path. How long is the path? Explain. * Draw a picture to illustrate each of these problems and their solution:, , , , . |

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| **Resources** |
| AMSI  [Addition and subtraction of fractions](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_1e.html#intro)  [Multiplication and division of fractions](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_1f.html#intro)  [Expressing one quantity as a fraction of a second](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_1j.html)  [Fractions](http://www.amsi.org.au/teacher_modules/fractions.html)  NLVM  (Note: Some web browsers may not support the NLVM Java plug-in. An off-line NLVM app is available for download)  [Adding fractions](http://nlvm.usu.edu/en/nav/frames_asid_106_g_3_t_1.html?from=category_g_3_t_1.html)  [Rectangle multiplications of fractions](http://nlvm.usu.edu/en/nav/frames_asid_194_g_3_t_1.html?from=category_g_3_t_1.html)  NZ Maths  [Teaching Fractions, Decimals and Percentages](http://www.nzmaths.co.nz/sites/default/files/Numeracy/2008numPDFs/NumBk7.pdf) (PDF)  FUSE: Discover resources aligned to the Victorian Curriculum  [Solve problems involving addition and subtraction of fractions, including those with unrelated denominators](http://fuse.education.vic.gov.au/VCAA/VCMNA243) |

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| Topic 7.2.2 Patterns, rules and equations | | |
| Strand:  Number and Algebra | Sub-strands:  Patterns and algebra  Linear and non-linear relationships | Recommended teaching time:  2 weeks (approx. 6 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content descriptions** | | |
| Patterns and algebra   * Introduce the concept of variables as a way of representing numbers using letters [(VCMNA251)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA251). * Create algebraic expressions and evaluate them by substituting a given value for each variable [(VCMNA252)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA252). * Extend and apply the laws and properties of arithmetic to algebraic terms and expressions [(VCMNA253)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA253). * Design and implement mathematical algorithms using a simple general purpose programming language [(VCMNA254)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA254)   Linear and non-linear relationships   * Solve simple linear equations [(VCMNA256)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA256). | | |
| **Achievement standard (excerpt in bold)** | | |
| Level 6 | Level 7 | Level 8 |
| Students recognise the properties of prime, composite, square and triangular numbers and determine sets of these numbers. They solve problems that involve all four operations with whole numbers and describe the use of integers in everyday contexts. Students locate fractions and integers on a number line and connect fractions, decimals and percentages as different representations of the same number. They solve problems involving the addition and subtraction of related fractions. Students calculate a simple fraction of a quantity and calculate common percentage discounts on sale items, with and without the use of digital technology. They make connections between the powers of 10 and the multiplication and division of decimals. Students add, subtract and multiply decimals and divide decimals where the result is rational. Students write number sentences using brackets and order of operations, and specify rules used to generate sequences involving whole numbers, fractions and decimals. They use ordered pairs of integers to represent coordinates of points and locate a point in any one of the four quadrants on the Cartesian plane. | Students solve problems involving the order, addition and subtraction of integers. They make the connections between whole numbers and index notation and the relationship between perfect squares and square roots. They solve problems involving all four operations with fractions, decimals, percentages and their equivalences, and express fractions in their simplest form.Students compare the cost of items to make financial decisions, with and without the use of digital technology. They make simple estimates to judge the reasonableness of results. **Students use variables to represent arbitrary numbers and connect the laws and properties of number to algebra and substitute numbers into algebraic expressions.** They assign ordered pairs to given points on the Cartesian plane and interpret and analyse graphs of relations from real data. **Students develop simple linear models for situations, make predictions based on these models, solve related equations and check their solutions.** | Students use efficient mental and written strategies to make estimates and carry out the four operations with integers, and apply the index laws to whole numbers. They identify and describe rational and irrational numbers in context. Students estimate answers and solve everyday problems involving profit and loss rates, ratios and percentages, with and without the use of digital technology. They simplify a variety of algebraic expressions and connect expansion and factorisation of linear expressions. Students solve linear equations and graph linear relationships on the Cartesian plane. |

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| **Activities** | **Proficiencies** |
| * Introducing the use of pronumerals. Translating simple linear equations and simple linear inequations into algebraic form and relating to context. * Introduction to functions as growing patterns and tables of values (e.g. [chairs around a table problem](http://illuminations.nctm.org/ActivityDetail.aspx?ID=144) or the [garden beds problem](http://mathematicscentre.com/taskcentre/147gardn.htm)). * Obtaining rules for number patterns; making and testing conjectures, using calculator or spreadsheet in some cases. * Algorithms and coding: developing algorithms to generate sequence, such as growing patterns, and implementing the algorithms as simple programs using a loop structure, or using a spreadsheet. * Constructing and comparing tables of values for simple algebraic expressions. * Restating problems in symbols to aid solution. * Equivalence and equations using, for example, [algebra balance](http://nlvm.usu.edu/en/nav/frames_asid_201_g_3_t_2.html?open=instructions&from=category_g_3_t_2.html) scales and length models. * Solving simple linear equations (e.g. by inspection, by ‘guess, check and review’ or by backtracking). * Testing solutions by substituting numbers. Numbers which satisfy and which do not. * Writing a rule in symbolic form for a simple relationship, given a set of number pairs; checking solution. | * **Understanding** through connecting the laws and properties of numbers to algebraic terms. * **Fluency** through solving simple linear equations and checking the solution by substitution. * **Problem solving** through predicting the number of objects in extensions of patterns, using multiplicative strategies for linear patterns and additive strategies for more complex patterns. * **Reasoning** through stating generalisations of linear patterns as rules in words and symbols. |

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| **Considering different levels** |
| Level 6  Students who are working at this level could:   * describe, extend and make generalisations about geometric and numeric patterns, and represent the patterns using tables and words. They could use ‘generalised arithmetic’ to extend the representation of rules from the specific case to the general case, using symbols. For example: for a human and 3 dogs, legs = 4 × 3 + 2; for a human and D dogs, L = 4D + 2.   Level 8  Students who are working at this level could:   * represent and generalise some non-linear patterns, such as the relationship between the number of disks and the number of moves in the Tower of Hanoi problem, using tables, words and symbolic rules. They could make predictions about the values of later iterations of the pattern. * make a connection between deconstructing a simple linear equation using a ‘backtracking’ flow diagram, and the solution of the equation using the method of inverse operations. |

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| **Assessment ideas** |
| * Students carry out assessment tasks involving making predictions by extending growing patterns and generalise the sequence using words and symbols. * Students solve simple linear equations using backtracking and verify the result using substitution. |

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| **Resources** |
| AMSI  [Introduction to algebra](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_1a.html)  [Laws of arithmetic and their use in algebra](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_1b.html#intro)  [Algebraic expressions](http://www.amsi.org.au/teacher_modules/Algebraic_expressions.html)  NCTM Illuminations  [Algebra tiles](http://illuminations.nctm.org/Activity.aspx?id=3482)  [Chairs around a table problem](http://illuminations.nctm.org/ActivityDetail.aspx?ID=144)  NLVM  (Note: Some web browsers may not support the NLVM Java plug-in. An off-line NLVM app is available for download)  [Function machine](http://nlvm.usu.edu/en/nav/frames_asid_191_g_3_t_2.html?from=category_g_3_t_2.html)  [Algebra balance scales](http://nlvm.usu.edu/en/nav/frames_asid_201_g_3_t_2.html?open=instructions&from=category_g_3_t_2.html)  FUSE: Discover resources aligned to the Victorian Curriculum  [Introduce the concept of variables as a way of representing numbers using letters](http://fuse.education.vic.gov.au/VCAA/VCMNA251)  [Create algebraic expressions and evaluate them by substituting a given value for each variable](http://fuse.education.vic.gov.au/VCAA/VCMNA252)  [Extend and apply the laws and properties of arithmetic to algebraic terms and expressions](http://fuse.education.vic.gov.au/VCAA/VCMNA253)  [Solve simple linear equations](http://fuse.education.vic.gov.au/VCAA/VCMNA256) |

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| Topic 7.2.3 Statistical data | | |
| Strand:  Statistics and Probability | Sub-strand:  Data representation and interpretation | Recommended teaching time:  3 weeks (approx. 9 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content descriptions** | | |
| * Identify and investigate issues involving numerical data collected from primary and secondary sources [(VCMSP268)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMSP268). * Construct and compare a range of data displays including stem-and-leaf plots and dot plots [(VCMSP269)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMSP269). * Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data [(VCMSP270)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMSP270). * Describe and interpret data displays using median, mean and range [(VCMSP271)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMSP271). | | |
| **Achievement standard (excerpt in bold)** | | |
| Level 6 | Level 7 | Level 8 |
| Students interpret and compare a variety of data displays, including displays for two categorical variables. They analyse and evaluate data from secondary sources. Students compare observed and expected frequencies of events, including those where outcomes of trials are generated with the use of digital technology. They specify, list and communicate probabilities of events using simple ratios, fractions, decimals and percentages. | **Students identify issues involving the collection of discrete and continuous data from primary and secondary sources. They construct stem-and-leaf plots and dot-plots. Students identify or calculate mean, mode, median and range for data sets, using digital technology for larger data sets. They describe the relationship between the median and mean in data displays.** Students determine the sample space for simple experiments with equally likely outcomes, and assign probabilities outcomes. | Students explain issues related to the collection of sample data and discuss the effect of outliers on means and medians of the data. They use various approaches, including the use of digital technology, to generate simple random samples from a population. Students model situations with Venn diagrams and two-way tables and explain the use of 'not', 'and' and 'or'. Students choose appropriate language to describe events and experiments. They determine complementary events and calculate the sum of probabilities. |

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| **Activities** | **Proficiencies** |
| * Statistical investigation involving collecting numerical data from survey or experiment, distinguishing between discrete counted data (e.g. number of words in a sentence) and continuous measured data (e.g. length of arm span), for example [ABS numerical data](http://www.abs.gov.au/websitedbs/CaSHome.nsf/Home/CaSQ+3B+NUMERICAL+DATA:+WHAT'S+THE+DIFFERENCE+BETWEEN+DISCRETE+AND+CONTINUOUS). Choosing appropriate methods for recording observations; organising, displaying and describing results; drawing informal conclusions and reporting on the whole process (orally or in writing). See, for example, [AMSI data investigation and interpretation](http://www.amsi.org.au/teacher_modules/Data_Investigation_and_interpretation7.html). * Organising data into tables, and obtaining summary statistics (mean, median, range); application to results of statistical investigation, especially through introduction of ideas of median and range to compare data sets. * Consideration of different ways of representing numerical data to understand that different representations provide different snapshots of the data, and that data representations influence audience interpretation. * Critically evaluating numerical data statistics that are presented in advertisements, newspapers and the like. * Working with dot plots, stem plots and histograms; application to results of statistical investigation. Using technology, for example, a spreadsheet program to display data in a variety of forms that can be evaluated. | * **Understanding** through summarising data into tables and displays. * **Fluency** through calculating summary statistics and constructing data displays to help make sense of data sets. * **Problem solving** through formulating and planning a statistical investigation and selecting appropriate ways of representing and summarising data sets. * **Reasoning** through critically appraising numerical data representations prepared by others, and the reasonableness of the conclusions made from the data. |

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| **Considering different levels** |
| Level 6  Students who are working at this level could:   * represent numerical data in various ways and identify differences in representing categorical and numerical data. They could compare different representations of the same data and identify what important features of the data are highlighted by each representation.   Level 8  Students who are working at this level could:   * pose questions and design a survey or other study to collect data about a particular question. They could select and create, using technology, appropriate displays of the data and related summary statistics, and interpret these, with a focus on how the data is distributed (shape of the data). |

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| **Assessment ideas** |
| * Students carry out a statistical investigation, as described in the *Activities* section, and report on the process and results. * Students critically evaluate statistical representations of data from the media, advertising and the like, considering factors such as misleading graphs, problems with data gathering and the inferences made from the data. |

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| **Resources** |
| ABS  [Census at School](http://www.abs.gov.au/censusatschool)  AMSI  [Data investigation and interpretation](http://www.amsi.org.au/teacher_modules/Data_Investigation_and_interpretation7.html)  NZ Maths  [Statistical investigation units of work](http://www.nzmaths.co.nz/statistical-investigations-units-work)  [Statistical literacy units of work](http://www.nzmaths.co.nz/statistical-literacy-units-work)  FUSE: Discover resources aligned to the Victorian Curriculum  [Identify and investigate issues involving numerical data collected from primary and secondary sources](http://fuse.education.vic.gov.au/VCAA/VCMSP268)  [Construct and compare a range of data displays including stem-and-leaf plots and dot plots](http://fuse.education.vic.gov.au/VCAA/VCMSP269)  [Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data](http://fuse.education.vic.gov.au/VCAA/VCMSP270)  [Describe and interpret data displays using median, mean and range](http://fuse.education.vic.gov.au/VCAA/VCMSP271) |

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| Topic 7.2.4 Decimals, percentages and simple ratios | | |
| Strand:  Number and Algebra | Sub-strand:  Real Numbers | Recommended teaching time:  3 weeks (approx. 6 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content descriptions** | | |
| * Multiply and divide fractions and decimals using efficient written strategies and digital technologies [(VCMNA244)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA244). * Round decimals to a specified number of decimal places [(VCMNA246)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA246). * Connect fractions, decimals and percentages and carry out simple conversions [(VCMNA247)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA247). * Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies [(VCMNA248)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA248). * Recognise and solve problems involving simple ratios [(VCMNA249)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA249). | | |
| **Achievement standard (excerpt in bold)** | | |
| Level 6 | Level 7 | Level 8 |
| Students recognise the properties of prime, composite, square and triangular numbers and determine sets of these numbers. They solve problems that involve all four operations with whole numbers and describe the use of integers in everyday contexts. Students locate fractions and integers on a number line and connect fractions, decimals and percentages as different representations of the same number. They solve problems involving the addition and subtraction of related fractions. Students calculate a simple fraction of a quantity and calculate common percentage discounts on sale items, with and without the use of digital technology. They make connections between the powers of 10 and the multiplication and division of decimals. Students add, subtract and multiply decimals and divide decimals where the result is rational. Students write number sentences using brackets and order of operations, and specify rules used to generate sequences involving whole numbers, fractions and decimals. They use ordered pairs of integers to represent coordinates of points and locate a point in any one of the four quadrants on the Cartesian plane. | Students solve problems involving the order, addition and subtraction of integers. They make the connections between whole numbers and index notation and the relationship between perfect squares and square roots. **They solve problems involving all four operations with fractions, decimals, percentages and their equivalences, and express fractions in their simplest form.** Students compare the cost of items to make financial decisions, with and without the use of digital technology. They make simple estimates to judge the reasonableness of results. Students use variables to represent arbitrary numbers and connect the laws and properties of number to algebra and substitute numbers into algebraic expressions. They assign ordered pairs to given points on the Cartesian plane and interpret and analyse graphs of relations from real data. Students develop simple linear models for situations, make predictions based on these models, solve related equations and check their solutions. | Students use efficient mental and written strategies to make estimates and carry out the four operations with integers, and apply the index laws to whole numbers. They identify and describe rational and irrational numbers in context. Students estimate answers and solve everyday problems involving profit and loss rates, ratios and percentages, with and without the use of digital technology. They simplify a variety of algebraic expressions and connect expansion and factorisation of linear expressions. Students solve linear equations and graph linear relationships on the Cartesian plane. |

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| **Activities** | **Proficiencies** |
| * Review of decimal place value and percentages. * Comparing and ordering of common fractions, decimals, percentages and ratios. * Connecting fractions, decimals, percentages and ratios by carrying out simple conversions. * Rounding decimals. Explore fix and float modes of calculator. * Visualise the four arithmetic operations on common and decimal fractions by modelling these operations on appropriately scaled number lines. * Real-world applications where one quantity is expressed as a fraction and percentage of another. * Using percentage capability of calculator. * Straightforward applications of percentages (e.g. marks, simple discounts); reading, interpreting and writing sentences involving symbols for amounts of money, quantities of materials, percentages and so on. Estimation strategies to check computations with decimals and percentages. * Multiplication and division of decimals. * Solving simple ratio and rate problems using fractions and percentages. | * **Understanding** through recognising equivalence between fractions, decimals and percentages. * **Fluency** through calculating decimals, percentages and ratios accurately, and representing them in various ways. * **Problem solving** through recognising simple ratio and rate problems, and using knowledge of fractions and percentages to solve them. * **Reasoning** through applying estimation strategies to check computations with decimals and percentages and judging the reasonableness of answers. |

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| **Considering different levels** |
| Level 6  Students who are working at this level could:   * carry out activities to reinforce decimal place value concepts, for example, by playing the calculator game *Wipeout* and by ordering decimals, like 4.65, 4.605, 4.645, … on a number line with 100 subdivisions, such as the one below.      * use ratio tables, which show the relationship between two quantities, as an aid to solving scaling and proportionality problems.   Level 8  Students who are working at this level could:   * investigate the aspect ratio (ratio of width to length) of A-series paper sizes. They could explore why this aspect ratio allows successive paper sizes in the series to be defined by halving the preceding paper size across the larger dimension. They could explore why an enlargement of approximately 141% on a photocopier is required to enlarge from A4 to A3, and 71% to reduce from A3 to A4. |

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| **Assessment ideas** |
| Students carry out assessment tasks where they:   * carry out operations on decimals and fractions with the assistance of appropriately scaled number lines * relate fractions, percentages and decimals * solve authentic percentage problems * apply decimals to solve problems and round the answers to the desired accuracy * solve straightforward ratio and rate problems using fractions and percentages. |

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| **Resources** |
| AMSI  [Rounding decimals](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_1i.html)  [Multiplication and division of decimals](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_1g.html)  [Decimals and percentages](http://www.amsi.org.au/teacher_modules/decimals_and_percentages.html)  NCTM Illuminations  [Grid and percent it](http://illuminations.nctm.org/LessonDetail.aspx?id=L249)  [Now and then](http://illuminations.nctm.org/LessonDetail.aspx?id=L837)  NLVM  (Note: Some web browsers may not support the NLVM Java plug-in. An off-line NLVM app is available for download)  [Percent grids](http://nlvm.usu.edu/en/nav/frames_asid_333_g_3_t_1.html?from=category_g_3_t_1.html)  Percentages  [Duelling calculators](http://nlvm.usu.edu/en/nav/frames_asid_312_g_3_t_1.html?from=category_g_3_t_1.html)  FUSE: Discover resources aligned to the Victorian Curriculum  [Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies](http://fuse.education.vic.gov.au/VCAA/VCMNA248)  [Recognise and solve problems involving simple ratios](http://fuse.education.vic.gov.au/VCAA/VCMNA249) |

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| Topic 7.2.5 Coordinates, graphs and transformations | | |
| Strand:  Number and Algebra  Measurement and Geometry | Sub-strand:  Linear and non-linear relationships  Location and transformation | Recommended teaching time:  3 weeks (approx. 9 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content descriptions** | | |
| **Number and Algebra**  **Linear and non-linear relationships**   * Given coordinates, plot points on the Cartesian plane, and find coordinates for a given point [(VCMNA255)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA255). * Investigate, interpret and analyse graphs from real life data, including consideration of domain and range [(VCMNA257)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA257).   **Measurement and Geometry**  **Location and transformation**   * Describe translations, reflections in an axis, and rotations of multiples of 90° on the Cartesian plane using coordinates. Identify line and rotational symmetries [(VCMMG261)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG261). | | |
| **Achievement standard (excerpt in bold)** | | |
| Level 6 | Level 7 | Level 8 |
| Students recognise the properties of prime, composite, square and triangular numbers and determine sets of these numbers. They solve problems that involve all four operations with whole numbers and describe the use of integers in everyday contexts. Students locate fractions and integers on a number line and connect fractions, decimals and percentages as different representations of the same number. They solve problems involving the addition and subtraction of related fractions. Students calculate a simple fraction of a quantity and calculate common percentage discounts on sale items, with and without the use of digital technology. They make connections between the powers of 10 and the multiplication and division of decimals. Students add, subtract and multiply decimals and divide decimals where the result is rational. Students write number sentences using brackets and order of operations, and specify rules used to generate sequences involving whole numbers, fractions and decimals. They use ordered pairs of integers to represent coordinates of points and locate a point in any one of the four quadrants on the Cartesian plane. | Students solve problems involving the order, addition and subtraction of integers. They make the connections between whole numbers and index notation and the relationship between perfect squares and square roots. They solve problems involving all four operations with fractions, decimals, percentages and their equivalences, and express fractions in their simplest form.Students compare the cost of items to make financial decisions, with and without the use of digital technology. They make simple estimates to judge the reasonableness of results. Students use variables to represent arbitrary numbers and connect the laws and properties of number to algebra and substitute numbers into algebraic expressions. **They assign ordered pairs to given points on the Cartesian plane and interpret and analyse graphs of relations from real data. Students develop simple linear models for situations, make predictions based on these models**, solve related equations and check their solutions. | Students use efficient mental and written strategies to make estimates and carry out the four operations with integers, and apply the index laws to whole numbers. They identify and describe rational and irrational numbers in context. Students estimate answers and solve everyday problems involving profit and loss rates, ratios and percentages, with and without the use of digital technology. They simplify a variety of algebraic expressions and connect expansion and factorisation of linear expressions. Students solve linear equations and graph linear relationships on the Cartesian plane. |
| Students relate decimals to the metric system and choose appropriate units of measurement to perform a calculation. They solve problems involving length and area, and make connections between capacity and volume. Students interpret a variety of everyday timetables. They solve problems using the properties of angles and investigate simple combinations of transformations in the plane, with and without the use of digital technology. Students construct simple prisms and pyramids. | Students use formulas for the area and perimeter of rectangles. **They** classify triangles and quadrilaterals and **represent transformations of these shapes on the Cartesian plane, with and without the use of digital technology.** Students name the types of angles formed by a transversal crossing parallel lines and solve simple numerical problems involving these lines and angles. They describe different views of three-dimensional objects, and use models, sketches and digital technology to represent these views. Students calculate volumes of rectangular prisms. | Students convert between units of measurement for area and for volume. They find the perimeter and area of parallelograms, rhombuses and kites. Students name the features of circles, calculate circumference and area, and solve problems relating to the volume of prisms. They make sense of time duration in real applications, including the use of 24-hour time. Students identify conditions for the congruence of triangles and deduce the properties of quadrilaterals. They use tools, including digital technology, to construct congruent shapes. |

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| **Activities** | **Proficiencies** |
| * Plotting points on the cartesian plane, in four quadrants, from tables and lists of integer coordinates. * Specifying the coordinates of a point from its location on the cartesian plane. * Computer or ‘by hand’ games using coordinates (for example, Mathsisfun’s [coordinates](http://www.mathsisfun.com/data/click-coordinate.html) or [battleship](http://www.mathsisfun.com/games/battleship.html) games). * Functions as graphical representations: plotting points using a table of coordinates generated from the rule of growing patterns (e.g. [chairs around a table problem](http://illuminations.nctm.org/ActivityDetail.aspx?ID=144) or garden beds problem (maths300 lesson)). * Recognising simple patterns, such as points that lie on a straight line. * Travel graphs (distance–time) to investigate and compare different modes of transport to school. * Interpreting features of travel graphs, such as the slope of lines and the meaning of horizontal lines. * Telling a story for a travel or other authentic graph (e.g. NRICH’s [You tell the story](http://nrich.maths.org/4802)). * Investigate the location of the image of points and shapes when transformed by translations, reflections or rotations. * Explore combinations of reflections and rotations using dynamic geometry software, such as Geogebra. | * **Understanding** through recognising that functions from growing patterns can be represented as rules, tables of coordinates and graphs. * **Fluency** through accurately plotting points from a table of values, and finding the coordinates of the vertices of the image of a shape under a transformation. * **Problem solving** through interpreting features of authentic graphs and being able to ‘tell a story’ of the circumstances that might have led to the behaviour displayed by the graph. * **Reasoning** through matching graphs to particular authentic situations, and through predicting the location of the image of a shape under a transformation. |

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| **Considering different levels** |
| Level 6  Students who are working at this level could:   * use a [virtual geoboard](https://nrich.maths.org/2883) or grid paper to carry out activities which reinforce the Cartesian coordinate system in four quadrants, such as drawing pictures by plotting and joining a sequence of points whose integer coordinates are given. * connect different representations of a functional relationship by choosing the matching story, rule, table and graph for simple everyday contexts.   Level 8  Students who are working at this level could:   * predict, from tables of values, symbolic rules or other representations of a relationship between two variables, the shape and some other key features of graphs. They could find missing values in tables of values by interpolating or extrapolating from a linear graph. * use graphing functionality of technology to determine break-even points for simple situations by finding and interpreting points of intersection between two or more linear graphs. |

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| **Assessment ideas** |
| * Assessments in this topic can concentrate on determining to what extent students are beginning to see functional relationships in a variety of situations, including growing patterns and distance-time data. The communication of these relationships can be expressed as a rule using words, equations, tables and graphs. * Tasks such as: ‘sketch a travel graph illustrating your journey to school’ or ‘sketch a graph of the water level in a bathtub from the time you start to fill it to the time it is empty after your bath’. |

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| **Resources** |
| AMSI  [Transformations of the plane](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_2d.html)  [Linear equations](http://amsi.org.au/teacher_modules/pdfs/Linear_equations.pdf) (PDF)  NLVM  (Note: Some web browsers may not support the NLVM Java plug-in. An off-line NLVM app is available for download)  [Point plotter](http://nlvm.usu.edu/en/nav/frames_asid_331_g_3_t_2.html?from=category_g_3_t_2.html)  [Function grapher](http://nlvm.usu.edu/en/nav/frames_asid_109_g_3_t_2.html?open=activities&from=category_g_3_t_2.html)  NRICH Maths (University of Cambridge)  [You tell the story](http://nrich.maths.org/4802)  [Transformations tease](http://nrich.maths.org/1111)  [Decoding transformations](http://nrich.maths.org/5331)  [Virtual geoboard](https://nrich.maths.org/2883) |

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| Topic 7.2.6 Time and money | | |
| Strand:  Measurement and Geometry  Number and Algebra | Sub-strand:  Using units of measurement  Money and financial mathematics  Patterns and algebra | Recommended teaching time:  2 weeks (approx. 6 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content descriptions** | | |
| **Measurement and Geometry**  **Using units of measurement**   * Interpret and use timetables [(VCMMG226)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG226) (from Level 6). * Solve problems involving duration, including using 12- and 24-hour time within a single time zone [(VCMMG290)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG290) (from Level 8).   **Number and Algebra**  **Money and financial mathematics**   * Investigate and calculate 'best buys', with and without digital technologies [(VCMNA250)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA250).   **Patterns and algebra**   * Design and implement mathematical algorithms using a simple general purpose programming language [(VCMNA254)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMNA254) | | |
| **Achievement standard (excerpt in bold)** | | |
| Level 6 | Level 7 | Level 8 |
| Students relate decimals to the metric system and choose appropriate units of measurement to perform a calculation. They solve problems involving length and area, and make connections between capacity and volume. **Students interpret a variety of everyday timetables.** They solve problems using the properties of angles and investigate simple combinations of transformations in the plane, with and without the use of digital technology. Students construct simple prisms and pyramids. | Students use formulas for the area and perimeter of rectangles. They classify triangles and quadrilaterals and represent transformations of these shapes on the Cartesian plane, with and without the use of digital technology. Students name the types of angles formed by transversal crossing parallel lines and solve simple numerical problems involving these lines and angles. They describe different views of three-dimensional objects, and use models, sketches and digital technology to represent these views. Students calculate volumes of rectangular prisms. | Students convert between units of measurement for area and for volume. They find the perimeter and area of parallelograms, rhombuses and kites. Students name the features of circles, calculate circumference and area, and solve problems relating to the volume of prisms. **They make sense of time duration in real applications, including the use of 24-hour time.** Students identify conditions for the congruence of triangles and deduce the properties of quadrilaterals. They use tools, including digital technology, to construct congruent shapes. |
| Students recognise the properties of prime, composite, square and triangular numbers and determine sets of these numbers. They solve problems that involve all four operations with whole numbers and describe the use of integers in everyday contexts. Students locate fractions and integers on a number line and connect fractions, decimals and percentages as different representations of the same number. They solve problems involving the addition and subtraction of related fractions. Students calculate a simple fraction of a quantity and calculate common percentage discounts on sale items, with and without the use of digital technology. They make connections between the powers of 10 and the multiplication and division of decimals. Students add, subtract and multiply decimals and divide decimals where the result is rational. Students write number sentences using brackets and order of operations, and specify rules used to generate sequences involving whole numbers, fractions and decimals. They use ordered pairs of integers to represent coordinates of points and locate a point in any one of the four quadrants on the Cartesian plane. | Students solve problems involving the order, addition and subtraction of integers. They make the connections between whole numbers and index notation and the relationship between perfect squares and square roots. They solve problems involving all four operations with fractions, decimals, percentages and their equivalences, and express fractions in their simplest form. **Students compare the cost of items to make financial decisions, with and without the use of digital technology. They make simple estimates to judge the reasonableness of results.** Students use variables to represent arbitrary numbers and connect the laws and properties of number to algebra and substitute numbers into algebraic expressions. They assign ordered pairs to given points on the Cartesian plane and interpret and analyse graphs of relations from real data. Students develop simple linear models for situations, make predictions based on these models, solve related equations and check their solutions. | Students use efficient mental and written strategies to make estimates and carry out the four operations with integers, and apply the index laws to whole numbers. They identify and describe rational and irrational numbers in context. Students estimate answers and solve everyday problems involving profit and loss rates, ratios and percentages, with and without the use of digital technology. They simplify a variety of algebraic expressions and connect expansion and factorisation of linear expressions. Students solve linear equations and graph linear relationships on the Cartesian plane. |

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| **Activities** | **Proficiencies** |
| * Using a variety of methods, units and scales to measure time intervals, including use of analogue and digital clocks, calendars, timetables and schedules. * Production of a timeline, for example, to record significant dates in the history of a city or a school. * Estimating and calculating duration of events; use and interpretation of clocks, calendars, timetables and schedules. * Checking reasonableness of answers, and appropriateness of degree of accuracy of answers. * Reading and writing sentences involving the use of numbers and symbols to represent times (including seconds and 24-hour time), temperatures and speeds. * Practical activity (e.g. outdoors) to obtain speeds from measurements of distance and time. Use of derived units such as metres per second, kilometres per hour. * Mental computation involving money transactions, including calculating change. * Percentages involving money, such as calculating the GST paid on purchases. * Applying the unitary method to identify ‘best buys’ situations, such as comparing the cost per 100g. * Algorithms and coding activities could be drawn from: * Develop an algorithm that utilises the inbuilt days-between-dates functionality of a device or spreadsheet. For example, write a simple game involving time elapsed between today’s date and a randomly generated date in the current year. The player inputs the result of their mental calculation and the program displays the correct answer and a percentage error (if the inputted answer is incorrect). * Best buys calculator: develop an algorithm where the input is amounts (e.g. 500 (mL)) and prices for a set of related items, and the output is unit price, ordered from best to worst buy – utilising an inbuilt sort command. | * **Understanding** through connecting knowledge of decimals, percentages and rates to problems involving money transactions. * **Fluency** through accurately calculating time elapsed between two events, change due from a money transaction and best buys. * **Problem solving** through formulating and solving scheduling problems involving timetables, and investigating best buys. * **Reasoning** through estimating and evaluating the reasonableness of answers and the appropriateness of the degree of accuracy. |

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| **Considering different levels** |
| Level 6  Students who are working at this level could:   * plan a journey requiring the use of more than one form of public transport, including metropolitan and non-metropolitan services, interpreting timetables to coordinate the journey and finding duration of travel in more than one unit of time, by carrying out appropriate conversions. * use prices from an online supermarket shopping site to prepare a simple shopping list for which a unitary method has been used to calculate the ‘best buy’ for each item. They could find some different combinations in which change for this shopping could be issued from, say, $20, $50 and $100.   Level 8  Students who are working at this level could:   * evaluate and interpret data from secondary sources to calculate time rates using a variety of units, such as km/h and m/s, and make conversions between these units in simple cases. * plan and price a short overseas trip, taking into account currency conversions, time zones and calculating flight times from airline schedules that are given in 24 hour time. |

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| **Assessment ideas** |
| * Students carry out an investigation of speed by accurately measuring the time taken to travel a known distance (for example, finding the speed of cars, cyclists and pedestrians past the school by measuring the time taken to travel between two points 100 metres apart). * Students carry out an activity where they calculate ‘best buys’ for a range of supermarket products, and calculate the GST on the products. |

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| **Resources** |
| AMSI  [The unitary method](http://www.amsi.org.au/teacher_modules/Unitary_Method.html)  [Time](http://www.amsi.org.au/teacher_modules/time.html)  [Function grapher](http://nlvm.usu.edu/en/nav/frames_asid_109_g_3_t_2.html?open=activities&from=category_g_3_t_2.html)  NRICH Maths (University of Cambridge)  [Clock hands](http://nrich.maths.org/50)  [Are you a smart shopper?](http://nrich.maths.org/110)  NLVM  (Note: Some web browsers may not support the NLVM Java plug-in. An off-line NLVM app is available for download)  [What time will it be?](http://nlvm.usu.edu/en/nav/frames_asid_318_g_3_t_4.html?from=category_g_3_t_4.html)  FUSE: Discover resources aligned to the Victorian Curriculum  [Interpret and use timetables (from Level 6)](http://fuse.education.vic.gov.au/VCAA/VCMMG226)  [Solve problems involving duration, including using 12- and 24-hour time within a single time zone (from Level 8)](http://fuse.education.vic.gov.au/VCAA/VCMMG290)  [Investigate and calculate 'best buys', with and without digital technologies](http://fuse.education.vic.gov.au/VCAA/VCMNA250) |

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| Topic 7.2.7 Solids, volume, capacity and mass | | |
| Strand:  Measurement and Geometry | Sub-strand:  Using units of measurement  Shape | Recommended teaching time:  3 weeks (approx. 9 hours) |

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| **Mapping to F–10 curriculum in Victoria** | | |
| **Content descriptions** | | |
| **Using units of measurement**   * Calculate volumes of rectangular prisms [(VCMMG259)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG259).   **Shape**   * Draw different views of prisms and solids formed from combinations of prisms [(VCMMG260)](http://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCMMG260). | | |
| **Achievement standard (excerpt in bold)** | | |
| Level 6 | Level 7 | Level 8 |
| Students relate decimals to the metric system and choose appropriate units of measurement to perform a calculation. They solve problems involving length and area, and make connections between capacity and volume. Students interpret a variety of everyday timetables. They solve problems using the properties of angles and investigate simple combinations of transformations in the plane, with and without the use of digital technology. Students construct simple prisms and pyramids. | Students use formulas for the area and perimeter of rectangles. They classify triangles and quadrilaterals and represent transformations of these shapes on the Cartesian plane, with and without the use of digital technology. Students name the types of angles formed by a transversal crossing parallel lines and solve simple numerical problems involving these lines and angles. **They describe different views of three-dimensional objects, and use models, sketches and digital technology to represent these views. Students calculate volumes of rectangular prisms.** | Students convert between units of measurement for area and for volume. They find the perimeter and area of parallelograms, rhombuses and kites. Students name the features of circles, calculate circumference and area, and solve problems relating to the volume of prisms. They make sense of time duration in real applications, including the use of 24-hour time. Students identify conditions for the congruence of triangles and deduce the properties of quadrilaterals. They use tools, including digital technology, to construct congruent shapes. |

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| **Activities** | **Proficiencies** |
| * Nets and diagrams of prisms and recognising different views of 3-D objects. * Using aerial views of buildings and other 3-D structures to visualise the structure of the building or prism (as illustrated in the AMSI’s [Geometric drawing including representation of simple solids](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_2b.html#teacher)). * Use of terms ‘capacity’ and ‘volume'; metric units of capacity and of volume. * Using a graduated jug/jar correctly and accurately to measure volume of liquid. * Making or inspecting objects with volumes about 1 m3, 1 dm3, 1 cm3; relating these to the litre and to familiar household objects (e.g. milk cartons). * Measuring mass, metric units of mass; and volume of objects by liquid displacement. * Reading scales with 5, 10, or 20 unlabelled calibrations between labelled units. * Estimating mass and capacity; using known quantities to dispute unrealistic estimates; checking estimates by measurement. * Calculating volumes of cubes and other rectangular prisms, and shapes based on rectangular prisms, from given measurements and from own measurements. * Understanding and using cubic units when interpreting and finding volumes of cubes and rectangular prisms. | * **Understanding** through connecting the related concepts of capacity and volume and identifying similarities and differences between them. * **Fluency** through accurately calculating the volume of rectangular prisms and using appropriate units for volume, capacity and mass. * **Problem solving** through designing and planning an investigation of volumes of prisms, and communicating the results effectively. * **Reasoning** through recognising and interpreting different views and representations of 3-D objects. |

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| **Considering different levels** |
| Level 6  Students who are working at this level could:   * use 24, 36 or 64 multilink cubes or wooden cubes to build different rectangular prisms. They find (by counting squares) and record, in a table, the surface area for each prism formed. They describe the patterns that occur in the table. In particular, what hap­pens to the surface area as the prism becomes less like a tall, thin box and more like a cube? They repeat the activity with different fixed vol­umes (i.e. numbers of cubes).   Level 8  Students who are working at this level could:   * use linkable regular shapes (such as commercial products *Polydron* or *Geofix*) to investigate other solids. They use equilateral triangles, squares and regular pentagons and hexagons to explore what completely regular solids they can build. The challenge is for them to build and find all five platonic solids. As an extension, they could investigate the relationship between faces, vertices and edges for their solids. |

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| **Assessment ideas** |
| * Students determine the number of small cubes that will fit inside various cardboard boxes of different dimensions, equipped with only a ruler and a few of the small cubes. They record their findings systematically and report their results. * Students investigate multiple attributes (such as volume, capacity, mass surface area) of various solids commonly found in households. |

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| **Resources** |
| AMSI  [Introduction to measurement](http://www.amsi.org.au/teacher_modules/introduction_to_measurement.html)  [Geometric drawing including representation of simple solids](http://www.amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_2b.html" \l "teacher)  NCTM Illuminations  [Hay bale farmer](http://illuminations.nctm.org/LessonDetail.aspx?id=L783)  [Cubes](http://illuminations.nctm.org/ActivityDetail.aspx?id=6)  NLVM  (Note: Some web browsers may not support the NLVM Java plug-in. An off-line NLVM app is available for download)  [How high?](http://nlvm.usu.edu/en/nav/frames_asid_275_g_3_t_4.html?from=category_g_3_t_4.html)  FUSE: Discover resources aligned to the Victorian Curriculum  [Calculate volumes of rectangular prisms](http://fuse.education.vic.gov.au/VCAA/VCMMG259)  [Draw different views of prisms and solids formed from combinations of prisms](http://fuse.education.vic.gov.au/VCAA/VCMMG260) |

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