# **Mathematics and Statistics Level 1 Course Outline 3**

# Guide to aid teacher planning only - designed to be printed or viewed in A3, Landscape.

## Purpose

This example Course Outline has been produced to help teachers and schools understand the new NCEA Learning and Assessment matrices and could be used to create a year-long programme of learning. It will give teachers ideas of how the new Standards might work to assess the curriculum at a particular level.

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| **Significant Learning** | **Learning activities and assessment opportunities**Throughout the year assessment for learning happens often. Evidence may also be collected for summative assessment. | **Duration** Total of 32 weeks |
| **Number across the curriculum – number, with applications in algebra, measurement, and statistics & probability*** Explore, describe, and generalise properties of number, measurement, space, algebra, and probability – *consider:*
	+ operating on numbers, with real number exponents by applying exponent rules, including evaluation integer exponents, excluding complex numbers
	+ operating on algebraic fractions with numeric denominators
	+ operating with percentages, rates, and ratios
	+ operating on very large and on very small numbers using scientific notation
	+ adding, subtracting, multiplying, dividing, and finding powers and roots of fractions
	+ estimating, accurately measuring, and calculating quantities using appropriate tools and formulae
	+ estimating the area or volume of regular, irregular, and compound shapes
	+ using scale factors and properties of similar shares to estimate length, area, and volume changes.
* Communicate mathematical and statistical ideas and insights using appropriate mathematical and statistical language, symbols, and representations
* Evaluate mathematical and statistical information, solutions, outcomes, and approaches from a range of perspectives
 | [Introduction](https://nzmaths.co.nz/number-strategies-and-knowledge-level-6)Students will explore how number skills are used across the topics by engaging in a range of activities, such as the following:* [Build number sense and maths reasoning](https://estimation180.com/).
* [Would you rather](https://www.wouldyourathermath.com/category/9to12/).
* [Investigating GST](https://seniorsecondary.tki.org.nz/content/download/2963/24488/file/Investigating%20GST.doc).
* [Investigating fence patterns](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Achievement-objectives/L6-learning-experiences#fence).
* [Working with powers and combining numbers](https://nzmaths.co.nz/resource/powers-investigations) (builds directly on previous learning at Curriculum Level 5).
* [Investigating debt and compound interest](https://nrich.maths.org/6088).
* [Looking at the Richter Scale and how it links with powers](https://nzmaths.co.nz/resource/moving-and-shaking).
* Direct and inverse relationships ([1](https://nrich.maths.org/2787) and [2](https://nrich.maths.org/5988)).
* [Tower of Hanoi](https://www.transum.org/Maths/Investigation/Tower_Of_Hanoi/) – for investigating exponential relationships.

**Work produced as part of this topic will support assessment of Achievement Standard (AS) 1.2 *Explore mathematical problems that relate to life in Aotearoa New Zealand and the Pacific* (Internal – 5 credits)and build knowledge for AS 1.3 *Interpret and apply mathematical and statistical information in context* (External – 5 credits).** | 5 weeks |
| **Geometry and measurement across the curriculum***Within the learning of geometry and measurement, students will:** Explore, describe, and generalise properties of number, measurement, space, algebra, and probability – *consider:*
	+ estimating, accurately measuring, and calculating quantities using appropriate tools and formulae
	+ estimating the area or volume of regular, irregular, and compound shapes
	+ using scale factors and properties of similar shares to estimate length, area, and volume changes
	+ exploring the fixed relationships between side lengths and angles in right-angle triangles in two and three dimensions.
 | [Read this first](https://nzmaths.co.nz/measurement-level-6)Students will explore how geometry and measurement skills are used across the Learning Matrix areas by engaging in a range of activities, such as the following: * A deeper link to investigate [Pythagoras’ theorem](https://nzmaths.co.nz/resource/julie-s-wheels).
* Using numerical and algebraic thinking to solve for [an optimal geometric problem](https://nzmaths.co.nz/resource/peter-s-third-string).
* [Measuring with digital pictures](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Learning-programme-design/Year-11-programme-design/Level-5-6/Activity-Measuring-with-pictures).

**Work completed within this topic will support assessment of AS 1.2 *Explore mathematical problems that relate to life in Aotearoa New Zealand or the Pacific* (Internal – 5 credits)and build knowledge for AS 1.4 *Demonstrate mathematical reasoning* (External – 5 credits)*.*** | 5 weeks |
| **Algebra across the curriculum*** Make sense of solutions in context, including in different cultural contexts – *consider:*
	+ linking statements to the context, reflecting on conjectures, and providing interpretations with possible relevant explanations for observations and patterns.
* Explore, describe, and generalise properties of number, measurement, space, algebra, and probability – *consider:*
	+ operating with percentages, rates, and ratios
	+ operating on very large and on very small numbers using scientific notation
	+ adding, subtracting, multiplying, dividing, and finding powers and roots of fractions
	+ estimating, accurately measuring, and calculating quantities using appropriate tools and formulae
	+ estimating the area or volume of regular, irregular, and compound shapes
	+ using scale factors and properties of similar shares to estimate length, area, and volume changes
	+ exploring the fixed relationships between side lengths and angles in right-angle triangles in two and three dimensions.
* Communicate mathematical and statistical ideas and insights using appropriate mathematical and statistical language, symbols, and representations – *consider:*
	+ recognising the complexity of the attribute being measured and using correct units with appropriate precision
	+ preserving units in calculations, including those involving derived measures and metric conversions
	+ communicating findings in a way that a non-specialist audience can understand.
* Evaluate mathematical information, solutions, outcomes, and approaches from a range of perspectives – *consider:*
	+ evaluating the findings presented and claims made by the media through interrogating relevant mathematical processes
	+ proposing possible relevant reasons as to why particular mathematical visualisations and calculations are used to support claims.
 | [Read this first](https://nzmaths.co.nz/equations-and-expressions-level-6)Students will explore how algebra and graphing skills are used across the Learning Matrix areas by engaging in a range of activities, such as the following: * [Same and different](https://samedifferentimages.wordpress.com/).
* [Investigate nth term patterns](http://www.visualpatterns.org/) (alternative [link](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Achievement-objectives/L6-learning-experiences#pattern)).
* [Fundamental algebraic skills](https://cimt.org.uk/projects/mepres/book7/bk7i16/bk7_16i1.htm).
* [Graphing sprint race times](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Achievement-objectives/L6-learning-experiences#sprints).
* [Graphing rates and investigating gradient](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Achievement-objectives/L6-learning-experiences#rates).
* [Matching graphs to real life situations](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Achievement-objectives/L6-learning-experiences#graphs).
* [Suggesting contextual situations and equations that model them](https://nrich.maths.org/7502).
* [Investigating biological growth curves](https://nrich.maths.org/6151) (as an example of reading various types of graphs).
* Investigations through Desmos on the various ways to construct and the properties of [quadratic functions](https://teacher.desmos.com/collection/5da649da5a46437eff2441d0) or [linear](https://teacher.desmos.com/collection/5d939bb5a577d244fa315ebd).
* [Forming simple in context linear equations](https://nzmaths.co.nz/resource/weighing-time).
* Forming and solving different looking types of equations that require a high level of reasoning ([1](https://nzmaths.co.nz/resource/diophantus-i) and [2](https://nzmaths.co.nz/resource/diophantus-ii)).
* [Introducing difference of two squares with a pattern approach](https://nzmaths.co.nz/resource/triangular-number-links).

**Work produced as part of this topic will support assessment of AS 1.2 *Explore mathematical problems that relate to life in Aotearoa New Zealand or the Pacific* (Internal – 5 credits) and build knowledge for AS 1.4 *Demonstrate mathematical reasoning* (External – 5 credits).** | 10 weeks |
| **Statistics across the curriculum*** Collect, explore, analyse, and form conclusions with measured quantities and data – *consider:*
	+ using a statistical enquiry process to undertake data-based investigations (includes use of PPDAC)
	+ sourcing, interrogating, and creating new variables for existing multivariate data sets
	+ selecting and using appropriate data visualisations to answer investigative questions or statements
	+ describing, explaining, and justifying features, patterns, or trends of data in proper context
	+ making informal inferences about well-defined populations from sample data for summary and comparison situations
	+ making useful and appropriate predictions for relationship and time series from visualisations
	+ justifying evidence from analysis and informal inferences
	+ designing and conducting experiments or simulations that demonstrate the relationship between combined conditions for events and the probability of individual events.
* Evaluate mathematical and statistical information, solutions, outcomes, and approaches from a range of perspectives – *consider:*
	+ recognising that features of sample distributions of a variable from the same population which have the same sample size, vary from sample to sample
	+ data collection process from an ethical viewpoint, considering the variables to be collected and how the data is collected, stored, used, and reported
	+ critically evaluating investigations and recognise limitations
	+ critically evaluating the strength of an argument by considering the appropriateness of the plan or simulation, quality of the data collection and analysis, and the evidence to support the claims made (connections to statistics)
	+ evaluating the findings presented and claims made by media through interrogating phased of the statistical enquiry cycle
	+ proposing possible relevant reasons as to why particular data visualisations and statistics or measures were used to support claims.
 | [Read this first](https://nzmaths.co.nz/statistical-investigations-level-6) and [this](https://nzmaths.co.nz/statistical-literacy-level-6)Students will explore how statistics skills integrate other learning from across the Learning Matrix areas by engaging in a range of activities, such as the following:* Multiple lesson [investigation](https://nzmaths.co.nz/resource/further-investigations-reaction-times) using reaction time as context.
* [Investigation](https://nzmaths.co.nz/resource/stork-delivery) into babies being delivered by storks using various visual infographics.
* Investigating [time series](https://nzmaths.co.nz/resource/time-series) using various contexts or specifically [Olympic sports](https://nrich.maths.org/records)
* Specific [bivariate investigation](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Achievement-objectives/L6-learning-experiences#jump)
* Both a [comparative and bivariate](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Achievement-objectives/L6-learning-experiences#writing) investigation.
* An [overview](https://new.censusatschool.org.nz/resource/making-the-call/) of making the call and appreciation of sampling variation.
* Guessing the length of a set time – could be used for comparative investigation.
* [Slow reveal graphs](https://slowrevealgraphs.com/) - students are given a range of unfamiliar displays to learn strategies for analysing and interpreting.

**Work produced as part of this topic may contribute towards the assessment of AS 1.1 *Explore data using a statistical enquiry process* (Internal – 5 credits)and build knowledge for AS 1.3 *Interpret and apply mathematical and statistical information in context* (External – 5 credits).** | 6 weeks |
| **Probability across the curriculum*** Calculate probabilities and use them to make predictions – *consider:*
	+ calculating with probabilities in discrete situations using systematic lists, 2-way tables and tree diagrams with counts.
* Evaluate mathematical and statistical information, solutions, outcomes, and approaches from a range of perspectives
* Collect, explore, analyse, and form conclusions with measured quantities and data
 | [Read this first](https://nzmaths.co.nz/probability-level-6)Investigation into [randomness](https://nzmaths.co.nz/resource/investigation-random-processes).Exploring strategies in games involving two dice using [probability](https://www.transum.org/software/Fun_Maths/Dice_Bingo.asp) as a guide.[Using the PPDAC cycle](https://seniorsecondary.tki.org.nz/content/download/1426/11139/file/04paperscissorsrock.doc) with a focus on probability to investigate paper, scissors, rock.A cross topic [investigation](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Learning-programme-design/Year-11-programme-design/Level-5-6/Activity-Culturally-locating-students) focusing on the use and investigation of data to get to know our classes.[Theoretical and practical probability investigation](https://seniorsecondary.tki.org.nz/content/download/1428/11145/file/06quizorno.doc).Using [relative frequency](https://nrich.maths.org/6123) and probability ideas to reverse engineer a problem.Probability [investigation](https://nrich.maths.org/7478) into closely matched sports teams.**Work produced as part of this topic may contribute towards the assessment of AS 1.1 *Explore data using a statistical enquiry process* (Internal – 5 credits) and build knowledge for AS 1.3 *Interpret and apply mathematical and statistical information in context* (External – 5 credits).** | 4 weeks |
| **Revision, consolidation and building connections**Within their revision programme students willreview appropriate pieces of Significant Learning from throughout the year. | Students will:* bring ideas from the year together, looking at how they relate
* solve problems using the whole modelling or statistical cycle
* demonstrate clear and logical working throughout.

**Work completed within this topic build will knowledge for assessment of AS 1.4 *Demonstrate mathematical reasoning* (External – 5 credits).** | 2 weeks |