MINISTRY OF EDUCATION
TE TĀHUHU O TE MĀTAURANGA

Mathematics and Statistics Learning Matrix

Curriculum Level 6

Learning Area Whakataukī:

Kei hopu tōu ringa ki te aka tāepa,	*Cling to the main vine,*
engari kia mau ki te aka matua	*not the loose one*

Big Ideas				
Critical thinking, and mathematical and statistical generalisations, emerge from te hononga of different observations, knowledges, and processes	**Tāiringa kōrero allows for elegance, creativity, and exploration of mathematical and statistical ideas**	**In Mathematics and Statistics, wānanga stimulates logical argument, investigation, analysis, and justification, supporting critical evaluation and reasoned conclusions**	**Mathematical and statistical concepts, patterns, and relationships can be represented in multiple ways**	**Mathematical and statistical methods can be used to explore, solve, or model problems while recognising variation, certainty, and uncertainty**

Significant Learning

Across all Curriculum Levels, ākonga will…

- use mātauranga Māori to make connections across all the strands of Mathematics and Statistics to help make sense of the world
- understand and appreciate the continuous, evolving history of mathematics and statistics across cultures in a variety of relevant contexts
- engage in meaningful inquiry
- explore digital technologies by using them appropriately.

At Curriculum Level 6, ākonga will…

- fluently and flexibly investigate situations
- communicate mathematical and statistical ideas and insights using appropriate mathematical and statistical language, symbols, and representations
- make sense of findings in context, including in different cultural contexts
- evaluate mathematical and statistical information, solutions, findings, and approaches from a range of perspectives
- form, use, rearrange, and solve equations, formulas, and inequalities
- explore and use relative change in two variables represented using patterns, tables, equations, and graphs
- explore, describe, and generalise properties of number, measurement, space, algebra, and probability
- explore situations involving variation using a variety of visualisations and measures
- calculate probabilities and use them to make predictions.

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Companion to the Learning Matrix for Curriculum Level 6
Mathematics and Statistics

This is further detail to help support kaiako in specific areas of the Learning Matrix.

At all times, at this level of study, learning must weave together relevant contextual information with skills. Ākonga should develop an understanding of the Big Ideas about Mathematics and Statistics through a variety of contexts which are relevant to their lives in Aotearoa New Zealand and the Pacific.

The points for consideration below will not all have the same teaching time requirements.

Italicised text is content that appears in the Learning Matrix, with the standard type giving the further detail.

- *fluently and flexibly investigate situations*
  Consider:
  - formulating questions about the situations that can be investigated. Using “What do you notice?” and “What do you wonder?” to develop further questions
  - using a range of representations including technology, models, manipulatives, drawings, symbols, equations, tables, graphs, and languages
  - using a statistical or mathematical enquiry process to collect, explore, and analyse – including but not limited to the statistical enquiry cycle Problem, Plan, Data, Analysis, Conclusion (PPDAC)
  - describing and explaining patterns, variations, trends and generalisations in context
  - using mathematics and statistics to reach conclusions, rather than single solutions.

- *communicate mathematical and statistical ideas and insights using appropriate mathematical and statistical language, symbols, and representations*
  Consider:
  - communicating findings in a way that a non-specialist audience can understand
  - following mathematical conventions, including accuracy of rounded answers using decimal places and significant figures
  - using limits of accuracy to recognise the complexity of the attribute being measured or calculated
  - using and preserving units in all calculations, including those involving derived measures and metric conversions.

- *make sense of findings 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
  - interpreting mathematical and statistical information from a variety of worldviews or perspectives
  - taking uncertainty into account when making informal predictions or inferences in Statistical investigations

- recognising that data is a taonga and care must be taken when recording, handling, storing, and presenting or publishing data.

- *evaluate mathematical and statistical information, findings, and approaches from a range of perspectives*
  Consider:
  - sources of information; the data collection process including an introduction to ethics around collection, storage, usage and reporting
  - findings; recognising assumptions and limitations, including choice of representation, alternate or best model(s), decisions about what is included or excluded, usefulness or applicability of predictions made, how widely findings might be applied.
  - approaches; appropriateness of the plan, method, or simulation, quality of the data collection and analysis, and the evidence used to support claims
  - recognising that features of sample distributions of a variable from the same population, which have the same sample size, vary from sample to sample
  - proposing relevant reasons as to why particular data or information, visualisations, and calculations can be used to support claims
  - evaluating the findings presented and claims made by the media.

- *form, use, rearrange, and solve equations, formulas, and inequalities*
  Consider:
  - rearranging, and using formulas, such as $d = \frac{1}{2}at^2$, $A = P(1 + nr)$ or $t = 2\pi\sqrt{\frac{L}{g}}$ excluding the use of logarithms
  - expanding and simplifying up to two brackets, such as $(2x^2 - 1)(x + 7)$, or $4x(x - 2) - (x - 2)$
  - factorising polynomials, including linear and quadratics where “a” is a positive integer including 1
  - forming equations and inequalities from contexts
  - solving, using a range of techniques including technology, and geometrically interpreting solutions of:
    - linear equations, including those with x on both sides, and fractions in the question and/or the solution, such as $\frac{3x}{4} = 2x - 7$
    - quadratic equations where “a” may or may not be equal to 1, excluding completing the square and use of quadratic formula
    - systems of two linear equations in two-dimensional space
    - linear inequalities, such as $3x + 6 > 6x + 12$

- *explore and use relative change in two variables represented using patterns, tables, equations, and graphs*
  Consider:
  - graphing linear, quadratic, and exponential functions from patterns, tables and equations
  - interpreting features of linear, quadratic, and exponential graphs in relation to the equation or the situation including x and y intercepts, gradient, vertex, asymptote, symmetry
  - finding the equations for linear and quadratic functions, including horizontal and vertical lines, from patterns, tables or graphs

- making links between different representations for the same model
- making comparisons between different functions.

- *explore, describe, and generalise properties of number, measurement, space, algebra, and probability*
  Consider:
  - operating with more complex rates and ratios involving metric unit conversions to solve problems, such as blood-alcohol levels, speed, heart rate, pay rates, density, scale factor or unit costs
  - operating with percentages, including expressing ratios as percentages and inverse percentage change
  - operating on very large and on very small numbers using scientific notation
  - adding, subtracting, multiplying, dividing, and finding powers and roots of fractions
  - operating on numbers with integer exponents, applying exponent rules excluding use of $\sqrt[n]{x^m}$
  - operating on algebraic fractions with numeric denominators
  - finding optimal solutions that maximise or minimise a quantity while meeting the constraints of the situation by making lists, tables, and graphs and comparing values, such as area, surface area, volume, shortest routes by time or distance, or maximising profit
  - estimating, accurately measuring, and calculating quantities using appropriate tools and formulas
  - approximating the surface area or volume of 3D objects using cylinders, pyramids, cones, spheres, and prisms consisting of more than rectangular prisms
  - converting between more complex metric units including volume, capacity, mass and derived units such as speed ($m.s^{-1}$ and $km.hr^{-1}$), unit costs (cents per gram and dollars per kg), fuel and energy consumption (L per 100 km, joules per minute), density ($kg.m^{-3}$ and $g.cm^{-3}$)
  - using properties of similar shapes to investigate changes in length, area, and volume of shapes with different scale factors
  - exploring the fixed relationships between side lengths and angles in right-angle triangles in two and three dimensions, including Pythagoras' theorem and trigonometric ratios
  - exploring chance situations with discrete random variables such as the distribution of the number of female puppies in a five-puppy litter, number of successful hoops in three free throw attempts in basketball, situations where the probability of success are unknown.

- *explore situations involving variation using a variety of visualisations and measures*
  Consider:
  - exploring a range of situations using different styles, such as relationships between numerical data, comparisons of numerical data by category, time series, probability investigations in which experimental results can be compared with theoretical models or using experiments and simulations where a theoretical model may not exist
  - collecting primary and secondary data and explaining sources of variation within the data
  - examining data sets, creating investigative questions and statements, and exploring new variables, with guidance
  - selecting, constructing, and analysing appropriate data visualisations and measures to answer investigative questions
  - investigating features, patterns and trends including, where appropriate, clusters, gaps, outliers, measures of centre and spread, shape of distribution, and position of data

  - using research to explore relevant reasons and possible explanations for identified features, patterns, and trends in relation to the context
  - making informal predictions for relationship and time-series situations using a trend line or visual inspection of the graph, justifying and evaluating the usefulness of predictions made
  - making informal inferences about populations from random sample data for comparison situations, using the ¾ - ½ rule where clear, and visually using the distance between medians as proportion of “overall visible spread” where a call is not clear.
  - designing and conducting digital simulations or straightforward experiments that demonstrate the relationship between combined conditions for events and the probability of individual events
  - exploring the impact of different sized data sets, such as: What is the effect of adding further data points to a scatter graph? What happens when the number of trials in a probability experiment is doubled? Do the same conclusions hold true for a completed comparison investigation using a bigger or smaller sample?
  - comparing theoretical distributions with experimental distributions for probability investigations noting similarities and differences, using graphs and measures, such as an imaginary two-eyed being has a combination of red, green or yellow eyes where the colours are all equally likely, and the colour of one eye is independent of the other.

- *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
  - calculating expected number and informal simple conditional probabilities from a two-way table
  - graphing, describing and calculating theoretical distributions, such as those found with combinations of fair and unfair coins, dice and spinners
  - describing key features of frequency distributions.

Some examples listed in this document have been referenced from:

Te Kete Ipurangi, Senior Secondary, AOs by level / Achievement objectives / Mathematics and statistics / Home - Senior Secondary (tki.org.nz)

Te Kete Ipurangi, nzmaths. , Homepage | NZ Maths