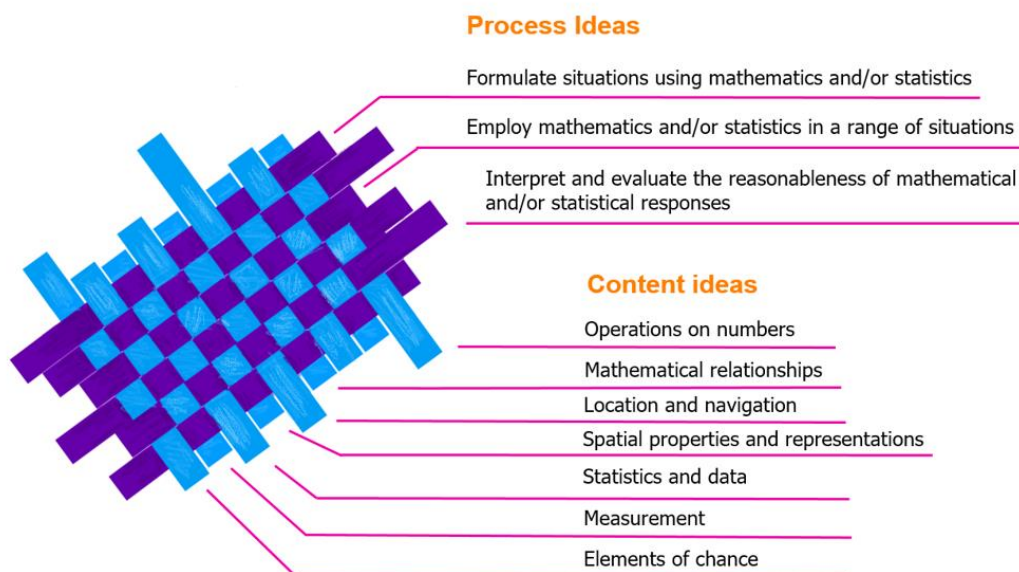# Numeracy Learning Matrix

Whiria te kaha tūātinitini, whiria te kaha tūāmanomano

This whakatauākī speaks to the many threads – academic, social, emotional, and cultural – that learners experience when they make mathematical/statistical decisions about situations in their daily lives.

These threads include the satisfaction learners experience by understanding situations using mathematics/statistics, the joy in using mathematical/statistical ideas to improve the lives of others, and the experience of mathematics/statistics as a creative and empowering human endeavour.

Being numerate in Aotearoa New Zealand today means recognition of tino rangatiratanga, where our cultural worldviews (e.g. Māori and Pasifika) influence how we weave together the many threads. This demonstrates that mathematics and statistics are bodies of knowledge created and used by people, for people, and for their communities.

The Numeracy Learning Matrix can be understood as a weaving between Process Ideas and Content Ideas, as illustrated below:

Process Ideas

Formulate situations using mathematics and/or statistics

Employ mathematics and/or statistics in a range of situations

Interpret and evaluate the reasonableness of mathematical and/or statistical responses

Content ideas

Operations on numbers

Mathematical relationships

Location and navigation

Spatial properties and representations

Statistics and data

Measurement

Elements of chance

NCEA Literacy and Numeracy

Content Ideas

1. Fluently and flexibly solve problems that require operations on numbers, understanding the relative size of those numbers, and making sense of the answer in context.
2. Recognise and work with mathematical relationships.
3. Understand and use the spatial properties and representations of objects.
4. Understand and use systems to locate and navigate.
5. Use numbers and units to measure and express attributes of objects and events as quantities, to a degree of precision appropriate to the context.
6. Understand and reason with statistics and data.
7. Use probability to interpret situations that involve elements of chance.

NCEA Literacy and Numeracy

Unpacking Numeracy

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Foundational numeracy refers to the knowledge and capabilities that enable learners to access further learning, develop important life skills, engage in employment and in their communities. In Aotearoa New Zealand, this includes an understanding of how to participate in a bicultural society.

Numerate people can interweave mathematical/statistical processes and content. This interweaving allows them to manage the mathematical and statistical demands of a range of situations, and supports them to find solutions that service others, promote innovation, empower communities, and care for our planet.

Fig.1 (on the next page) illustrates whiriwhiri – interweaving – in relation to the whakataukī.
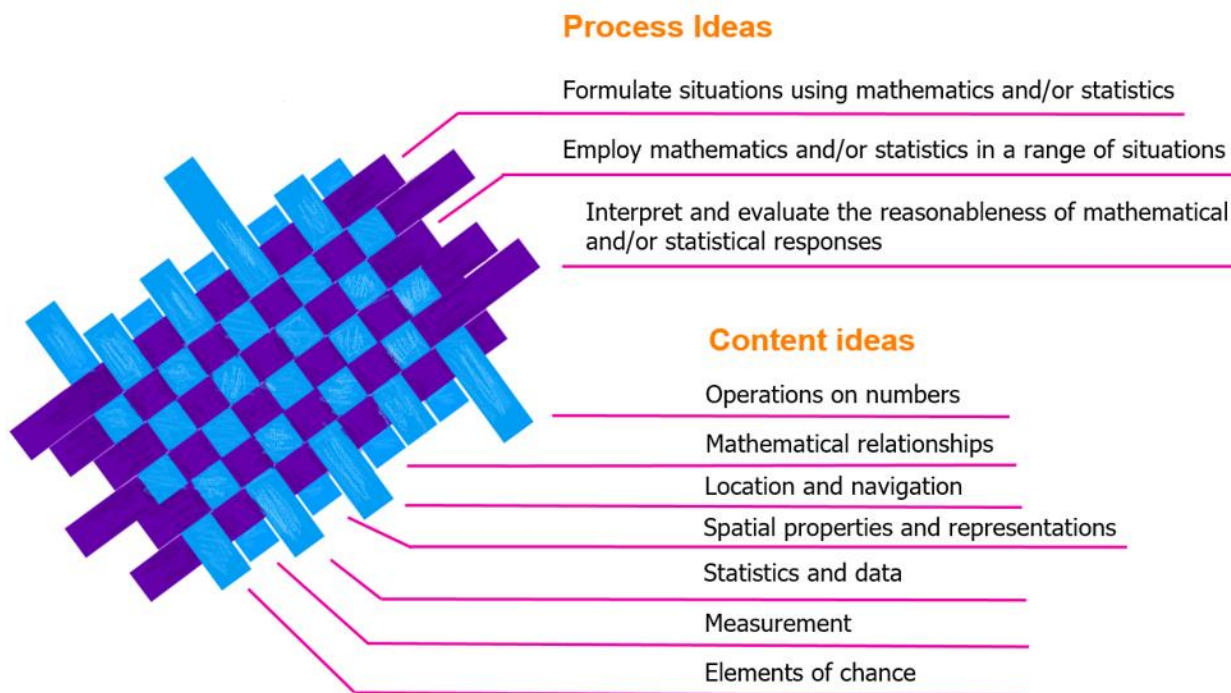
Process Ideas

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Fig. 1: Interweaving of the Process Ideas and Content Ideas

Purpose

This document accompanies the Numeracy Unit Standard and Numeracy Learning Matrix. Together, these materials outline and unpack the kaha tūātinitini and the kaha tūāmanomano – the many threads to be woven together – at the numeracy benchmark.

Frameworks

The NCEA numeracy benchmark is aligned to the following frameworks:

1. *Upper level 4 and lower level 5 of the mathematics/statistics learning area of the New Zealand Curriculum (NZC).*
   This means that learners have full mastery over Curriculum Level 4 and are ready to work at Level 5.
   This benchmark broadly aligns with scale descriptors in the range 750-850 on the PaCT scale for mathematics. The tool locates learners on a learning progression, provides exemplars of the progression, and is aligned to levels of the NZC.

2. *Upper Step 5 of the Learning Progressions for Adult Numeracy (LPAN)*
   The LPAN outlines numeracy progressions for New Zealand adults to work and participate effectively in a modern knowledge society.
   (see: https://ako.ac.nz/assets/Knowledge-centre/ALNACC-Resources/Learningprogressions/682d9852b0/Learning-progressions-numeracy.pdf)

3. *Upper level 2 and lower level 3 on the PIAAC framework*
   The Programme for the International Assessment of Adult Competencies (PIAAC) is a programme of assessment and analysis of skills required by adults to participate in the workforce, in ongoing education and in active citizenship.
   (see: https://nces.ed.gov/surveys/piaac/numproficiencylevel.asp)

Unpacking the Content Ideas for Numeracy

Learners at the benchmark can…

1. Fluently and flexibly solve problems that require operations on numbers, understanding the relative size of those numbers, and making sense of the answer in context.

This means that they:

- recognise the precision required for the context.
- choose an appropriate calculating approach (written, mental or digital).
- work with whole numbers up to billions, as well as fractions, decimals to 3 places, percentages and integers.
- Work with simple interest (although compound interest is outside the benchmark).

The problems they solve will include commonly encountered rates, ratios and powers.

The following fall outside the benchmark:

- multiplying and dividing fractions.
- negative and fractional exponents.
- properties of exponents.
- reverse percentage problems.

2. Recognise and work with mathematical relationships.

Specifically, this includes:

- linear, simple exponential and step function relationships that are represented as graphs or word rules.
- simple exponential covers situations that people encounter in everyday life, e.g. pandemics, population growth, cooling of substances.
- step functions that are commonly used, e.g. parking rates.
- recognising unknown values for a given relationship.

3. Understand and use the spatial properties and representations of objects

This includes:

- symmetry.
- transformation to design for purpose.
- making connections between representation of objects in simple 2D and 3D.

The following falls outside the benchmark:
- working with cross-sections.

4. Understand and use systems to locate and navigate.

This includes how to position and orientate themselves. It means that they:

- have a way to navigate between points.
- describe position and orientation; but
  - situations that explore this content idea must be flexible in the system being used

The following falls outside the benchmark:

- using SSW or bearings.

5. Use numbers and units to measure and express attributed of objects and events as quantities, to a degree of precision appropriate to the context.

This means that they:

- use and interpret results of the measurement (including timetables and time charts).

- select appropriate units and convert between metric measures for the same attribute.
- solve measurement problems in practical contexts (perimeter, volume (cuboids only), area (rectangles, parallelograms, triangles), mass, and temperature).

The following falls outside the benchmark:

- measurements associated with circles.

6. Understand and reason with statistics and data.

This means that they:

- recognise and use appropriate data displays to investigate questions or claims for summary, comparison, and simple time series situations.
- interpret data displays using features such as spread, clustering or frequency, centrality, and outliers.
- evaluate statements and representations made by others based on provided data.

The following fall outside the benchmark:

- sampling.
- sample to population inference.
- calculating the mean.
- gathering and organising data.

7. Use probability to interpret situations that involve elements of chance.

This means that they:

- interpret everyday probabilities such as chance and simple risk.
- use the language of probability to describe outcomes.

The following falls outside the benchmark:

- doing experiments and comparing with theoretical models.

Links to Key Competencies, Tātaiako, and Tapasā

The table below shows how the teaching and learning of numeracy is linked to current frameworks for best practice.

Process Ideas	Links to Key Competencies in the New Zealand Curriculum	Links to Tātaiako All cultural competencies should be apparent in learning for the numeracy standard.	Links to Tapasā All values and all Turu should be apparent in learning for the numeracy standard.
		Learners formulate situations that…	*Quality literacy teaching and learning…*
1. Learners formulate situations using mathematics and statistics.	**Thinking** Learners engage in thinking processes in order to access, use, and engage in mathematics and statistics for a range of situations. **Using language, symbols, and texts** Learners can interpret and use representations such as words, number, images, and symbols. **Managing self** Learners draw upon their knowledge and have skills and strategies for meeting challenges.	**Tangata Whenuatanga** Are place-based and make use of socio-cultural awareness and knowledge. **Ako** Authentically explore connections and similarities between learning at school and the wider world. **Wānanga** Ask for innovation, future thinking and planning as they relate to people's lives and goals. **Whanaungatanga** Support relationships with communities.	**Turu 1** Happens in contexts that are familiar and relevant to Pacific learners. Builds on the cultural and linguistical capital of Pacific learners, their parents, families and communities. **Turu 2** Involves and reflects the relationships with and between Pacific learners, parents, families, and communities. Uses Pacific resources, tools, references and conceptual models. **Turu 3** Recognises and values the prior knowledge that Pacific learners bring with them.
		Learners employ mathematics/statistics to embody…	*Quality literacy teaching and learning…*
2. Learners employ mathematics and statistics to meet the numeracy demands of a range of meaningful situations.	**Thinking** Learners use creative, critical, and metacognitive processes to make sense of information and apply these processes to different purposes. **Participating and contributing** Through employing mathematics and statistics for meaningful situations, learners participate in communities, and make connections with others. Communities include family, whānau, may be school-based, or based on a common interest or purpose. They may be local, national or global.	**Manaakitanga** Ethical decision-making about how we approach mathematics/statistics to address meaningful situations. **Ako** Teaching and learning using classroom situations and beyond. **Wānanga** Collaborative problem solving and communicating.	**Turu 1** Considers the full breadth of reactions, responses, and solutions to situations that are dependent on culture **Turu 2** Understands the importance of shared knowledge and the power of collaborative relationships Uses Pacific resources, tools, references and conceptual models. **Turu 3** Encourages collaborative working and learning. Ensures Pacific learners are confident and successful in both Pacific and English-medium contexts.

Process Ideas	Links to Key Competencies in the New Zealand Curriculum	Links to Tātaiako All cultural competencies should be apparent in learning for the numeracy standard.	Links to Tapasā All values and all Turu should be apparent in learning for the numeracy standard.
		Learners interpret and evaluate by…	*Quality literacy teaching and learning…*
3. Learners interpret and evaluate the reasonableness of mathematical and statistical responses.	**Thinking** Learners ask questions, draw upon personal knowledge and intuition, and challenge the basis of assumptions and perceptions. **Using language, symbols, and text** Learners recognise how choices of language, symbols, and texts affect people's understanding and the ways in which they respond to mathematics and statistics. **Managing self** Learners are capable of self-assessment. They are resourceful, reliable, and resilient. They have strategies for meeting challenges.	**Tangata Whenuatanga** Considering the impacts on identity, place, socio-cultural awareness and knowledge that may be in the mathematical/statistical situations. **Wānanga** Communicating the impact of mathematical/statistical responses to situations. A process of in-depth thinking and discussion followed by a sharing of ideas with others. **Manaakitanga** Including notions of ethics, integrity, and respectful evaluation/critiquing.	**Turu 1** Considers the full breadth of reactions, responses, and solutions to situations that are dependent on culture. **Turu 2** Understands the importance of shared knowledge and the power of collaborative relationships. **Turu 3** Considers the holistic and collective aspects of Pacific learners, families, and communities. Understands the dual and multiple contexts and world views Pacific learners navigate both in and out of the classroom.