Mathematics Junior Achievement Standards

[Year 9 - 20 Points](#_pnjl75fsqbot)

[9.1 Number (4)](#_dngez0lwa1fy)

[9.2 Algebra (3)](#_h3xpwqm1nzh0)

[9.3 Tables, Equations and Graphs (3)](#_s428xvm5bqxe)

[9.5 Measurement (2)](#_2gp55rc1r1f1)

[9.9 Geometry (3)](#_pfuhv16dwbqc)

[9.10 Statistics (3)](#_wc4fd6ljmhd2)

[9.12 Chance and Data (2)](#_tmeisn2lj8n3)

[Year 10 - 22 Points](#_8rlsl4ib0i04)

[10.1 Number (4)](#_91sqxyclew2g)

[10.2 Algebra (3)](#_x4mrvsu663en)

[10.3 Tables, Equations and Graphs (3)](#_iojc5sq4lfay)

[10.6 Geometry (3)](#_aknytk95txle)

[10.7 Measurement, Pythagoras and Trigonometry (4)](#_msc09w5flw2x)

[10.10 Statistics (3)](#_ro8u6cmz3uen)

[10.12 Probability (2)](#_t06q2mrnmenv)

# **Year 9 - 20 Points**

## 

## 

## **9.1 Number (4)**

**Title**: Use number strategies when solving problems

**Year Level**: 9

**Assessment**: Internal

**Points**: 4

**Achievement Criteria**

|  |  |  |
| --- | --- | --- |
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Use number strategies when Solving Problems | Use number strategies, using relational thinking, when Solving Problems | Use number strategies, using extended abstract thinking, when Solving Problems |

**Explanatory Notes**

1. This achievement standard is derived from Level 4 and 5 of The New Zealand Curriculum,  
   Learning Media, Ministry of Education, 2007. The following achievement objectives, are related to this achievement standard:

* NA4.1 Use a range of multiplicative strategies when operating on whole numbers.
* NA4.2 Understand addition and subtraction of fractions, decimals, and integers.
* NA4.3 Find fractions, decimals, and percentages of amounts expressed as whole numbers, simple fractions, and decimals.
* NA4.4 Apply simple linear proportions, including ordering fractions.
* NA4.5 Know the equivalent decimal and percentage forms for everyday fractions.
* NA4.6 Know the relative size and place value structure of positive and negative integers and decimals to three places.
* NA5.1 Reason with linear proportions.
* NA5.2 Use prime numbers, common factors and multiples, and powers (including square roots).
* NA5.3 Understand operations on fractions, decimals, percentages, and integers.
* NA5.4 Use rates and ratios.
* NA5.5 Know commonly used fraction, decimal, and percentage conversions.
* NA5.6 Know and apply standard form, significant figures, rounding, and decimal place value.

1. ***Using Number Strategies*** involves

* selecting and using a range of methods in solving problems
* demonstrating knowledge of number concepts and terms
* communicating solutions which would usually require only one or two steps

***Relational Thinking*** involves one or more of:

* selecting and carrying out a logical sequence of steps
* connecting different concepts and representations
* demonstrating understanding of concepts
* forming and using a model;

and also relating findings to a context, or communicating thinking using appropriate mathematical statements.

***Extended Abstract Thinking*** involves:

* devising a strategy to investigate or solve a problem
* identifying relevant concepts in context
* developing a chain of logical reasoning, or proof
* forming a generalisation;

and also using correct mathematical statements, or communicating mathematical insight

1. The phrase ‘a range of methods’ indicates that evidence of the application of at least  
   three different methods is required
2. The skills students need to be familiar with are:
   * Addition and subtraction of fractions, integers and decimals
   * Multiplication and division of fractions, integers and decimals
   * Finding fractions, decimals and percentages of an amount
   * Ordering of fractions and decimals
   * Convert between fraction, decimal and percentage
   * Place value of integers and decimals
   * Use Rates (eg: speed)
   * Use Ratios (with 2 parts)
   * Rounding (significant figures and decimal place)
   * Convert to and from standard form
   * Identify prime numbers
   * Use common factors and multiples
   * Use powers, including square roots
3. The extension skills associated with this topic are:

* Use complex powers
* Complex Rates
* Ratios with more than 2 parts
* Non “square” roots

## 

## 

## **9.2 Algebra (3)**

**Title**: Use algebra skills when solving problems

**Year Level**: 9

**Assessment**: External

**Points**: 3

**Achievement Criteria**

|  |  |  |
| --- | --- | --- |
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Use algebra skills when solving problems | Use algebra skills, using relational thinking, when solving problems | Use algebra skills, using extended abstract thinking, when solving problems |

**Explanatory Notes**

1. This achievement standard is derived from Level 4 and 5 of The New Zealand Curriculum,  
   Learning Media, Ministry of Education, 2007. The following achievement objectives, are related to this achievement standard:
   * NA4.7 Form and solve simple linear equations.
   * NA4.8 Generalise properties of multiplication and division with whole numbers.
   * NA5.7 Form and solve linear and simple quadratic equations.
   * NA5.8 Generalise the properties of operations with fractional numbers and integers.
2. ***Using Algebra Skills*** involves

* selecting and using a range of methods in solving problems
* demonstrating knowledge of number concepts and terms
* communicating solutions which would usually require only one or two steps

***Relational Thinking*** involves one or more of:

* selecting and carrying out a logical sequence of steps
* connecting different concepts and representations
* demonstrating understanding of concepts
* forming and using a model;

and also relating findings to a context, or communicating thinking using appropriate mathematical statements.

***Extended Abstract Thinking*** involves:

* devising a strategy to investigate or solve a problem
* identifying relevant concepts in context
* developing a chain of logical reasoning, or proof
* forming a generalisation;

and also using correct mathematical statements, or communicating mathematical insight

1. The phrase ‘a range of methods’ indicates that evidence of the application of at least  
   three different methods is required
2. When solving problems implies that the concepts will be set largely in mathematical contexts, with a few real life contexts as appropriate.
3. The skills students need to be familiar with are:
   * Generalise the following number properties with algebra for whole numbers:
     + Commutativity: a + b = b + a, ab = ba
     + Distributivity: ax + bx = (a + b)x
     + Associativity: a + (b + c) = (a + b) + c, a(bc) = (ab)c
     + Inverses: a + b = c so c - b = a, ab = c so c ÷ b = a
     + Identity: a + 0 = a, a - 0 = a, a x 1 = a, a ÷ 1 = a
   * Generalise operations on fractionals algebraically based on number examples
   * Simplifying expressions by adding / subtracting like terms and multiplying / dividing terms involving variables with simple powers
   * Expanding and factorising with one bracket involving terms with simple powers
   * Form simple linear equations.   
     Simple linear equations will have two operations such as 2x+3=5 or x/2+3=5
   * Solve simple linear equations
   * Substituting into formula
4. The extension skills associated with this topic are:

* Generalise the following number properties with algebra for integers and fractions:
  + - Commutativity: a + b = b + a, ab = ba
    - Distributivity: ax + bx = (a + b)x
    - Associativity: a + (b + c) = (a + b) + c, a(bc) = (ab)c
    - Inverses: a + b = c so c - b = a, ab = c so c ÷ b = a
    - Identity: a + 0 = a, a - 0 = a, a x 1 = a, a ÷ 1 = a
* Form non-simple linear equations
* Solve non-simple linear equations

## 

## 

## **9.3 Tables, Equations and Graphs (3)**

**Title**: Use tables, equations and graphs when solving problems

**Year Level**: 9

**Assessment**: Internal

**Points**: 3

**Achievement Criteria**

|  |  |  |
| --- | --- | --- |
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Use tables, equations and graphs when solving problems | Use tables, equations and graphs, using relational thinking, when solving problems | Use tables, equations and graphs, using extended abstract thinking, when solving problems |

**Explanatory Notes**

1. This achievement standard is derived from Level 4 and 5 of The New Zealand Curriculum,  
   Learning Media, Ministry of Education, 2007. The following achievement objectives, are related to this achievement standard:

* NA4.9 Use graphs, tables, and rules to describe linear relationships found in number and spatial patterns.
* NA5.9 Relate tables, graphs, and equations to linear and simple quadratic relationships found in number and spatial patterns.

1. ***Using tables, equations and graphs*** involves

* selecting and using a range of methods in solving problems
* demonstrating knowledge of number concepts and terms
* communicating solutions which would usually require only one or two steps

***Relational Thinking*** involves one or more of:

* selecting and carrying out a logical sequence of steps
* connecting different concepts and representations
* demonstrating understanding of concepts
* forming and using a model;

and also relating findings to a context, or communicating thinking using appropriate mathematical statements.

***Extended Abstract Thinking*** involves:

* devising a strategy to investigate or solve a problem
* identifying relevant concepts in context
* developing a chain of logical reasoning, or proof
* forming a generalisation;

and also using correct mathematical statements, or communicating mathematical insight

1. The phrase ‘a range of methods’ indicates that evidence of the application of at least  
   three different methods is required
2. The patterns in this standard should be able to be found in numerical and spatial patterns
3. The skills students need to be familiar with are:
   * Drawing a linear graph from
     + A rule
     + A table
   * Creating a linear table from
     + A rule
     + A graph
   * Creating a linear rule from
     + A table
     + A graph
4. The extension skills associated with this topic are:
   * Drawing a simple quadratic graph from
     + A rule
     + A table
   * Creating a simple quadratic table from
     + A rule
     + A graph
   * Creating a simple quadratic rule from
     + A table
     + A graph
   * Recursive patterns such as the fibonacci sequence

## 

## 

## **9.5 Measurement (2)**

**Title**: Use measurement skills when solving problems

**Year Level**: 9

**Assessment**: Internal

**Points**: 2

**Achievement Criteria**

|  |  |  |
| --- | --- | --- |
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Use measurement skills when solving problems | Use measurement skills, using relational thinking, when solving problems | Use measurement skills, using extended abstract thinking, when solving problems |

**Explanatory Notes**

1. This achievement standard is derived from Level 4 and 5 of The New Zealand Curriculum,  
   Learning Media, Ministry of Education, 2007. The following achievement objectives, are related to this achievement standard:

* GM4.1 Use appropriate scales, devices, and metric units for length, area, volume and capacity, weight (mass), temperature, angle, and time.
* GM4.3 Use side or edge lengths to find the perimeters and areas of rectangles, parallelograms, and triangles and the volumes of cuboids.
* GM4.4 Interpret and use scales, timetables, and charts.
* GM5.1 Select and use appropriate metric units for length, area, volume and capacity, weight (mass), temperature, angle, and time, with awareness that measurements are approximate.
* GM5.2 Convert between metric units, using decimals.
* GM5.3 Deduce and use formulae to find the perimeters and areas of polygons and the volumes of prisms.
* GM5.4 Find the perimeters and areas of circles and composite shapes and the volumes of prisms, including cylinders.

1. ***Using measurement skills*** involves

* selecting and using a range of methods in solving problems
* demonstrating knowledge of number concepts and terms
* communicating solutions which would usually require only one or two steps

***Relational Thinking*** involves one or more of:

* selecting and carrying out a logical sequence of steps
* connecting different concepts and representations
* demonstrating understanding of concepts
* forming and using a model;

and also relating findings to a context, or communicating thinking using appropriate mathematical statements.

***Extended Abstract Thinking*** involves:

* devising a strategy to investigate or solve a problem
* identifying relevant concepts in context
* developing a chain of logical reasoning, or proof
* forming a generalisation;

and also using correct mathematical statements, or communicating mathematical insight

1. The phrase ‘a range of methods’ indicates that evidence of the application of at least  
   three different methods is required
2. The skills students need to be familiar with are:
   * Selecting appropriate units and measuring devices for length, area, volume, capacity, weight (mass), temperature, angle and time.
   * Finding the area of rectangles, parallelograms and triangles
   * Finding the volume of cuboids
   * Interpret and use scales
   * Interpret and use timetables and charts
   * Awareness that measurements are approximate
   * Convert between metric units, using decimals.
   * Deduce and use formulae to find the perimeters and areas of polygons
   * Deduce and use formulae to find the volumes of prisms.
   * Find the area of circles
   * Find the volume of cylinders
3. The extension skills associated with this topic are:
   * Understanding of limits of accuracy for different measurements.
   * Find the area of compound shapes
   * Find the volume of compound solids

## 

## 

## **9.9 Geometry (3)**

**Title**: Use geometry skills when solving problems

**Year Level**: 9

**Assessment**: Internal

**Points**: 3

**Achievement Criteria**

|  |  |  |
| --- | --- | --- |
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Use geometry skills when solving problems | Use geometry skills, using relational thinking, when solving problems | Use geometry skills, using extended abstract thinking, when solving problems |

**Explanatory Notes**

1. This achievement standard is derived from Level 4 and 5 of The New Zealand Curriculum,  
   Learning Media, Ministry of Education, 2007. The following achievement objectives, are related to this achievement standard:

* GM4.5 Identify classes of two- and three-dimensional shapes by their geometric properties.
* GM4.6 Relate three-dimensional models to two-dimensional representations, and vice versa.
* GM4.8 Use the invariant properties of figures and objects under transformations (reflection, rotation, translation, or enlargement).
* GM5.5 Deduce the angle properties of intersecting and parallel lines and the angle properties of polygons and apply these properties.
* GM5.6 Create accurate nets for simple polyhedra and connect three-dimensional solids with different two-dimensional representations.
* GM5.7 Construct and describe simple loci.
* GM5.8 Interpret points and lines on co-ordinate planes, including scales and bearings on maps.
* GM5.9 Define and use transformations and describe the invariant properties of figures and objects under these transformations.
* GM5.10 Apply trigonometric ratios and Pythagoras’ theorem in two dimensions.

1. ***Using geometry skills*** involves

* selecting and using a range of methods in solving problems
* demonstrating knowledge of number concepts and terms
* communicating solutions which would usually require only one or two steps

***Relational Thinking*** involves one or more of:

* selecting and carrying out a logical sequence of steps
* connecting different concepts and representations
* demonstrating understanding of concepts
* forming and using a model;

and also relating findings to a context, or communicating thinking using appropriate mathematical statements.

***Extended Abstract Thinking*** involves:

* devising a strategy to investigate or solve a problem
* identifying relevant concepts in context
* developing a chain of logical reasoning, or proof
* forming a generalisation;

and also using correct mathematical statements, or communicating mathematical insight

1. The phrase ‘a range of methods’ indicates that evidence of the application of at least  
   three different methods is required
2. The skills students need to be familiar with are:
   * Identify shapes by their geometric properties
   * Identify solids by their geometry properties
   * Relate three dimensional models to two dimensional representations
     + Nets (for simple polyhedra)
     + Side Views
     + Isometric Drawings
   * Use transformations (reflections, rotation, translation and enlargement)
   * Read and interpret maps
     + Scales
     + Bearings
3. The extension skills associated with this topic are:
   * Describe transformations (reflections, rotation, translation and enlargement)
   * Pythagoras in two dimensions
   * Trigonometry in two dimensions
   * Angle properties of intersecting and parallel lines
   * Angle properties of polygons.
   * Construct and describe simple loci.

## 

## 

## **9.10 Statistics (3)**

**Title**: Investigate a given data set using the statistical enquiry cycle

**Year Level**: 9

**Assessment**: Internal

**Points**: 3

**Achievement Criteria**

|  |  |  |
| --- | --- | --- |
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Investigate a given data set using the statistical enquiry cycle. | Investigate a given data set using the statistical enquiry cycle, with justification. | Investigate a given data set using the statistical enquiry cycle, with statistical insight. |

**Explanatory Notes**

1. This achievement standard is derived from Level 4 and 5 of The New Zealand Curriculum,  
   Learning Media, Ministry of Education, 2007. The following achievement objectives, are related to this achievement standard:

* S4.1 Plan and conduct investigations using the statistical enquiry cycle:
  + determining appropriate variables and data collection methods;
  + gathering, sorting, and displaying multivariate category, measurement, and time-series data to detect patterns, variations, relationships, and trends;
  + comparing distributions visually;
  + communicating findings, using appropriate displays.
* S5.1 Plan and conduct surveys and experiments using the statistical enquiry cycle:
  + determining appropriate variables and measures;
  + considering sources of variation;
  + gathering and cleaning data;
  + using multiple displays, and re-categorising data to find patterns, variations, relationships, and trends in multivariate data sets;
  + comparing sample distributions visually, using measures of centre, spread, and proportion;
  + presenting a report of findings.

1. ***Using the statistical enquiry cycle*** involves using each component of the statistical  
   enquiry cycle to make comparisons.  
     
   ***Using the statistical enquiry cycle with justification*** involves linking aspects of the  
   statistical enquiry cycle to the context and the population and making supporting  
   statements which refer to evidence such as summary statistics, data values, trends  
   or features of visual displays.  
     
   ***Using the statistical enquiry cycle with statistical insight*** involves integrating statistical  
   and contextual knowledge throughout the statistical enquiry cycle, and may involve  
   reflecting on the process or considering other explanations for the findings.
2. Students need to be familiar with the statistical enquiry cycle (PPDAC) to investigate a data set, which involves:
   * **Problem** - posing an appropriate questions that can be solved using the statistical enquiry cycle
   * **Plan** - plan what to measure or collect and how this will be done
   * **Data** - collect or find an appropriate dataset
   * **Analysis** - construct appropriate graphs, either by hand or using online tools, and make appropriate comments
   * **Conclusion** - communicating findings and supporting evidence, in a conclusion.
3. The extension skills associated with this topic are:
   * Integrating statistical and contextual knowledge throughout the statistical enquiry cycle
   * Giving alternative explanations to features in the data
   * Reflecting on the process and looking for improvements

## 

## 

## **9.12 Chance and Data (2)**

**Title**: Demonstrate understanding of chance and data

**Year Level**: 9

**Assessment**: External

**Points**: 2

**Achievement Criteria**

|  |  |  |
| --- | --- | --- |
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Demonstrate understanding of chance and data. | Demonstrate understanding of chance and data, with justification. | Demonstrate understanding of chance and data, with statistical insight. |

**Explanatory Notes**

1. This achievement standard is derived from Level 4 and 5 of The New Zealand Curriculum,  
   Learning Media, Ministry of Education, 2007. The following achievement objectives, are related to this achievement standard:

* S4.2 Evaluate statements made by others about the findings of statistical investigations and probability activities.
* S4.3 Investigate situations that involve elements of chance by comparing experimental distributions with expectations from models of the possible outcomes, acknowledging variation and independence.
* S4.4 Use simple fractions and percentages to describe probabilities.
* S5.2 Evaluate statistical investigations or probability activities undertaken by others, including data collection methods, choice of measures, and validity of findings.
* S5.3 Compare and describe the variation between theoretical and experimental distributions in situations that involve elements of chance.
* S5.4 Calculate probabilities, using fractions, percentages, and ratios.

1. ***Demonstrate understanding of chance and data*** involves using appropriate concepts and terms to demonstrate statistical and probability literacy.   
     
   ***Justifying statements and findings*** involves providing supporting evidence such as summary statistics, probabilities, data values, trends or features of visual displays, and could involve reference to the context and the population.   
     
   ***Showing statistical insight*** involves integrating statistical and contextual information and knowledge to show a deeper understanding. This may involve critical reflection on the validity of the processes and conclusions given in contexts involving probability or statistics.
2. The skills students need to be familiar with are:
   * The statistical enquiry cycle (linked to 9.10)
   * Reading and interpreting statistical tables, graphs and associated text
   * Multivariate category, measurement, and time-series data
   * Probabilities expressed as simple fractions and percentages
   * Variation and independence
   * Evaluating statements made by others
3. The extension skills associated with this topic are:
   * Comparing theoretical and experimental probabilities
   * Probabilities expressed as ratios

# 

# 

# **Year 10 - 22 Points**

## 

## 

## **10.1 Number (4)**

**Title**: Use number strategies when solving problems

**Year Level**: 10

**Assessment**: Internal

**Points**: 4

**Achievement Criteria**

|  |  |  |
| --- | --- | --- |
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Use number strategies when solving problems | Use number strategies, using relational thinking, when solving problems | Use number strategies, using extended abstract thinking, when solving problems |

**Explanatory Notes**

1. This achievement standard is derived from Level 4 and 5 of The New Zealand Curriculum,  
   Learning Media, Ministry of Education, 2007. The following achievement objectives, are related to this achievement standard:

* NA5.1 Reason with linear proportions.
* NA5.2 Use prime numbers, common factors and multiples, and powers (including square roots).
* NA5.3 Understand operations on fractions, decimals, percentages, and integers.
* NA5.4 Use rates and ratios.
* NA5.5 Know commonly used fraction, decimal, and percentage conversions.
* NA5.6 Know and apply standard form, significant figures, rounding, and decimal place value.
* NA6.1 Apply direct and inverse relationships with linear proportions.
* NA6.2 Extend powers to include integers and fractions.
* NA6.3 Apply everyday compounding rates.
* NA6.4 Find optimal solutions, using numerical approaches.

1. ***Using Number Strategies*** involves

* selecting and using a range of methods in solving problems
* demonstrating knowledge of number concepts and terms
* communicating solutions which would usually require only one or two steps

***Relational Thinking*** involves one or more of:

* selecting and carrying out a logical sequence of steps
* connecting different concepts and representations
* demonstrating understanding of concepts
* forming and using a model;

and also relating findings to a context, or communicating thinking using appropriate mathematical statements.

***Extended Abstract Thinking*** involves:

* devising a strategy to investigate or solve a problem
* identifying relevant concepts in context
* developing a chain of logical reasoning, or proof
* forming a generalisation;

and also using correct mathematical statements, or communicating mathematical insight

1. The phrase ‘a range of methods’ indicates that evidence of the application of at least  
   three different methods is required
2. The skills students need to be familiar with are:
   * Addition and subtraction of fractions, integers and decimals
   * Multiplication and division of fractions, integers and decimals
   * Finding fractions, decimals and percentages of an amount
   * Convert between fraction, decimal and percentage
   * Place value of integers and decimals
   * Use Rates
   * Use Ratios with two or more parts
   * Rounding (significant figures and decimal place)
   * Convert to and from standard form
   * Identify prime numbers
   * Use common factors and multiples
   * Use powers, including square roots
3. The extension skills associated with this topic are:

* Extend powers to include integers and fractions
* Apply everyday compounding rates
* Find optimal solutions using numerical approaches

## 

## 

## **10.2 Algebra (3)**

**Title**: Use algebra skills when solving problems

**Year Level**: 10

**Assessment**: External

**Points**: 3

**Achievement Criteria**

|  |  |  |
| --- | --- | --- |
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Use algebra skills when solving problems | Use algebra skills, using relational thinking, when solving problems | Use algebra skills, using extended abstract thinking, when solving problems |

**Explanatory Notes**

1. This achievement standard is derived from Level 4 and 5 of The New Zealand Curriculum,  
   Learning Media, Ministry of Education, 2007. The following achievement objectives, are related to this achievement standard:
   * NA5.7 Form and solve linear and simple quadratic equations.
   * NA5.8 Generalise the properties of operations with fractional numbers and integers.
   * NA6.5 Form and solve linear equations and inequations, quadratic and simple exponential equations, and simultaneous equations with two unknowns.
   * NA6.6 Generalise the properties of operations with rational numbers, including the properties of exponents.
2. ***Using Algebra Skills*** involves

* selecting and using a range of methods in solving problems
* demonstrating knowledge of number concepts and terms
* communicating solutions which would usually require only one or two steps

***Relational Thinking*** involves one or more of:

* selecting and carrying out a logical sequence of steps
* connecting different concepts and representations
* demonstrating understanding of concepts
* forming and using a model;

and also relating findings to a context, or communicating thinking using appropriate mathematical statements.

***Extended Abstract Thinking*** involves:

* devising a strategy to investigate or solve a problem
* identifying relevant concepts in context
* developing a chain of logical reasoning, or proof
* forming a generalisation;

and also using correct mathematical statements, or communicating mathematical insight

1. The phrase ‘a range of methods’ indicates that evidence of the application of at least  
   three different methods is required
2. When solving problems implies that the concepts will be set largely in mathematical contexts, with a few real life contexts as appropriate.
3. The skills students need to be familiar with are:
   * Generalise the following number properties with algebra for integers and fractions:
     + Commutativity: a + b = b + a, ab = ba
     + Distributivity: ax + bx = (a + b)x
     + Associativity: a + (b + c) = (a + b) + c, a(bc) = (ab)c
     + Inverses: a + b = c so c - b = a, ab = c so c ÷ b = a
     + Identity: a + 0 = a, a - 0 = a, a x 1 = a, a ÷ 1 = a
   * Generalise operations on fractionals algebraically based on number examples
   * Simplifying expressions by adding / subtracting like terms and multiplying / dividing terms involving variables with simple powers
   * Expanding and factorising with one bracket involving terms with simple powers
   * Form linear equations.
   * Solve linear equations
   * Substituting into formula
   * Form simple quadratic equations of the form x2+bx+c=d or (x-a)(x-b)=d
   * Solve simple quadratic equations of the form x2+bx+c=d or (x-a)(x-b)=d
   * Solve simultaneous equations with two unknowns
4. The extension skills associated with this topic are:

* Form non-simple quadratic equations of the form c(x-a)(x-b)=d
  + Solve non-simple quadratic equations of the form c(x-a)(x-b)=d
  + Form simple exponential equations
  + Solve simple exponential equations
  + Simplify fractional exponents
  + Form simultaneous equations with two unknowns
* NA5.7 Form and solve linear and simple quadratic equations.
* NA5.8 Generalise the properties of operations with fractional numbers and integers.
* NA6.6 Generalise the properties of operations with rational numbers, including the properties of exponents.

## 

## 

## **10.3 Tables, Equations and Graphs (3)**

**Title**: Use tables, equations and graphs when solving problems

**Year Level**: 10

**Assessment**: Internal

**Points**: 3

**Achievement Criteria**

|  |  |  |
| --- | --- | --- |
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Use tables, equations and graphs when solving problems | Use tables, equations and graphs, using relational thinking, when solving problems | Use tables, equations and graphs, using extended abstract thinking, when solving problems |

**Explanatory Notes**

1. This achievement standard is derived from Level 4 and 5 of The New Zealand Curriculum,  
   Learning Media, Ministry of Education, 2007. The following achievement objectives, are related to this achievement standard:
   * NA5.9 Relate tables, graphs, and equations to linear and simple quadratic relationships found in number and spatial patterns.
   * NA6.5 Form and solve simultaneous equations with two unknowns.
   * NA6.7 Relate graphs, tables, and equations to linear, quadratic, and simple exponential relationships found in number and spatial patterns.
   * NA6.8 Relate rate of change to the gradient of a graph.
2. ***Using tables, equations and graphs*** involves

* selecting and using a range of methods in solving problems
* demonstrating knowledge of number concepts and terms
* communicating solutions which would usually require only one or two steps

***Relational Thinking*** involves one or more of:

* selecting and carrying out a logical sequence of steps
* connecting different concepts and representations
* demonstrating understanding of concepts
* forming and using a model;

and also relating findings to a context, or communicating thinking using appropriate mathematical statements.

***Extended Abstract Thinking*** involves:

* devising a strategy to investigate or solve a problem
* identifying relevant concepts in context
* developing a chain of logical reasoning, or proof
* forming a generalisation;

and also using correct mathematical statements, or communicating mathematical insight

1. The phrase ‘a range of methods’ indicates that evidence of the application of at least  
   three different methods is required
2. The patterns in this standard should be able to be found in numerical and spatial patterns
3. The skills students need to be familiar with are:
   * Drawing a linear graph from
     + A rule
     + A table
   * Creating a linear table from
     + A rule
     + A graph
   * Creating a linear rule from
     + A table
     + A graph
   * Finding the intersection of two linear patterns
4. The extension skills associated with this topic are:
   * Drawing a simple quadratic graph from
     + A rule
     + A table
   * Creating a simple quadratic table from
     + A rule
     + A graph
   * Creating a simple quadratic rule from
     + A table
     + A graph
   * Recursive patterns such as the fibonacci sequence
   * Finding the intersection of two non-linear patterns

## 

## **10.6 Geometry (3)**

**Title**: Use geometry skills when solving problems

**Year Level**: 10

**Assessment**: Internal

**Points**: 3

**Achievement Criteria**

|  |  |  |
| --- | --- | --- |
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Use geometry skills when solving problems | Use geometry skills, using relational thinking, when solving problems | Use geometry skills, using extended abstract thinking, when solving problems |

**Explanatory Notes**

1. This achievement standard is derived from Level 4 and 5 of The New Zealand Curriculum,  
   Learning Media, Ministry of Education, 2007. The following achievement objectives, are related to this achievement standard:

* GM4.5 Identify classes of two- and three-dimensional shapes by their geometric properties.
* GM4.6 Relate three-dimensional models to two-dimensional representations, and vice versa.
* GM4.8 Use the invariant properties of figures and objects under transformations (reflection, rotation, translation, or enlargement).
* GM5.5 Deduce the angle properties of intersecting and parallel lines and the angle properties of polygons and apply these properties.
* GM5.6 Create accurate nets for simple polyhedra and connect three-dimensional solids with different two-dimensional representations.
* GM5.7 Construct and describe simple loci.
* GM5.8 Interpret points and lines on co-ordinate planes, including scales and bearings on maps.
* GM5.9 Define and use transformations and describe the invariant properties of figures and objects under these transformations.

1. ***Using geometry skills*** involves

* selecting and using a range of methods in solving problems
* demonstrating knowledge of number concepts and terms
* communicating solutions which would usually require only one or two steps

***Relational Thinking*** involves one or more of:

* selecting and carrying out a logical sequence of steps
* connecting different concepts and representations
* demonstrating understanding of concepts
* forming and using a model;

and also relating findings to a context, or communicating thinking using appropriate mathematical statements.

***Extended Abstract Thinking*** involves:

* devising a strategy to investigate or solve a problem
* identifying relevant concepts in context
* developing a chain of logical reasoning, or proof
* forming a generalisation;

and also using correct mathematical statements, or communicating mathematical insight

1. The phrase ‘a range of methods’ indicates that evidence of the application of at least  
   three different methods is required
2. The skills students need to be familiar with are:
   * Relate three dimensional models to two dimensional representations
     + Nets (for simple polyhedra)
     + Side Views
     + Isometric Drawings
   * Compare and apply single and multiple transformations.
   * Describe transformations (reflections, rotation, translation and enlargement)
   * Read and interpret maps
     + Scales
     + Bearings
   * Angle properties of intersecting and parallel lines
   * Angle properties of polygons.
3. The extension skills associated with this topic are:
   * Angle properties of circles.
   * Construct and describe simple loci.
   * Use a co-ordinate plane or map to show points in common and areas contained by two or more loci.
   * Use proportional reasoning to find an unknown length.
   * Analyse symmetrical patterns by the transformations used to create them.

## 

## 

## **10.7 Measurement, Pythagoras and Trigonometry (4)**

**Title**: Use measurement, pythagoras and trigonometry when solving problems

**Year Level**: 9

**Assessment**: Internal

**Points**: 2

**Achievement Criteria**

|  |  |  |
| --- | --- | --- |
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Use measurement, pythagoras and trigonometry when solving problems | Use measurement, pythagoras and trigonometry, using relational thinking, when solving problems | Use measurement, pythagoras and trigonometry, using extended abstract thinking, when solving problems |

**Explanatory Notes**

1. This achievement standard is derived from Level 4 and 5 of The New Zealand Curriculum,  
   Learning Media, Ministry of Education, 2007. The following achievement objectives, are related to this achievement standard:

* GM5.1 Select and use appropriate metric units for length, area, volume and capacity, weight (mass), temperature, angle, and time, with awareness that measurements are approximate.
* GM5.2 Convert between metric units, using decimals.
* GM5.3 Deduce and use formulae to find the perimeters and areas of polygons and the volumes of prisms.
* GM5.4 Find the perimeters and areas of circles and composite shapes and the volumes of prisms, including cylinders.
* GM5.10 Apply trigonometric ratios and Pythagoras’ theorem in two dimensions.
* GM6.1 Measure at a level of precision appropriate to the task.
* GM6.2 Apply the relationships between units in the metric system, including the units for measuring different attributes and derived measures.
* GM6.3 Calculate volumes, including prisms, pyramids, cones, and spheres, using formulae.
* GM6.6 Use trigonometric ratios and Pythagoras’ theorem in two and three dimensions.

1. ***Using measurement, pythagoras and trigonometry*** involves

* selecting and using a range of methods in solving problems
* demonstrating knowledge of number concepts and terms
* communicating solutions which would usually require only one or two steps

***Relational Thinking*** involves one or more of:

* selecting and carrying out a logical sequence of steps
* connecting different concepts and representations
* demonstrating understanding of concepts
* forming and using a model;

and also relating findings to a context, or communicating thinking using appropriate mathematical statements.

***Extended Abstract Thinking*** involves:

* devising a strategy to investigate or solve a problem
* identifying relevant concepts in context
* developing a chain of logical reasoning, or proof
* forming a generalisation;

and also using correct mathematical statements, or communicating mathematical insight

1. The phrase ‘a range of methods’ indicates that evidence of the application of at least  
   three different methods is required
2. The skills students need to be familiar with are:
   * Selecting appropriate units and measuring devices for length, area, volume, capacity, weight (mass), temperature, angle and time.
   * Awareness that measurements are approximate
   * Convert between metric units, using decimals.
   * Deduce and use formulae to find the perimeters and areas of polygons
   * Deduce and use formulae to find the volumes of prisms.
   * Find the area of circles
   * Find the volume of cylinders
   * Use pythagoras in two dimensions3
   * Measure at a level of precision appropriate to the task.
3. The extension skills associated with this topic are:
   * Understanding of limits of accuracy for different measurements.
   * Find the area of compound shapes
   * Find the volume of compound solids
   * Calculate volumes, including prisms, pyramids, cones, and spheres, using formulae.
   * Use trigonometry in two dimensions

* GM6.3
* GM6.6 Use trigonometric ratios and Pythagoras’ theorem in two and three dimensions.

## 

## 

## **10.10 Statistics (3)**

**Title**: Investigate a given data set using the statistical enquiry cycle

**Year Level**: 10

**Assessment**: Internal

**Points**: 3

**Achievement Criteria**

|  |  |  |
| --- | --- | --- |
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Investigate a given data set using the statistical enquiry cycle. | Investigate a given data set using the statistical enquiry cycle, with justification. | Investigate a given data set using the statistical enquiry cycle, with statistical insight. |

**Explanatory Notes**

1. This achievement standard is derived from Level 4 and 5 of The New Zealand Curriculum,  
   Learning Media, Ministry of Education, 2007. The following achievement objectives, are related to this achievement standard:

* S5.1 Plan and conduct surveys and experiments using the statistical enquiry cycle:
  + determining appropriate variables and measures;
  + considering sources of variation;
  + gathering and cleaning data;
  + using multiple displays, and re-categorising data to find patterns, variations, relationships, and trends in multivariate data sets;
  + comparing sample distributions visually, using measures of centre, spread, and proportion;
  + presenting a report of findings.
* S5.2 Evaluate statistical investigations or probability activities undertaken by others, including data collection methods, choice of measures, and validity of findings.
* S6.1 Plan and conduct investigations using the statistical enquiry cycle:
  + justifying the variables and measures used;
  + managing sources of variation, including through the use of random sampling;
  + Identifying and communicating features in context (trends, relationships between variables, and differences within and between distributions), using multiple displays;
  + making informal inferences about populations from sample data;
  + justifying findings, using displays and measures.
* S6.2 Evaluate statistical reports in the media by relating the displays, statistics, processes, and probabilities used, to the claims made.

1. ***Using the statistical enquiry cycle*** involves using each component of the statistical  
   enquiry cycle to make comparisons.  
     
   ***Using the statistical enquiry cycle with justification*** involves linking aspects of the  
   statistical enquiry cycle to the context and the population and making supporting  
   statements which refer to evidence such as summary statistics, data values, trends  
   or features of visual displays.  
     
   ***Using the statistical enquiry cycle with statistical insight*** involves integrating statistical  
   and contextual knowledge throughout the statistical enquiry cycle, and may involve  
   reflecting on the process or considering other explanations for the findings.
2. Students need to be familiar with the statistical enquiry cycle (PPDAC) to investigate a data set, which involves:
   * **Problem** - posing an appropriate questions that can be solved using the statistical enquiry cycle
   * **Plan** - plan what to measure or collect and how this will be done
   * **Data** - collect or find an appropriate dataset
   * **Analysis** - construct appropriate graphs, either by hand or using online tools, and make appropriate comments
   * **Conclusion** - communicating findings and supporting evidence, in a conclusion.
3. The extension skills associated with this topic are:
   * Integrating statistical and contextual knowledge throughout the statistical enquiry cycle
   * Giving alternative explanations to features in the data
   * Reflecting on the process and looking for improvements

## 

## 

## **10.12 Probability (2)**

**Title**: Demonstrate understanding of chance and data

**Year Level**: 10

**Assessment**: External

**Points**: 2

**Achievement Criteria**

|  |  |  |
| --- | --- | --- |
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Demonstrate understanding of chance and data. | Demonstrate understanding of chance and data, with justification. | Demonstrate understanding of chance and data, with statistical insight. |

**Explanatory Notes**

1. This achievement standard is derived from Level 4 and 5 of The New Zealand Curriculum,  
   Learning Media, Ministry of Education, 2007. The following achievement objectives, are related to this achievement standard:

* S5.3 Compare and describe the variation between theoretical and experimental distributions in situations that involve elements of chance.
* S5.4 Calculate probabilities, using fractions, percentages, and ratios.
* S6.3 Investigate situations that involve elements of chance:
  + comparing discrete theoretical distributions and experimental distributions, appreciating the role of sample size;
  + calculating probabilities in discrete situations.

1. ***Demonstrate understanding of chance and data*** involves using appropriate concepts and terms to demonstrate statistical and probability literacy.   
     
   ***Justifying statements and findings*** involves providing supporting evidence such as summary statistics, probabilities, data values, trends or features of visual displays, and could involve reference to the context and the population.   
     
   ***Showing statistical insight*** involves integrating statistical and contextual information and knowledge to show a deeper understanding. This may involve critical reflection on the validity of the processes and conclusions given in contexts involving probability or statistics.
2. The skills students need to be familiar with are:
   * The statistical enquiry cycle (linked to 9.10)
   * Reading and interpreting statistical tables, graphs and associated text
   * Multivariate category, measurement, and time-series data
   * Probabilities expressed as fractions, percentages and ratios
   * Variation and independence
   * Evaluating statements made by others
3. The extension skills associated with this topic are:
   * Comparing theoretical and experimental probabilities
   * Calculating probabilities in discrete situations.