# **Mathematics and Statistics Level 1 Course Outline for Pilot 2023 |**

# 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, which 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.

|  |  |  |
| --- | --- | --- |
| **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 |
| **This theme integrates learning from statistics, probability, and number***Students will have opportunities to:** collect, explore, analyse, and form conclusions with measured quantities and data – *this includes:*
	+ 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 – *this includes:*
	+ 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.
* calculate probabilities and use them to make predictions – *this includes:*
	+ calculating with probabilities in discrete situations using systematic lists, 2-way tables and tree diagrams with counts.
* make sense of solutions in context, including in different cultural contexts – *this includes:*
	+ making inferences from samples to populations
	+ recognising uncertainty should be considered when making informal inferences and predictions
	+ recognising that data is a taonga and care must be taken when recording, handling, storing, and presenting or publishing data
	+ linking statements to contexts, reflecting on conjectures, providing interpretations with possible relevant explanations for observations and patterns.
 | **Theme 1: Exploring our world using data**The start of the year presents a unique opportunity for ākonga to get to know each other and build a strong foundation for learning in the classroom. Ākonga will work together to discuss how quantities can be measured, explore sources of variations that could occur in the process of collection, then create plans and collect data while managing variation. Some suggested measurements include:* daily temperature and rainfall for an extended period of time
* number of social media notifications received in one class over time
* finding out the distance between where they currently live and where they were born
* throwing a tennis ball with dominant and non-dominant arms
* writing or typing a sentence with dominant and non-dominant arms
* performing a standing jump
* any of the measurements used in CensusAtSchool, and similar measurements.

Kaiako will use this data set to help ākonga explore and learn about:* relationship investigations
* comparison investigations
* time series investigations.

This includes evaluation of existing reports based on similar investigations, which leads to an opportunity to engage with media and claims about anything relating to statistics or probability. Kaiako should also consider evaluating reports that contain misleading information or claims, or claims made without insufficient information. Ākonga could attempt to write a misleading conclusion and see if others can spot any flaws, misconceptions, outright lies, misinformation, or missing critical information.Useful places to source data include:* CensusAtSchool
* Figure.NZ
* NIWA
* Athletics NZ records and rankings.

**Probability experiments**Ākonga should have several opportunities to explore games and experiments that have both known and unknown probabilities. Suggestions can be found on the TKI website [HERE](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Achievement-objectives/AOs-by-level/AO-S6-3). Ākonga should also have opportunities to view and create media that include probability statements. Revision of important number and measurement ideas will be integrated into this programme of learning. Examples of this are measuring with precision, converting metric units, and rates.***This topic may contribute to the assessment of:******AS1.1 (91944) Explore data using a statistical enquiry process (Internal – 5 credits)******And build knowledge for:******AS1.3 (91946) Interpret and apply mathematical and statistical information in context (External – 5 credits)*** | 10 weeks |
| **This theme integrates learning from algebra and number***Students will have opportunities to:** fluently and flexibly solve problems – *this includes:*
	+ using manipulation of equations and inequations to solve problems
	+ using technology to solve problems.
* form, use, rearrange, and solve equations, formulae, and inequations – *this includes:*
	+ forming, rearranging, and using formulae
	+ expanding and factorising up to quadratic polynomials
	+ accurately solving more complex linear and quadratic equations, showing working
	+ algebraically solving systems of two linear equations in two-dimensional space and geometrically interpreting the solution
	+ linear inequations.
* explore situations using a variety of representations such as patterns, equations, tables, and graphs, as well as data displays and numerical statistics – *this includes:*
	+ graphing linear and quadratic functions
	+ finding the equation for the line between two points
	+ finding equations for parallel lines, including horizontal and vertical lines
	+ graphing linear and quadratic functions and interpreting x-intercepts, the y intercept, and key features in relation to the equation or the situation
	+ investigating features, patterns and trends including, where appropriate, clusters, gaps, outliers, measures of centre and spread, shape of distribution, context, position of data, and research relevant reasons and possible explanations.
* explore, describe, and generalise properties of number, measurement, space, algebra, and probability – *this includes:*
	+ 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.
* explore and use relative change in two variables represented using equations, tables, and graphs, within linear and quadratic relationships.
 | **Theme 2: Algebraic problem solving in real life and mathematical settings**Ākonga will explore a range of learning contexts. Links to suggested learning contexts on TKI are listed below:* [Achievement objective NA6-5 (TKI)](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Achievement-objectives/AOs-by-level/AO-NA6-5)
* [Achievement objective NA6-6 (TKI)](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Achievement-objectives/AOs-by-level/AO-NA6-6)
* [Achievement objective NA6-7 (TKI)](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Achievement-objectives/AOs-by-level/AO-NA6-7)
* [Achievement objective NA6-8 (TKI)](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Achievement-objectives/AOs-by-level/AO-NA6-8)

Ākonga will solve problems involving: * simplifying algebraic expressions
* substitution
* rearranging formulae
* solving linear equations and inequations
* expanding and factorising quadratics
* simplifying and operating on rational expressions
* solving quadratic equations, inequations, and more complex linear equations
* patterns
* straight line graphs
* rates
* simultaneous equations (computationally and graphically) in two variables and two dimensions
* parabolas – optimising solutions
* use of technology.

***This topic may contribute to assessment of:******AS1.2 (91945) Use mathematical methods to explore problems that relate to life in Aotearoa New Zealand or the Pacific (Internal – 5 credits)******And build knowledge for:******AS1.3 (91946) Interpret and apply mathematical and statistical information in context (External – 5 credits)******AS1.4 (91947) Demonstrate mathematical reasoning (External – 5 credits)*** | 10 weeks |
| **This theme integrates learning from number, measurement, geometry, and space***Students will have opportunities to:** make sense of solutions in context including different cultural contexts – *this includes:*
	+ 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 – *this includes:*
	+ 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 ideas and insights using appropriate mathematical and statistical language, symbols, and representations – *this includes:*
	+ 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 – *this includes:*
	+ 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.
 | **Theme 3: Problem solving in both real and mathematical settings**Ākonga will explore a range of learning contexts.Key areas of learning sit within measurement, number, and geometry and space, and include:* revision of Pythagoras’ theorem in two dimensions and extension into three dimensions
* use of the three standard trigonometric ratios to calculate side lengths and angles in two and three dimensions
* perimeter, area, and volume of a range of standard shapes and using these to approximate non-standard shapes
* the use of formulae to calculate volume of prisms, pyramids, cones, and spheres
* using percentages, ratios, and fractions in a range of complex scenarios, looking for optimal solutions
* planning and taking measurements in a range of scenarios, including physical and digital
* similar shapes, particularly triangles.

Suggested learning activities can be found through [TKI](https://seniorsecondary.tki.org.nz/Mathematics-and-statistics/Achievement-objectives/AOs-by-level/AO-GM6-1) and using the provided links for the other GM 6 objectives. * Teaching and learning activities from NZ Maths [Level 6 Problems (NZ Maths](https://nzmaths.co.nz/level-6-problems)).

Other web-based resources include:* [Secondary Teachers (maths.org)](https://nrich.maths.org/teacher-secondary)
* [Maths Topics (transum.org)](https://www.transum.org/Software/Transum_Topics.asp)
* [Dan Meyer's Three-Act Math Tasks (Google Drive](https://docs.google.com/spreadsheets/d/1jXSt_CoDzyDFeJimZxnhgwOVsWkTQEsfqouLWNNC6Z4/pub?output=html))
* [stem.org.uk](https://www.stem.org.uk/secondary/resources/collections/maths/secondary-maths), including their webpage that provides information on [A level mathematics subject collections (STEM Learning)](https://www.stem.org.uk/post-16/resources/collections/a-level-maths) – you will need a blend of both to reach the right curriculum level
* [High School STEM Activities for Kids (sciencebuddies.org)](https://www.sciencebuddies.org/stem-activities/subjects/high-school) (practical activities, mostly within science contexts)
* [STEM Lessons for Educators – NASA Jet Propulsion Laboratory](https://www.jpl.nasa.gov/edu/teach/tag/search/Geometry) (searchable by topic and year).

***This topic may contribute to assessment of:******AS1.2 (91945) Use mathematical methods to explore problems that relate to life in Aotearoa New Zealand or the Pacific (Internal – 5 credits)******And build knowledge for:******AS1.3 (91946) Interpret and apply mathematical and statistical information in context (External – 5 credits)******AS1.4 (91947) Demonstrate mathematical reasoning (External – 5 credits)*** | 10 weeks |
| **This theme integrates learning from algebra, geometry and space, measurement, and number.** | **Theme 4: Putting it all together (revision)**This time slot is dedicated to submission for AS1.3 activity and revision for the end-of-year examination.***This topic will build knowledge for assessment of:******AS1.4 (91947) Demonstrate mathematical reasoning (External – 5 credits)*** | 2 weeks |