

COOK ISLANDS

Mathematics

Curriculum

Mathematics

Achievement Objectives

March 2017

COOK ISLANDS

Mathematics Achievement Objectives

TIME ALLOCATION RECOMMENDATIONS

Being numerate and having mastery of mathematical skills are crucial to being successful in school and in life. For that reason it is important that sufficient time be allocated to mathematics to enable that foundational learning, and that the time allocated is distributed across the day and week to optimise learning.

MINIMUM TIME ALLOCATION

Levels 1, 2 and 3:

Irrespective of Grade/Year level, students who have not yet mastered Curriculum Levels 1, 2 and 3 should receive MINIMUM of 300 minutes of mathematics instruction per week with mathematics being taught 5 days a week.

At Level 1, where appropriate, the time may be allocated in smaller blocks distributed across the day, rather than a single 60 minute session.

Numeracy should be integrated wherever possible into other curriculum areas.

Levels 4 through 8

Students functioning at Levels 4 through 8 should receive a MINIMUM of 250 minutes per week with mathematics being taught 5 days per week.

Numeracy should be integrated wherever possible into other curriculum areas.

It is important that scheduling/timetabling be done with INSTRUCTIONAL EFFICACY as the focus rather than administrative convenience.

LEVEL
ONE

COOK ISLANDS

LEVEL
ONE

Mathematics Achievement Objectives

300 min/wk

By the end of Level One (*the end of Year 2 for most students*), students can:

Statistics, Measurement & Geometry should be INTEGRATED with Number & Algebra whenever possible	NUMBER & ALGEBRA (80% of Maths time)	Say, read and write, forwards & backwards, numbers in the range 0 to 100 Recall from memory all single digit addition facts up to sums of 10 and the corresponding subtraction facts Recall from memory groupings with 10, within 10 and the number of 10s in decades Use place value materials to represent two digit numbers Use advanced counting strategies to solve addition and subtraction word problems to 100 both with concrete objects and in their heads Use place value materials to form groups of tens and ones and to add or subtract using skip counting by tens first, then by ones Group sets of objects or partition shapes into equal parts and describe the parts using the words <i>half/halves, third(s), quarter(s)</i> and <i>eighth(s)</i> Read and write <i>half, third, quarter</i> and <i>eighth</i> ($1/2$, $1/3$, $1/4$ and $1/8$) as both words and symbols Make and describe patterns using materials Know number patterns with 1s, 2s, 5s and 10s Read or listen to simple addition or subtraction stories and express them using number sentences
	MEASUREMENT & GEOMETRY	Measure the length of objects using appropriate non standard units (<i>cubes, ice block sticks, hands, paper clips, etc.</i>) Compare and order objects by length, volume/capacity and weight (mass) Tell and write time in hours and half-hours using analogue clocks and name the days of the week and months of the year Sort objects by their appearance and identify, name and describe simple 2D and 3D shapes (<i>square, rectangle, triangle, pentagon, hexagon, circle, cube, cuboid, cylinder, sphere</i>) Create patterns through the use of reflection, rotation and/or repetition Use objects to show symmetry and describe symmetry in objects, pictures or nature Follow instructions that involve movement including half and quarter turns
	STATISTICS	Sort objects and count the number of objects in each category. Show the data on a tally chart and display it with simple bar graphs using manipulatives (PPDAC - Problem, Plan, Data, Analysis, Conclusion) Solve simple problems using information presented in tally charts and/or bar graphs Use everyday language to describe situations that involve chance (certain, likely, equal chance, unlikely, impossible)

NUMBER
STRATEGY
STAGE

By the end of Level One students should be working at Number Framework Strategy Stage 4

Stage 1. One-to-One counting

Stage 2. Counting on Materials

Stage 3. Counting by Imaging (in head)

Stage 4. Advanced counting

**LEVEL
TWO**

COOK ISLANDS

Mathematics Achievement Objectives

**LEVEL
TWO**

300 min/wk

By the end of Level Two (*the end of Year 4 for most students*), students can:

Statistics, Measurement & Geometry should be INTEGRATED with Number & Algebra whenever possible	NUMBER & ALGEBRA (60 — 80% of Maths time)	Say, read and write, forwards & backwards, numbers in the range 0 to 1, 000 Recall from memory all single digit addition facts up to sums of 20 and the corresponding subtraction facts Recall from memory multiplication facts for the 2, 5 and 10 times tables and the corresponding division facts Use early additive (including place value) strategies to solve addition & subtraction word problems with sums into the hundreds Use early additive strategies to solve single digit multiplication and the corresponding division word problems Use place value materials and/or number lines to represent three digit numbers and round them to the nearest ten or hundred Read, write, order and represent simple unit fractions ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$ and $\frac{1}{8}$) Use early additive strategies to find unit fractions of a region or set and solve simple division problems with remainders named by fractions Continue a number pattern and use a rule to describe it Solve simple equations in the form of missing addends or missing factors Use the mathematical symbols $<$, $>$, and $=$ in number sentences
	MEASUREMENT & GEOMETRY	Identify and use appropriate equipment to measure length, area, volume/capacity, weight (mass), time and temperature Solve problems of length, area, weight (mass) and temperature Use money in practical situations, model transactions up to \$1, 000 and give change correctly. Add money to find the total cost of at least three items Read time on both digital and analogue clocks, know and understand the number of hours in a day, days in a week and month, and weeks and months in a year Describe and classify 2D and common 3D objects (<i>square, rectangle, triangle, pentagon, hexagon, circle, cube, cuboid, cylinder, sphere, cone</i>) using appropriate terms (<i>sides, right angle, parallel, vertices, edges, faces, etc.</i>) Describe personal location and give directions using simple maps Predict and illustrate the effects of reflections and rotations on 2D shapes
	STATISTICS	Collect data and display it using a table, a pictograph and/or a bar graph (PPDAC - Problem, Plan, Data, Analysis, Conclusion) Read information from a table, a pictograph or a bar graph and use it to solve simple problems Compare and explain the likelihoods of outcomes for a simple situations involving chance (e.g. dice; spinner, etc)

**NUMBER
STRATEGY
STAGE**

By the end of Level Two students should be working at Number Framework Strategy Stage 5

Stage 4. Advanced counting

----- **Stage 5 .Early Additive-** -----

Stage 6. Advanced Additive

**LEVEL
THREE**

COOK ISLANDS

Mathematics Achievement Objectives

**LEVEL
THREE**

300min/wk

By the end of Level Three (*the end of Year 6 for most students*), students can

Statistics, Measurement & Geometry should be INTEGRATED with Number & Algebra whenever possible	NUMBER & ALGEBRA (50 — 70% of Maths time)	Say, read and write numbers in the range 0 to 1,000,000 including decimal numbers to tenths Understand the place value structure of the number system including decimal numbers to one decimal place Recall from memory all single digit addition and subtraction facts to 20 and multiplication and division facts up to 10 times tables Use advanced additive strategies to solve addition and subtraction problems including fractions with like denominators and decimal numbers to one decimal place Use early multiplicative strategies to solve whole number multiplication and division problems Round numbers sensibly for the context Know fractions and percentages in everyday use, add and subtract fractions with like denominators and find equivalent fractions Know and use the correct order of operations (BEDMAS) Generalise the properties of addition and subtraction with whole numbers. Use words, models (materials or diagrams) and symbols to record and interpret additive and simple multiplicative word problems Look at a real world pattern, present the pattern in a table and explain the rule which describes the numerical sequence
		Estimate and measure length, area, volume, mass, angle, time and temperature Estimate and calculate the perimeter and area of simple 2D shapes and the surface areas and volumes of simple 3D shapes (cuboids) Convert between units of linear measurement (millimetres centimetres, metres, kilometres) and between analogue and digital time Use basic geometrical terms or properties to describe and classify 2D and 3D objects Make, draw and classify 3D objects (<i>cube, cuboid, cylinder, sphere, cone, prisms, pyramids</i>) Describe and use a combination of reflection, rotation, translation or enlargement of shapes and be able to identify the resulting symmetries Draw and interpret simple scale maps Use a co-ordinate system or the language of direction and distance to specify locations and describe paths on a map
		Plan a simple statistical investigation, collect and display the data, and be able to describe and interpret the results (PPDAC - Problem, Plan, Data, Analysis, Conclusion) Evaluate the effectiveness of different displays in representing the findings of a statistical investigation or probability activity undertaken by others Investigate simple situations that involve elements of chance by comparing experimental results with expectations
NUMBER STRATEGY STAGE	By the end of Level Three students should be working at Number Framework Strategy Stage 6	Stage 5: Early Additive ---Stage 6: Advanced Additive — Early Multiplicative — Stage 7: Advanced Multiplicative

**LEVEL
FOUR**

COOK ISLANDS

Mathematics Achievement Objectives

**LEVEL
FOUR**

250 min/wk

By the end of Level Four (*the end of Year 8 for most students*), students can:

Statistics, Measurement & Geometry should be INTEGRATED with Number & Algebra whenever possible	NUMBER & ALGEBRA (40 – 60% of Maths time)	Find factors of numbers to 100, find prime numbers to 100 and know square numbers to 100 and the corresponding roots. Know the relative size of positive and negative integers and place value structure of whole numbers and decimals to 3 places Use a range of multiplicative strategies when operating on whole numbers Understand addition and subtraction of fractions, decimals and integers Find fractions, decimals and percentages of amounts expressed as whole numbers Apply simple linear proportions including the ordering of fractions Know the equivalent decimal and percentage forms of everyday fractions Know, understand and use the order of operations (BEDMAS) Use graphs, tables and rules to describe linear relationships found in number and spatial patterns Rearrange, simplify and solve linear equations including using substitution
	MEASUREMENT & GEOMETRY	Use appropriate scales, devices, and metric units to find length, area, volume, mass, angle, time and temperature Use side or edge lengths to find the perimeters and areas of rectangles, parallelograms, and triangles and the volumes of cuboids. Convert between units of measurement (linear, area and volume) Interpret and use scales, timetables, and charts Identify classes of 2D and 3D shapes by their geometric properties Draw two-dimensional representations of three-dimensional models, and make 3D models using 2D drawings Describe and interpret location using maps, grid references, bearing (compass direction) and distances Communicate and interpret locations and directions, using compass directions, distances, and grid references Identify and use the invariant properties of objects under transformations. (reflection, rotation, translation or enlargement)
	STATISTICS	Plan and conduct investigations using the statistical enquiry cycle (PPDAC - Problem, Plan, Data, Analysis, Conclusion) Interpret and evaluate student created and other statistical reports Conduct experiments to investigate the variation between theoretical and experimental distributions in situations that involve elements of chance Use simple fractions and percentages to describe probabilities

**NUMBER
STRATEGY
STAGE**

By the end of Level Four students should be working at Number Framework Strategy Stage 7

Stage 7: Advanced Multiplicative — Early Proportional
8: Advanced Proportional

Note: A thorough understanding of Numeracy through Stages SEVEN & EIGHT is essential for success in NCEA

LEVEL
FIVE

COOK ISLANDS

Mathematics Achievement Objectives

LEVEL
FIVE

By the end of Level Five (*the end of Year 10 for most students*), students can:

NUMBER & ALGEBRA

Use and understand prime numbers, common factors and multiples, square roots and powers

Use and understand operations with fractions, decimals, percentages and integers

Find fractions, decimals and percentages of amounts expressed as whole numbers, simple fractions and decimals

Solve problems involving rates, ratio and proportion

Know commonly used fraction, decimal and percentage conversions

Know and apply standard form, significant figures, rounding and decimal place value

Rearrange, simplify and solve linear, and simple quadratic equations

Generalize the properties of operations with fractional numbers and integers

Graph and interpret linear and simple quadratic functions

Relate tables, graphs and equations to linear and simple quadratic relationships found in number and spatial patterns and everyday situations

MEASUREMENT & GEOMETRY

Select and use appropriate units of measure to carry out practical measuring tasks in length, area, volume, mass, temperature, angle and time

Use formulae to determine the perimeters and areas of polygons, composite shapes and circles, and the surface area and volume of simple 3D objects

Convert between units of measurement using decimals

Identify and use the angle properties of intersecting and parallel lines and the angle properties of polygons

Draw nets for simple polyhedra and connect three-dimensional solids with different two-dimensional representations

Construct and describe simple loci.

Interpret points and lines on coordinate planes

Use and interpret maps using scales, grid references, bearings and distances

Define and use transformations and describe the invariant properties of figures and objects under these transformations.

Deduce Pythagoras' Theorem and apply trigonometric ratios

STATISTICS

Plan and conduct surveys and experiments using the statistical enquiry cycle (PPDAC)

Evaluate statistical investigations undertaken by others, including data collection methods, choice of measures, and validity of findings.

Compare and describe the variation between theoretical and experimental distributions in situations that involve elements of chance

Calculate probabilities using fractions, percentages and ratios.

NUMBER
STRATEGY
STAGE

By the end of Level Five students should be working at Number Framework Strategy Stage 8

--- Stage 8: Advanced Proportional ---

A thorough understanding of Numeracy through STAGE EIGHT is essential for success in NCEA

By the end of Level Six (*the end of Year 11 for most students*), students can:

NUMBER & ALGEBRA

Conduct operations using prime numbers, common factors and multiples, square roots and powers
 Extend powers to include integers and fractions
 Know and be able to explain operations with fractions, decimals, percentages and integers
 Apply direct and inverse relationships with linear proportions
 Apply everyday compounding rates
 Find optimal solutions, using numerical approaches
 Form and solve linear equations and inequations, quadratic and simple exponential equations, and simultaneous equations with two unknowns
 Generalise the properties of operations with rational numbers, including the properties of exponents
 Relate graphs, tables, and equations to linear, quadratic, and simple exponential relationships found in number and spatial patterns
 Relate rate of change to the gradient of a graph

MEASUREMENT & GEOMETRY

Measure at a level of precision appropriate to the task
 Apply the relationships between units in the metric system, including the units for measuring different attributes and derived measures
 Calculate volumes, including prisms, pyramids, cones, and spheres, using formulae
 Deduce and apply the angle properties related to circles
 Recognise when shapes are similar and use proportional reasoning to find an unknown length
 Use trigonometric ratios and Pythagoras' theorem in two and three dimensions
 Use a co-ordinate plane or map to show points in common and areas contained by two or more loci
 Compare and apply single and multiple transformations
 Analyse symmetrical patterns by the transformations used to create them

STATISTICS

Plan and conduct investigations using the statistical inquiry cycle:

- A – justifying the variables and measures used
- B – managing sources of variation, including the use of random sampling
- C – identifying and communicating features in context (trends, relationships between variables, and differences within and between distributions), using multiple displays
- D – making informal inferences about populations from sample data
- E – justifying findings, using displays and measures

Evaluate statistical reports in the media by relating the displays, statistics, processes, and probabilities used to the claims made

Investigate situations that involve elements of chance:

- A – comparing discrete theoretical distributions and experimental distributions, appreciating the role of sample size
- B – calculating probabilities in discrete situations

By the end of Level Seven (*the end of Year 12 for most students*), students can:

MATHEMATICS

Apply co-ordinate geometry techniques to points and lines

Display the graphs of linear and non-linear functions and connect the structure of the functions with their graphs

Use arithmetic and geometric sequences and series

Apply trigonometric relationships, including the sine and cosine rules, in two and three dimensions

Choose appropriate networks to find optimal solutions

Manipulate rational, exponential, and logarithmic algebraic expressions

Form and use linear, quadratic, and simple trigonometric equations

Form and use pairs of simultaneous equations, one of which may be non-linear

Sketch the graphs of functions and their gradient functions and describe the relationship between these graphs

Apply differentiation and anti-differentiation techniques to polynomials

STATISTICS

Carry out investigations of phenomena, using the statistical inquiry cycle:

- A – conducting surveys that require random sampling techniques, conducting experiments, and using existing data sets
- B – evaluating the choice of measures for variables and the sampling and data collection methods used
- C – using relevant contextual knowledge, exploratory data analysis, and statistical inference

Make inferences from surveys and experiments:

- A – making informal predictions, interpolations, and extrapolations
- B – using sample statistics to make point estimates of population parameters
- C – recognising the effect of sample size on the variability of an estimate

Evaluate statistically based reports:

- A – interpreting risk and relative risk
- B – identifying sampling and possible non-sampling errors in surveys, including polls

Investigate situations that involve elements of chance:

- A – comparing theoretical continuous distributions, such as the normal distribution, with experimental distributions
- B – calculating probabilities, using such tools as two-way tables, tree diagrams, simulations, and technology

By the end of Level Eight (*the end of year 13 for most students*), students can:

MATHEMATICS

Apply the geometry of conic sections

Display and interpret the graphs of functions with the graphs of their inverse and/or reciprocal functions

Use permutations and combinations

Use curve fitting, log modelling, and linear programming techniques

Develop network diagrams to find optimal solutions, including critical paths

Manipulate trigonometric expressions

Form and use trigonometric, polynomial, and other non-linear equations

Form and use systems of simultaneous equations, including three linear equations and three variables, and interpret the solutions in context

Manipulate complex numbers and present them graphically

Identify discontinuities and limits of functions

Choose and apply a variety of differentiation, integration, and anti-differentiation techniques to functions and relations, using both analytical and numerical methods

Form differential equations and interpret the solutions

STATISTICS

Carry out investigations of phenomena, using the statistical inquiry cycle:

- A – conducting experiments using experimental design principles, conducting surveys, and using existing data sets
- B – finding, using, and assessing appropriate models (including linear regression for bivariate data and additive models for time-series data), seeking explanations, and making predictions
- C – using informed contextual knowledge, exploratory data analysis, and statistical inference
- D – communicating findings and evaluating all stages of the cycle

Make inferences from surveys and experiments:

- A – determining estimates and confidence intervals for means, proportions, and differences, recognising the relevance of the central limit theorem
- B – using methods such as resampling or randomisation to assess the strength of evidence

Evaluate a wide range of statistically based reports, including surveys and polls, experiments, and observational studies:

- A – critiquing causal-relationship claims
- B – interpreting margins of error

Investigate situations that involve elements of chance:

- A – calculating probabilities of independent, combined, and conditional events
- B – calculating and interpreting expected values and standard deviations of discrete random variables
- C – applying distributions such as the Poisson, binomial, and normal

COOK ISLANDS

Mathematics Achievement Objectives

Acknowledgements

Sincere thanks to the following people who guided the revision of the Curriculum.

ARAURA COLLEGE Aitutaki

Simon Bragger
Nora Kitai
Tepaeru Clare Nelio
Tukumate Ngatuakana
Ana Jessie Pareonga
Michele Wellington

ARAURA PRIMARY Aitutaki

Naomi Strickland Henry
Pa Tapairu Kata
Moeroa Poaru Maro
Michelle Paerau
Kerry Lazaro Puapii
Retire Puapii
Teokotai Rota
Elizabeth Rikiau
Miringa Samuela
Barbara Toka
Kaytiana Tugaga
Teipu Turi

ARORANGI

Mairi Heather
Theresa Heather
Mama Pukeiti
Rachael Tetera
Nanai Vaevae

AVARUA

Tracey Okotai
Vaine Tangaroa

MINISTRY of EDUCATION

Kathryn Cheval
Danielle Cochrane
Ina Herrmann
Gail Townsend
Strickland Upu

NIKAO

Annie Iona
Piri Tuao Puna

NUKUTERE

“DY” Delaney Yaqona

PAPAAROA

Tetua Eliu
Metera Kureta
Tekiete Tekanene

RUTAKI

Kylie Rawiri

ST. JOSEPH

Dick Ratawake

TAKITUMU

Carly Ave
Tuakana Ave
Mariana Mataio
Tonia Taua

TE UKI OU

Jeanine Fiebig
Nat Halliday

TEREORA

Selwyn Cleland
Tarona Daniela
Tania Morgan
Teremoana Ngoau
Teaea Parima
Joel Pokura
Nga Puna
Metua Teariki
Caleb Teulilo

TEKAAROA Aitutaki

Louisa Charlie
Leah George
Mataio Karore
Pa Tapairu Kata
Eikura Turia

TITIKAVEKA

Gaylyn Lockington
Meena Buksh

VAITAU Aitutaki

Meremere Daniel
Karen MacShane
Tuaine Rota
Joanna Simiona

COOK ISLANDS

Mathematics Curriculum Review

Review of the Cook Islands Mathematics Curriculum

2016-2017

- All revisions reflect considerable practitioner input from Rarotonga, Aitutaki and Atiu
- A total of 73 people were consulted including:
 - ◊ 59 School Instructional staff (Pa Enea 31, Rarotonga 28)
 - ◊ 9 Principals (Pa Enea 5; Rarotonga 4)
 - ◊ 2 MoE mathematics advisors
 - ◊ 3 MoE administrators
- The Curriculum was compressed to 3 strands from 5 per teacher recommendations
- There is improved articulation of the Number strand to the Numeracy Framework
- There is increased emphasis on place value and fractions at the primary level
- Articulation across all Achievement Levels is significantly improved, with major revisions at levels 4 and 5 to strengthen articulation with NCEA
- Both non-mathematical and mathematical language have been simplified, where appropriate, throughout the document
- Internal consistency in wording, and word order, and ordering of the achievement objectives within the document has been improved
- Where applicable, use of parallel language to the language in the New Zealand Curriculum to facilitate electronic access to appropriate curriculum resources – including the ability to readily “hot link” to, or search for, on-line resource materials
- Levels 6 is the same as the New Zealand Achievement objectives reflecting the NCEA requirements, but with the addition of some foundational numeracy statement to improve articulation with Level 5
- Levels 7 and 8 are identical to the New Zealand Achievement objectives as they reflect the NCEA requirements.