Mathematics and Statistics

Level One

In a range of meaningful contexts, students will be engaged in knowing, doing, and thinking mathematically and statistically.

Level Two

In a range of meaningful contexts, students will be engaged in knowing, doing, and thinking mathematically and statistically.

Number and Algebra

Level One

Number strategies
- Solve problems, using a range of counting, grouping, and equal-sharing strategies with whole numbers and simple fractions.

Number knowledge
- Say, read, and write forward and backward counting sequences with whole numbers to 100;
- Know groupings with five and groupings within ten.

Equations and expressions
- Communicate and explain counting strategies, using words and pictures.

Patterns and relationships
- Recognise that the next counting number gives the result of adding one object to a set and that counting the number of objects in a set tells how many.

Level Two

Number strategies
- Solve problems, using simple additive strategies with whole numbers and fractions.

Number knowledge
- Say, read, and write forward and backward counting sequences with whole numbers to 1000.
- Say, read, and write common fractions.
- Know doubles to 20 and corresponding halves and groupings with ten.
- Classify numbers as odd or even.

Equations and expressions
- Communicate and interpret simple additive strategies represented by words, diagrams (pictures), and symbols.

Patterns and relationships
- Recognise that a number can be partitioned in multiple ways.
- Predict the number of objects that make up sequential patterns using systematic counting.

Geometry and Measurement

Level One

Measurement
- Order and compare lengths, areas, volumes (capacities), weights (masses), turns (angles), temperatures, and times, by direct comparison and/or counting whole numbers of units.

Shape
- Sort objects by their appearance.

Position and orientation
- Give and follow instructions for movement that involve distances, directions, and half/quarter turns.
- Describe their position relative to a person or object.

Transformation
- Communicate and record the results of slides, flips, and turns on plane shapes.

Level Two

Measurement
- Create and use appropriate units and devices to measure lengths, areas, volumes (capacities), weights (masses), turns (angles), temperatures, and times.
- Partition and/or combine measures additively and communicate them using numbers and units.

Shape
- Sort objects by their spatial features, with justification.
- Identify and describe the plane shapes found in objects.

Position and orientation
- Create and use simple maps to show position and direction.
- Describe different views and pathways from locations on a map.

Transformation
- Predict and communicate the results of slides, flips, turns, and enlargements on plane shapes.

Statistics

Level One

Statistical investigation (thinking)
- Conduct investigations using the statistical enquiry cycle by:
    - *posing and answering questions;*
    - *gathering, sorting and counting, and displaying category data;*
    - *discussing the results.*

Statistical literacy
- Interpret statements made from the simple category data displays of others.

Probability
- In practical, simple chance situations, predict and trial what might happen, acknowledging all the possible outcomes.

Level Two

Statistical investigation (thinking)
- Conduct investigations using the statistical enquiry cycle by:
    - *posing and answering questions;*
    - *gathering, sorting, and displaying category and discrete numeric data;*
    - *communicating findings based on the data.*

Statistical literacy
- Compare statements made about data with the features of simple data displays.

Probability
- In practical, simple chance situations, predict and trial what might happen, recognising equal and different likelihoods and acknowledging uncertainty.

Level Three

In a range of meaningful contexts, students will be engaged in knowing, doing, and thinking mathematically and statistically.

N&A · G&M · S

Level Four

In a range of meaningful contexts, students will be engaged in knowing, doing, and thinking mathematically and statistically.

N&A · G&M · S

Number and Algebra

Number strategies
- Solve problems involving whole numbers, fractions, simple decimals, and percentages, using a range of additive and simple multiplicative strategies, with an appreciation for the sensibleness of the answer.

Number knowledge
- Say, read, and write counting sequences for whole numbers.
- Say, read, and write common fractions and decimals.
- Know basic addition, subtraction, and multiplication facts.
- Know how many tenths, tens, hundreds, and thousands are in whole numbers.
- Classify numbers as whole numbers and/or fractions (decimals).

Equations and expressions
- Record and interpret additive and simple multiplicative strategies represented by words, diagrams, and symbols.

Patterns and relationships
- Generalise that numbers can be partitioned and combined additively.
- Use additive and spatial strategies to find given members of a pattern made with numbers or shapes.

Number strategies
- Solve problems, involving integers, fractions, ratios, decimals, percentages, and simple exponents, using multiplicative and simple proportional strategies, with an appreciation for the sensibleness of the answer.

Number knowledge
- Know the basic division facts and the equivalent decimal and percentage forms for common fractions.
- Classify numbers as positive or negative, and by their factors and multiples, including prime numbers.

Equations and expressions
- Communicate and interpret multiplicative and simple proportional strategies represented by words, diagrams, and symbols.
- Represent and solve problems involving linear relationships, using equations with unknowns.

Patterns and relationships
- Generalise that numbers can be partitioned and combined multiplicatively.
- Create rules and graphs to describe linear relationships.

Geometry and Measurement

Measurement
- Solve practical problems, using linear scales and whole numbers of standard (including metric) units for length, area, volume (capacity), weight (mass), angle, temperature, and time.
- Find areas and volumes from arrays of squares and cubes, using multiplication.

Shape
- Define plane shapes, prisms, pyramids, cones, and spheres by their spatial features.
- Represent objects with drawings and models.

Position and orientation
- Create and use rectangular and rotation-based co-ordinate systems to specify locations and describe paths.

Transformation
- Describe the transformation (reflection, rotation, translation, or enlargement), that has mapped one object onto another.

Measurement
- Solve practical problems that involve:
  - *selecting and using appropriate standard (including metric) units for length, area, volume (capacities), mass, temperature, angle, and time;*
  - *converting between whole numbers of units;*
  - *finding perimeters and areas of rectangles and volumes of cuboids from side or edge lengths;*
  - *interpreting and using timetables and charts.*

Shape
- Define classes of plane shapes by their geometric properties and solid shapes by their surfaces; assign shapes to these classes.
- Relate 3-dimensional models to 2-dimensional representations and vice versa.

Position and orientation
- Communicate and interpret locations and directions using bearings and grid references (ordered pairs).

Transformation
- Identify, communicate, and apply the symmetries of objects and their invariant properties under transformation.

Statistics

Statistical investigation (thinking)
- Conduct investigations using the statistical enquiry cycle by:
  - *gathering, sorting, and displaying multivariate category data, discrete numeric data and simple time-series data to answer questions;*
  - *identifying patterns and trends in context, within and between data sets;*
  - *communicating findings, using data displays.*

Statistical literacy
- Evaluate the effectiveness of different displays in representing the findings of an investigation.

Probability
- Investigate simple chance situations by comparing trial results with predictions that are based on representations of all the outcomes, acknowledging that samples vary and are independent.

Statistical investigation (thinking)
- Conduct investigations using the statistical enquiry cycle by:
  - *determining the variables to be measured;*
  - *selecting the data collection methods to be used;*
  - *gathering, sorting, and displaying multivariate category, measurement, and time-series data to detect patterns, variations, relationships, and trends;*
  - *comparing distributions visually, using notions of centrality and spread;*
  - *communicating findings, using appropriate displays.*

Statistical literacy
- Make and evaluate statements about the implications of data displays, including possible causes of variation.

Probability
- Investigate chance situations by comparing trial distributions with predictions based on finding all the possible outcomes, recognising unreasonable sample variation, and using simple fractions to describe probabilities.

Level Five

In a range of meaningful contexts, students will be engaged in knowing, doing, and thinking mathematically and statistically.

Number and Algebra
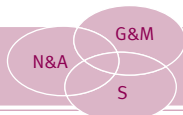
Number strategies and knowledge
- Solve problems involving integers, powers (exponents), factorials, fractions, rate (ratios), decimals, and percentages, using proportional reasoning strategies, with an appreciation for the sensibleness of the answer.
- Know commonly used fraction, decimal, and percentage conversions.
- Find common factors and multiples.
- Classify numbers as factors, multiples, powers, integers, and positive and negative fractions (decimals).

Equations and expressions
- Record and interpret proportional strategies represented by words, diagrams, and symbols.
- Form and solve linear equations.
- Manipulate simple expressions.

Patterns and relationships
- Generalise the number properties of fractions, ratios, and proportions.
- Show the structural similarity of different rules for the same linear relationship.
- Model situations by graphing linear, quadratic, and simple exponential relationships.

Geometry and Measurement

Measurement
- Solve practical problems by:
  - *measuring length, area, volume (capacity), mass, temperature, angles, and time, using appropriate units, scales, and devices;*
  - *converting between standard units, using decimals;*
  - *deducing and using formulae to find the perimeters and areas of polygons and volumes of prisms.*

Shape
- Deduce and apply the angle properties of intersecting and parallel lines and of polygons and construct simple polygons.
- Create accurate nets for simple polyhedra and connect different 2-dimensional representations of 3-dimensional solids.
- Apply trigonometric ratios and Pythagoras' theorem to right-angled triangles.

Position and orientation
- Construct and describe simple loci.
- Interpret points and lines on co-ordinate planes, including the use of scales and compass directions with maps.

Transformation
- Define and use transformations and describe their structures in terms of invariant properties.

Statistics

Statistical investigation (thinking)
- Plan and conduct surveys and experiments using the statistical enquiry cycle by:
  - *determining the variables involved and selecting appropriate measures;*
  - *considering sources of variation;*
  - *gathering and cleaning data;*
  - *selecting a range of displays and redefining categories and intervals to find patterns, variations, relationships, and trends in multivariate data sets;*
  - *comparing samples and relating them to possible populations, using measures of spread and centrality;*
  - *presenting a report of findings.*

Statistical literacy
- Evaluate the statistical processes used by others, including their sampling methods, measures of centrality and spread, and the validity of their findings.

Probability
- Investigate single-stage and multi-stage chance situations by:
  - *using fractions and ratios to predict and describe distributions from trialling;*
  - *quantifying reasonable ranges for sample variation from trial data.*

Level Six

In a range of meaningful contexts, students will be engaged in knowing, doing, and thinking mathematically and statistically.

Number and Algebra

Number strategies and knowledge
- Solve problems and model situations, including those that involve proportional reasoning, by:
  - *devising and implementing effective solution strategies that involve estimation and/or an appropriate choice of calculation methods;*
  - *scaling, converting between quantities and units, and operating on variables;*
- Classify numbers as whole, rational, integer, and irrational.

Equations and expressions
- Solve problems and model situations by:
  - *forming and solving linear equations and inequations, simultaneous equations, and simple quadratic equations;*
  - *manipulating expressions and comparing the structure of expressions.*

Patterns and relationships
- Solve problems and model situations by:
  - *forming and applying rules for linear, quadratic, and exponential relationships found in shape and number patterns;*
  - *connecting the structure of linear, quadratic, and exponential equations with their graphs and vice versa;*
  - *relate rate of change to the gradient of a graph.*

Geometry and Measurement

Measurement
- Solve problems and model situations by:
  - *measuring at a level of precision appropriate to the task, acknowledging the bounds of potential error;*
  - *applying the relationships between units in the metric system, including the units for different attributes;*
  - *calculating volumes, including prisms, pyramids, cones, and spheres, using formulae.*

Shape
- Solve problems and model situations by:
  - *deducing and applying the angle properties related to circles;*
  - *solving problems in 2 and 3 dimensions with trigonometric ratios and the properties of right triangles, including Pythagoras' theorem.*

Position and orientation
- Solve problems and model situations by using a co-ordinate plane or map to show points in common and areas contained by two or more loci .

Transformation
- Solve problems and model situations by:
  - *comparing, contrasting, and applying the structures of single and multiple transformations;*
  - *analysing symmetric patterns by the transformations used to create them.*

Statistics

Statistical investigation (thinking)
- Plan and conduct surveys and experiments using the statistical enquiry cycle by:
  - *gathering multivariate data and/or by accessing relevant datasets;*
  - *determining and justifying the attributes and measures selected, using a range of random sampling techniques;*
  - *creating multiple displays to identify and communicate trends, relationships between variables, and differences within and between distributions;*
  - *making informal inferences from sample data and communicating findings.*

Statistical literacy
- Critically evaluate statistically based information in the media by considering the measures and data displays used, the statistics calculated, and the claims made.

Probability
- Investigate practical chance situations by:
  - *estimating population parameters and theoretical probabilities from samples, acknowledging that increased sample size increases the reliability of the estimate;*
  - *calculating probabilities and expressing them as percentages.*

Level Seven	Level Eight
In a range of meaningful contexts students will be engaged in knowing, doing, and thinking mathematically and statistically.	In a range of meaningful contexts students will be engaged in knowing, doing, and thinking mathematically and statistically.

Mathematics

Level Seven

Patterns and relationships
- Solve problems and model situations by:
  - *applying co-ordinate geometry techniques to points, lines, and curves;*
  - *exploring the graphs of linear and non-linear functions and connecting the structure of the functions with their graphs and vice versa;*
  - *using arithmetic and geometric sequences and series;*
  - *applying trigonometric relationships in 2 and 3 dimensions, including the sine and cosine rules;*
  - *choosing appropriate networks to find optimal solutions.*

Equations and expressions
- Solve problems and model situations by:
  - *manipulating rational, exponential, and logarithmic algebraic expressions;*
  - *forming and using linear, quadratic, and simple trigonometric equations;*
  - *forming and using pairs of simultaneous equations, one of which may be non-linear.*

Calculus
- Solve problems and model situations by:
  - *exploring the graphs of functions and their gradient functions and describing the relationship between these graphs;*
  - *applying differentiation and anti-differentiation techniques to polynomials.*

Level Eight

Patterns and relationships
- Solve problems and model situations by:
  - *applying the geometry of conic sections;*
  - *displaying (sketching) and interpreting the graphs of inverse and/or reciprocal functions, connecting the structure of the equations with their graphs, and vice versa;*
  - *using permutations and combinations;*
  - *using curve fitting, log modelling, and linear programming techniques;*
  - *developing network diagrams to find optimal solutions, including critical paths.*

Equations and Expressions
- Solve problems and model situations by:
  - *manipulating trigonometric expressions;*
  - *forming and using trigonometric, polynomial, and other non-linear equations;*
  - *forming and using systems of simultaneous equations, including three linear equations and three variables, and interpreting the solutions in context;*
  - *manipulating complex numbers to solve equations and presenting them graphically.*

Calculus
- Solve problems and model situations by:
  - *identifying discontinuities and limits of functions, where they exist;*
  - *choosing and applying a variety of differentiation, integration, and anti-differentiation techniques to functions and relations, including both analytical and numerical methods;*
  - *forming and using differential equations and interpreting the solutions.*

Statistics

Level Seven

Statistical investigation (thinking)
- Use the statistical enquiry cycle to investigate phenomena by:
  - *conducting surveys, using randomised sampling techniques and experiments or using existing data sets;*
  - *evaluating the choice of measures for variables and the sampling and data collection methods used;*
  - *using relevant contextual knowledge, exploratory data analysis, and statistical inference.*
- Make inferences from surveys and experiments by:
  - *making informal predictions, interpolations, and extrapolations;*
  - *using sample statistics to make point estimates of population parameters;*
  - *recognising the effect of sample size on the variability of an estimate.*

Statistical literacy
- Consider statistically based claims by:
  - *interpreting risk and relative risk;*
  - *identifying possible sampling and non-sampling errors in polls and surveys.*

Probability
- Solve problems and model chance situations by:
  - *applying the normal distribution;*
  - *using Venn diagrams, tree diagrams, two-way tables, and simulations;*
  - *calculating relative risk from two-way tables;*
  - *recognising dependent, independent, and mutually exclusive events.*

Level Eight

Statistical investigation (thinking)
- Use the statistical enquiry cycle to investigate phenomena by:
  - *conducting surveys or experiments, using experimental design principles or existing data sets;*
  - *identifying and evaluating sources of variation;*
  - *finding, using, and assessing appropriate models, including linear regression for bivariate data and additive models for time-series data, to make predictions and seek explanations;*
  - *using informed contextual knowledge, exploratory data analysis, and statistical inference techniques;*
  - *communicating findings and evaluating all stages of the cycle.*
- Make inferences from surveys and experiments by:
  - *determining estimates and confidence intervals for means, proportions, and differences;*
  - *using methods such as re-sampling or randomisation to assess the strength of evidence.*

Statistical literacy
- Consider statistically based claims by:
  - *evaluating a wide range of media reports, including polls, surveys, experiments, and observational studies;*
  - *critiquing causal-relationship claims and interpreting margins of error.*

Probability
- Solve problems and model chance situations by:
  - *calculating probabilities of independent, combined, and conditional events;*
  - *calculating and interpreting expected values and variance of discrete random variables;*
  - *applying the central limit theorem;*
  - *applying the Poisson, binomial, and normal distributions.*