**Stage 1 Mathematics Subjects Implementation**

Workshop Booklet

2015



Ref: A463194, July 2015

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CONTENTS

Assessment Overview: Stage 1 and Stage 2 mathematics subjects 1

Stage 1 Assessment Design Criteria and Specific Features 4

Stage 1 Performance Standards 5

Topic Overview: Stage 1 and Stage 2 mathematics subjects 8

Learning and Assessment Plan Form 11

Stage 1 Mathematics 13

Program 1 (pre-Mathematical Methods) - Semester 1 13

Program 1 (pre-Mathematical Methods) - Semester 2 17

Program 1 Learning and Assessment Plan - Semester 1 21

Program 1 Learning and Assessment Plan - Semester 2 22

Program 1 Task - Assessment Type 2: Polynomials Features 23

Program 1 Task - Assessment Type 2: Optimisation - Cake Tin 25

Program 2 (pre-Specialist Mathematics) - Semester 1 28

Program 2 (pre-Specialist Mathematics) - Semester 2 31

Program 2 Learning and Assessment Plan - Semester 1 33

Program 2 Learning and Assessment Plan - Semester 2 34

Program 2 Task - Assessment Type 2: Tower Proofs 35

Program 2 Task - Assessment Type 2: Matrices – Cipher 38

Stage 1 General Mathematics 41

Program 1 (General Mathematics) - Semester 1 41

Program 1 (General Mathematics) - Semester 2 44

Program 1 Learning and Assessment Plan - Semester 1 47

Program 1 Learning and Assessment Plan - Semester 2 48

Program 1 Task - Assessment Type 2: Chess Set 49

Program 1 Task - Assessment Type 2: Networks Investigation 51

Stage 1 Essential Mathematics 53

Program 1 (Numeracy Focus) - One Semester 53

Program 1 Learning and Assessment Plan 56

Program 1 Task 1 - Assessment Type 1: Calculations, Time, and Ratio 57

Program 1 Task 2 - Assessment Type 2: Earning 60

Program 1 Task 3 - Assessment Type 2: Scale Diagram 63

Program 2 (Trade Focus) - Semester 1 65

Program 2 (Trade Focus) - Semester 2 69

Program 2 Learning and Assessment Plan - Semester 1 73

Program 2 Learning and Assessment Plan - Semester 2 74

Program 2 Task 1 - Assessment Type 2: Rates 75

Program 2 Task 2 - Assessment Type 2: Novelty Packaging 77

Program 2 Task 1 - Assessment Type 2: Consistency in Baking 79

Program 2 Task 2 - Assessment Type 2: Design and Cost a Deck 81

| **Assessment Overview: Stage 1 mathematics subjects from 2016** | | |
| --- | --- | --- |
| *Subject* | *Assessment Type 1* | *Assessment Type 2* |
| Stage 1 Mathematics | **Skills and Applications Tasks**   * At least *two* SATs (10-credit) * At least *four* SATs (20-credit) | **Mathematical Investigation**   * At least *one* mathematical investigation (10-credit) * At least *two* mathematical investigations (20-credit) * maximum of 8 A4 pages if written, or the equivalent in multimodal form |
| Stage 1 General Mathematics | **Skills and Applications Tasks**   * At least *two* SATs (10-credit) * At least *four* SATs (20-credit) | **Mathematical Investigation**   * At least *one* mathematical investigation (10-credit) * At least *two* mathematical investigations (20-credit) * maximum of 8 A4 pages if written, or the equivalent in multimodal form |
| Stage 1 Essential Mathematics | **Skills and Applications Tasks**   * At least *two* SATs (10-credit) * At least *four* SATs (20-credit) | **Folio**   * At least *one* folio task (10-credit) * At least *two* folio tasks (20-credit) * maximum of 6 A4 pages if written, or the equivalent in multimodal form |

***Notes:***

* Number of Assessments: Four assessments for a 10-credit subject; eight assessments for a 20-credit subject.
* AT1: Skills and Applications Tasks: The use of calculators and notes is at the teacher’s discretion.
* AT2: Mathematical Investigation/Folio: The maximum page limit is for single-sided A4 pages with minimum font size 10. Page reduction such as 2 A4 reduced to fit on 1 A4 is not acceptable.
* Each Assessment Type minimum weighting of 20%.

| **Assessment Overview: Stage 2 mathematics subjects from 2017** | | | |
| --- | --- | --- | --- |
| *Subject* | *School Assessment:*  *Assessment Type 1* | *School Assessment:*  *Assessment Type 2* | *External Assessment:*  *Assessment Type 3* |
| Stage 2 Mathematical Methods | **Skills and Applications Tasks (50%)**   * *Six* SATs * Equivalent of 1 SAT without the use of a calculator or notes | **Mathematical Investigation (20%)**   * *One* mathematical investigation * Maximum of 15 A4 pages | **Examination (30%) – 3 hours**   * *with access to approved electronic technology* * *2 unfolded A4 sheets handwritten notes (i.e. 4 sides of sheets)* |
| Stage 2 Specialist Mathematics | **Skills and Applications Tasks (50%)**   * *Six* SATs * Equivalent of 1 SAT without the use of a calculator or notes | **Mathematical Investigation (20%)**   * *One* mathematical investigation * Maximum of 15 A4 pages | **Examination (30%) – 3 hours**   * *with access to approved electronic technology* * *2 unfolded A4 sheets handwritten notes (i.e. 4 sides of sheets)* |
| Stage 2 General Mathematics | **Skills and Applications Tasks (40%)**   * *Five* SATs * at least 1 from each of the 2 non-examined topics (one of which maybe the open topic if selected) * Equivalent of 1 SAT without the use of a calculator or notes | **Mathematical Investigation (30%)**   * *Two* mathematical investigations * Maximum of 12 A4 pages | **Examination (30%) – 2 hours**   * *3 specified topics only* * *with access to approved electronic technology* * *1 unfolded A4 sheet handwritten notes (i.e. 2 sides of sheet)* |
| Stage 2 Essential Mathematics | **Skills and Applications Tasks (30%)**   * *Four* SATs * at least 1 from each of the 2 non-examined topics (one of which may be the open topic if selected) * Equivalent of 1 SAT without the use of a calculator or notes | **Folio (40%)**   * *Three* folio tasks * Maximum of 8 A4 pages | **Examination (30%) – 2 hours**   * *3 specified topics only* * *with access to approved electronic technology* * *1 unfolded A4 sheet handwritten notes (i.e. 2 sides of sheet)* |

***Notes:***

* AT2: Mathematical Investigation/Folio: The maximum page limit for an assessment is for single-sided A4 pages with minimum font size 10. Page reduction such as 2 A4 reduced to fit on 1 A4 is not acceptable.

**Stage 1 Assessment Design Criteria and Specific Features**

The assessment design criteria are based on the learning requirements and are used by teachers to:

* clarify for the student what he or she needs to learn
* design opportunities for the student to provide evidence of his or her learning at the highest level of achievement.

The assessment design criteria consist of specific features that:

* students need to demonstrate in their evidence of learning
* teachers look for as evidence that students have met the learning requirements.

The set of assessments, as a whole give students opportunities to demonstrate each of the specific features by the completion of study of the subject.

|  |  |  |  |
| --- | --- | --- | --- |
| **Mathematics** | | | |
| **Concepts and Techniques** | | **Reasoning and Communication** | |
| CT1 | Knowledge and understanding of concepts and relationships | RC1 | Interpretation of mathematical results |
| CT2 | Selection and application of mathematical techniques and algorithms to find solutions to problems in a variety of contexts | RC2 | Drawing conclusions from mathematical results, with an understanding of their  reasonableness and limitations |
| CT3 | Application of mathematical models | RC3 | Use of appropriate mathematical notation, representations, and terminology |
| CT4 | Use of electronic technology to find solutions to mathematical problems | RC4 | Communication of mathematical ideas and reasoning to develop logical arguments |
| RC5 | Development and testing of valid conjectures |

|  |  |  |  |
| --- | --- | --- | --- |
| **General Mathematics** | | | |
| **Concepts and Techniques** | | **Reasoning and Communication** | |
| CT1 | Knowledge and understanding of concepts and relationships | RC1 | Interpretation of mathematical results |
| CT2 | Selection and application of mathematical techniques and algorithms to find solutions to problems in a variety of contexts | RC2 | Drawing conclusions from mathematical results, with an understanding of their  reasonableness and limitations |
| CT3 | Application of mathematical models | RC3 | Use of appropriate mathematical notation, representations, and terminology |
| CT4 | Use of electronic technology to find solutions to mathematical problems | RC4 | Communication of mathematical ideas and reasoning to develop logical arguments |
|  |  | RC5 | Forming and testing of predictions\* |

*\* In this subject the forming and testing of predictions (RC5) is not intended to include formal mathematical proof*

|  |  |  |  |
| --- | --- | --- | --- |
| **Essential Mathematics** | | | |
| **Concepts and Techniques** | | **Reasoning and Communication** | |
| CT1 | Knowledge and understanding of mathematical information and concepts | RC1 | Interpretation of mathematical results |
| CT2 | Application of mathematical skills and techniques to find solutions to practical  problems in context | RC2 | Use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions |
| CT3 | Gathering, representation, and interpretation of data in context | RC3 | Use of appropriate mathematical notation, representations, and terminology |
| CT4 | Use of electronic technology to find solutions to practical problems. | RC4 | Communication of mathematical ideas and information. |

Performance Standards Stage 1 Mathematics

|  |  |  |
| --- | --- | --- |
|  | **Concepts and Techniques** | **Reasoning and Communication** |
| A | Comprehensive knowledge and understanding of concepts and relationships.  Highly effective selection and application of mathematical techniques and algorithms to find efficient and accurate solutions to routine and complex problems in a variety of contexts.  Successful development and application of mathematical models to find concise and accurate solutions.  Appropriate and effective use of electronic technology to find accurate solutions to routine and complex problems. | Comprehensive interpretation of mathematical results in the context of the problem.  Drawing logical conclusions from mathematical results, with a comprehensive understanding of their reasonableness and limitations.  Proficient and accurate use of appropriate mathematical notation, representations, and terminology.  Highly effective communication of mathematical ideas and reasoning to develop logical and concise arguments.  Effective development and testing of valid conjectures. |
| B | Some depth of knowledge and understanding of concepts and relationships.  Mostly effective selection and application of mathematical techniques and algorithms to find mostly accurate solutions to routine and some complex problems in a variety of contexts.  Some development and successful application of mathematical models to find mostly accurate solutions.  Mostly appropriate and effective use of electronic technology to find mostly accurate solutions to routine and some complex problems. | Mostly appropriate interpretation of mathematical results in the context of the problem.  Drawing mostly logical conclusions from mathematical results, with some depth of understanding of their reasonableness and limitations.  Mostly accurate use of appropriate mathematical notation, representations, and terminology.  Mostly effective communication of mathematical ideas and reasoning to develop mostly logical arguments.  Mostly effective development and testing of valid conjectures. |
| C | Generally competent knowledge and understanding of concepts and relationships.  Generally effective selection and application of mathematical techniques and algorithms to find mostly accurate solutions to routine problems in a variety of contexts.  Successful application of mathematical models to find generally accurate solutions.  Generally appropriate and effective use of electronic technology to find mostly accurate solutions to routine problems. | Generally appropriate interpretation of mathematical results in the context of the problem.  Drawing some logical conclusions from mathematical results, with some understanding of their reasonableness and limitations.  Generally appropriate use of mathematical notation, representations, and terminology, with reasonable accuracy.  Generally effective communication of mathematical ideas and reasoning to develop some logical arguments.  Development and testing of generally valid conjectures. |
| D | Basic knowledge and some understanding of concepts and relationships.  Some selection and application of mathematical techniques and algorithms to find some accurate solutions to routine problems in some contexts.  Some application of mathematical models to find some accurate or partially accurate solutions.  Some appropriate use of electronic technology to find some accurate solutions to routine problems. | Some interpretation of mathematical results.  Drawing some conclusions from mathematical results, with some awareness of their reasonableness or limitations.  Some appropriate use of mathematical notation, representations, and terminology, with some accuracy.  Some communication of mathematical ideas, with attempted reasoning and/or arguments.  Attempted development or testing of a reasonable conjecture. |
| E | Limited knowledge or understanding of concepts and relationships.  Attempted selection and limited application of mathematical techniques or algorithms, with limited accuracy in solving routine problems.  Attempted application of mathematical models, with limited accuracy.  Attempted use of electronic technology, with limited accuracy in solving routine problems. | Limited interpretation of mathematical results.  Limited understanding of the meaning of mathematical results, their reasonableness or limitations.  Limited use of appropriate mathematical notation, representations, or terminology, with limited accuracy.  Attempted communication of mathematical ideas, with limited reasoning.  Limited attempt to develop or test a conjecture. |

Performance Standards Stage 1 General Mathematics

|  |  |  |
| --- | --- | --- |
|  | Concepts and Techniques | Reasoning and Communication |
| A | Comprehensive knowledge and understanding of concepts and relationships.  Highly effective selection and application of mathematical techniques and algorithms to find efficient and accurate solutions to routine and complex problems in a variety of contexts.  Successful development and application of mathematical models to find concise and accurate solutions.  Appropriate and effective use of electronic technology to find accurate solutions to routine and complex problems. | Comprehensive interpretation of mathematical results in the context of the problem.  Drawing logical conclusions from mathematical results, with a comprehensive understanding of their reasonableness and limitations.  Proficient and accurate use of appropriate mathematical notation, representations, and terminology.  Highly effective communication of mathematical ideas and reasoning to develop logical and concise arguments.  Formation and testing of appropriate predictions, using sound mathematical evidence. |
| B | Some depth of knowledge and understanding of concepts and relationships.  Mostly effective selection and application of mathematical techniques and algorithms to find mostly accurate solutions to routine and some complex problems in a variety of contexts.  Attempted development and successful application of mathematical models to find mostly accurate solutions.  Mostly appropriate and effective use of electronic technology to find mostly accurate solutions to routine and some complex problems. | Mostly appropriate interpretation of mathematical results in the context of the problem.  Drawing mostly logical conclusions from mathematical results, with some depth of understanding of their reasonableness and limitations.  Mostly accurate use of appropriate mathematical notation, representations, and terminology.  Mostly effective communication of mathematical ideas and reasoning to develop mostly logical arguments.  Formation and testing of mostly appropriate predictions, using some mathematical evidence. |
| C | Generally competent knowledge and understanding of concepts and relationships.  Generally effective selection and application of mathematical techniques and algorithms to find mostly accurate solutions to routine problems in different contexts.  Application of mathematical models to find generally accurate solutions.  Generally appropriate and effective use of electronic technology to find mostly accurate solutions to routine problems. | Generally appropriate interpretation of mathematical results in the context of the problem.  Drawing some logical conclusions from mathematical results, with some understanding of their reasonableness and limitations.  Generally appropriate use of mathematical notation, representations, and terminology, with reasonable accuracy.  Generally effective communication of mathematical ideas and reasoning to develop some logical arguments.  Formation of an appropriate prediction and some attempt to test it using mathematical evidence. |
| D | Basic knowledge and some understanding of concepts and relationships.  Some selection and application of mathematical techniques and algorithms to find some accurate solutions to routine problems in context.  Some application of mathematical models to find some accurate or partially accurate solutions.  Some appropriate use of electronic technology to find some accurate solutions to routine problems. | Some interpretation of mathematical results.  Drawing some conclusions from mathematical results, with some awareness of their reasonableness.  Some appropriate use of mathematical notation, representations, and terminology, with some accuracy.  Some communication of mathematical ideas, with attempted reasoning and/or arguments.  Attempted formation of a prediction with limited attempt to test it using mathematical evidence. |
| E | Limited knowledge or understanding of concepts and relationships.  Attempted selection and limited application of mathematical techniques or algorithms, with limited accuracy in solving routine problems.  Attempted application of mathematical models, with limited accuracy.  Attempted use of electronic technology, with limited accuracy in solving routine problems. | Limited interpretation of mathematical results.  Limited understanding of the meaning of mathematical results, their reasonableness or limitations.  Limited use of appropriate mathematical notation, representations, or terminology, with limited accuracy.  Attempted communication of mathematical ideas, with limited reasoning.  Limited attempt to form or test a prediction. |

Performance Standards Stage 1 Essential Mathematics

|  |  |  |
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|  | Concepts and Techniques | Reasoning and Communication |
| **A** | Knowledge and understanding of mathematical information and concepts in familiar and unfamiliar contexts.  Highly effective application of mathematical skills and techniques to find efficient and accurate solutions to routine and complex problems in a variety of contexts.  Gathering, representation, and interpretation of a range of data in familiar and unfamiliar contexts.  Appropriate and effective use of electronic technology to find accurate solutions to routine and complex problems. | Accurate interpretation of mathematical results in familiar and unfamiliar contexts.  Highly effective use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions to routine and complex problems.  Proficient and accurate use of appropriate mathematical notation, representations, and terminology.  Clear and effective communication of mathematical ideas and information to develop logical and concise arguments. |
| **B** | Knowledge and understanding of mathematical information and concepts in familiar and some unfamiliar contexts.  Effective application of mathematical skills and techniques to find mostly accurate solutions to routine and some complex problems in a variety of contexts.  Gathering, representation, and interpretation of data in familiar and some unfamiliar contexts.  Mostly appropriate and effective use of electronic technology to find mostly accurate solutions to routine and some complex problems. | Mostly accurate interpretation of mathematical results in familiar and some unfamiliar contexts.  Effective use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions to routine and some complex problems.  Mostly accurate use of appropriate mathematical notation, representations, and terminology.  Clear and appropriate communication of mathematical ideas and information to develop some logical arguments. |
| **C** | Knowledge and understanding of simple mathematical information and concepts in familiar contexts.  Application of some mathematical skills and techniques to find solutions to routine problems in familiar contexts.  Gathering, representation, and interpretation of data in familiar contexts.  Generally appropriate and some effective use of electronic technology to find solutions to routine problems. | Generally accurate interpretation of mathematical results in familiar contexts.  Appropriate use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions to routine problems.  Generally appropriate use of familiar mathematical notation, representations, and terminology.  Appropriate communication of mathematical ideas and information. |
| **D** | Basic knowledge and some understanding of simple mathematical information and concepts in some familiar contexts.  Application of basic mathematical skills and techniques find partial solutions to routine problems in some contexts.  Some gathering, representation, and basic interpretation of simple data in familiar contexts.  Some appropriate use of electronic technology to find solutions to routine problems. | Some interpretation of mathematical results in some familiar contexts.  Attempted use of mathematical reasoning to consider the appropriateness of solutions to routine problems.  Some use of familiar mathematical notation, representations, and terminology.  Attempted communication of simple mathematical ideas and information. |
| **E** | Limited knowledge or understanding of mathematical information or concepts.  Attempted application of basic mathematical skills or techniques, with limited accuracy in solving routine problems.  Some gathering and attempted representation of simple data in a familiar context.  Attempted use of electronic technology in to find a solution to a routine problem. | Limited interpretation of mathematical results.  Limited awareness of the use of mathematical reasoning in solving a problem.  Limited use of mathematical notation, representations, or terminology.  Attempted communication of an aspect of mathematical information. |

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| **SACE Stage 1 Mathematics and Stage 2 Mathematical Methods/Specialist Mathematics** | | | | |
| **Stage 1 Mathematics** | | | | |
| Topic 1: Functions and Graphs   * 1. Lines and Linear Relationships   2. Inverse Relationships   3. Relations   4. Functions   Topic 2: Polynomials   * 1. Quadratic Relationships   2. Cubic and Quartic Polynomials   Topic 3: Trigonometry  3.1 Cosine and Sine Rules  3.2 Circular Measure and Radian Measure  3.3 Trigonometric Functions | Topic 4: Counting and Statistics   * 1. Counting   2. Discrete and Continuous Random Data   3. Samples and Statistical Measures   4. Normal Distributions   Topic 5: Growth and Decay   * 1. Indices and Index Laws   2. Exponential Functions   3. Logarithmic Functions   Topic 6: Introduction to Differential Calculus   * 1. Rate of Change   2. The Concept of a Derivative   3. Computations of Derivatives   4. Properties of Derivatives   5. Applications of Derivatives | Topic 7: Arithmetic and Geometric Sequences and Series  7.1 Arithmetic Sequences and Series  7.2 Geometric Sequences and Series  **Topic 8: Geometry**  8.1 Circle Properties  8.2 The Nature of Proof  **Topic 9: Vectors in the Plane**  9.1 Vector Operations  9.2 Component and Unit Vector Forms  9.3 Projections  9.4 Geometric Proofs using Vectors | Topic 10: Further Trigonometry  10.1 Further Trigonometric Functions  10.2 Trigonometric Identities  **Topic 11: Matrices**  11.1 Matrix Arithmetic  11.2 Transformations in the Plane  Topic 12: Real and Complex Numbers  12.1 The Number Line  12.2 Introduction to Mathematical Induction  12.3 Complex Numbers  12.4 The Complex (Argand) Plane  12.5 Roots of Equations | |
| **Stage 2 Mathematical Methods** | | **Stage 2 Specialist Mathematics** | | |
| Topic 1: Further Differentiation and Applications   * 1. Introductory Differential Calculus   2. Differentiation Rules   3. Exponential Functions   4. Trigonometric Functions   5. The second derivative   Topic 2: Discrete Random Variables   * 1. Discrete Random Variables   2. The Bernoulli Distribution   3. Repeated Bernoulli Trials and the Binomial Distribution   Topic 3: Integral Calculus   * 1. Anti-differentiation   2. The Area under Curves   3. Fundamental Theorem of Calculus   4. Applications of integration | Topic 4: Logarithmic Functions  4.1 Using logarithms for solving exponential equations   * 1. Logarithmic Functions and their Graphs   2. Calculus of Logarithmic Functions   Topic 5: Continuous Random Variables and the Normal Distribution   * 1. Continuous Random Variables   2. Normal Distributions   3. Sampling   **Topic 6: Sampling and Confidence Intervals**   * 1. Confidence Intervals for a Population Mean   2. Population Proportions   3. Confidence Intervals for a Population Proportion | Topic 1: Mathematical Induction   * 1. Proof by Mathematical Induction   Topic 2: Complex Numbers   * 1. Cartesian and Polar Forms   2. The Complex (Argand ) Plane   3. Roots of Complex Numbers   4. Factorisation of Polynomials   Topic 3: Functions and Sketching Graphs   * 1. Composition of Functions   2. One-to-one Functions   3. Sketching Graphs   Topic 4: Vectors in Three Dimensions   * 1. The Algebra of Vectors in Three Dimensions   2. Vector and Cartesian Equations   3. Systems of Linear Equations | | Topic 5: Integration Techniques and Applications   * 1. Integration Techniques   2. Applications of Integral Calculus   **Topic 6: Rates of Change and Differential Equations**   * 1. Implicit Differentiation   2. Differential Equations   3. Pairs of Varying Quantities – Polynomials of Degree 1 to 3   4. Related Rates, Velocity, and Tangents   5. Trigonometric Parameterisations |

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| **SACE Stage 1 and Stage 2 General Mathematics** | |
| **Stage 1 General Mathematics** | |
| Topic 1: Investing and Borrowing   * 1. Investing for Interest   2. Investing in Shares   3. Return on Investment   4. Costs of Borrowing   Topic 2: Measurement   * 1. Application of measuring devices and units of measurement   2. Perimeter and area of plane shapes   3. Volume and surface area of solids   4. Scale and rates   Topic 3: Statistical Investigation   * 1. The statistical investigation process   2. Sampling and collecting data   3. Classifying and organising data   4. The shape, location and spread of distributions of numerical data   5. Forming and supporting conjectures across two or more groups | Topic 4: Applications of Trigonometry   * 1. Similarity   2. Right triangle geometry   3. Area of triangles   4. Solving problems with non-right triangles   Topic 5: Linear and Exponential Functions and their Graphs   * 1. Linear functions and graphs   2. Exponential functions and graphs   Topic 6: Matrices and Networks   * 1. Matrix arithmetic and costing applications   2. Networks   Topic 7: Open Topic |
| **Stage 2 General Mathematics** | |
| Topic 1: Modelling with Linear Relationships   * 1. Simultaneous linear equations   2. Linear programming   Topic 2: Modelling with Matrices   * 1. Application of matrices to network problems   2. Application of matrices to transition problems   Topic 3: Statistical Models \*   * 1. Bivariate statistics   2. The Normal Distribution   Topic 4: Financial Models \*   * 1. Models for Saving   2. Models for Borrowing   Topic 5: Discrete Models \*   * 1. Critical Path analysis   2. Assignment Problems   Topic 6: Open Topic  \* Examined topics |  |

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| **SACE Stage 1 and Stage 2 Essential Mathematics** | |
| **Stage 1 Essential Mathematics** | |
| Topic 1: Calculations, Time and Ratio   * 1. Calculations   2. Time and Rates   3. Ratio and Scale   Topic 2: Earning and Spending   * 1. Earning   2. Spending   3. Budgeting   **Topic 3: Geometry**  3.1 Shapes  3.2 Angle Geometry  3.3 Geometry and Construction | Topic 4: Data in Context   * 1. Classifying data   2. Reading and Interpreting Graphs   3. Drawing Graphs   4. Summarising and Interpreting Data   5. Comparing Data Sets   Topic 5: Measurement   * 1. Linear Measure   2. Area Measure   3. Mass   4. Volume and Capacity   5. Power and Energy   Topic 6: Investing   * 1. Simple interest   2. Compound interest   3. Investing for interest   Topic 7: Open Topic |
| **Stage 2 Essential Mathematics** | |
| Topic 1: Scales, Plans and Models   * 1. Geometry   2. Scale Diagrams   Topic 2: Measurement \*   * 1. Linear Measure   2. Area Measure   3. Mass, Volume and Capacity   Topic 3: Business Applications   * 1. Planning a Business Premises   2. Costing Calculations   3. Business Structures and Taxation   Topic 4: Statistics \*   * 1. Sampling from Populations   2. Analysing and Representation of Sets of Data   3. Linear Correlation   Topic 5: Investments and Loans \*   * 1. Lump Sum Investments   2. Annuity Investments   3. Loan Annuities   Topic 6: Open Topic  \* Examined topics |  |



LEARNING AND ASSESSMENT PLAN

Stage 1 Mathematics (10 credits)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| School |  | | Contact Teacher |  |
| Other schools using this plan | |  | | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SACE  School Code | | |  | Year |  | Enrolment Code | | | | |  | Program Variant Code (A–W) |
| Stage | Subject Code | | | No. of Credits (10 or 20) |
|  |  |  |  | **1** |  |  |  | **10** |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| |  |  |  | | --- | --- | --- | | Recommended by principal or nominee (signature)  **DRAFT** |  | Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Approved |  | Not approved |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Accession Number |  |  |  |  |  |  |  |  | Expiry date | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |

**Addendum**

Please **only** use this section for any changes made after the learning and assessment plan has been approved.

**Changes made to the learning and assessment plan**

|  |
| --- |
| Describe any changes made to the learning and assessment plan to support students to be successful in meeting the requirements of the subject. In your description, please explain:   * what changes have been made to the plan * the rationale for making the changes * whether these changes have been made for all students, or individuals within the student group. |

**Principal endorsement of changes**

The changes made to the learning and assessment plan support student achievement of the performance standards and retain alignment with the subject outline.

|  |  |  |  |
| --- | --- | --- | --- |
| Signature of principal or nominee |  | Date |  |



**ASSESSMENT OVERVIEW**

Complete the table below to show details of the planned tasks. Use numbers to show where students will have the opportunity to provide evidence for each of the specific features for all assessment design criteria.

| **Assessment Type and Weighting** | **Name and details of assessment** | **Assessment Design Criteria** | | **Assessment conditions** (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- |
| **C&T** | **R&C** |
| **Skills and Applications Tasks**  **Weighting \_\_\_\_%** | **DRAFT** |  |  |  |
|  |  |  |  |
| *\*Please delete row if completing only two Skills and Application Tasks.* |  |  |  |
| **Mathematical Investigation**  **Weighting \_\_\_\_%** |  |  |  |  |
| *\*Please delete row if completing only one Mathematical Investigation.* |  |  |  |

***Four assessments****. Please refer to the Mathematics Subject Outline.*

Stage 1 Mathematics

Sample School Program 1 – Semester 1

This program is for a cohort of students intending to continue to Mathematical Methods at Stage 2. This is presented as Semester 1 of a two-semester program.

Semester One 18 Weeks Including Exam Weeks

* Topic 1 - Functions And Graphs (5 Weeks)
* Topic 2 - Polynomials (5 Weeks)
* Topic 3 - Trigonometry (6 Weeks)

Topic 1 – Functions And Graphs (5 Weeks)

|  |  |  |  |
| --- | --- | --- | --- |
| Term  week | Subtopic | Concepts and Content  Technology is incorporated into all aspects of this topic as appropriate | Assessment Task |
| 1-1 | 1.1  Lines and Linear Relationships | The equation of a straight line   * Given two points * Given the slope and a point * Parallel to a line through a given point * Perpendicular to a line through a given point   Features of the graph of a linear function of the form   * Slope (*m*) as a rate of growth * Y-intercept *(c*)   Determine the formula for a linear relationship given data or description of situation   * Various problems are addressed from everyday situations such as simple interest and conversion graphs. Slope as a rate of growth and interpretation of intercepts are considered in context.   Calculation of points of intersection   * Solve simultaneous equations algebraically and graphically * Consideration given to situations involving coincident, perpendicular and parallel lines |  |
| 1-2 | 1.2  Inverse Relationships | Exploring the mathematical relationship where one variable decreases as the other increases  Consider the graph of the basic hyperbola   * Define asymptote, both horizontal and vertical   Consider translations of the basic hyperbola i.e.  The use of technology is incorporated in the graphs above |  |
| 1-3 | 1.3  Relations | Definition of a relation as a set of ordered pairs   * Discuss various examples   Exploration of the circle as a relation   * Development of the equation of a circle in centre radius form * Development of the circle in expanded (general) form, demonstrate the use of completing the square to convert from general to centre radius form |  |
| 1-4 | 1.4  Functions | Definition of a function as a set of ordered pairs whereby no two have the same value (it defines one variable in terms of one other)   * The graph of a function * Domain and range * Function notation * Dependent and independent variables * Use of vertical line test to establish a function   Understanding the distinction between functions and relations |  |
| 1-5 |  | Revision and SAT 1 | **SAT 1**  Entire topic  Calculator permitted |

Topic 2 – Polynomials (5 Weeks)

|  |  |  |  |
| --- | --- | --- | --- |
| Term  Week | Subtopic | Concepts and Content  Technology is incorporated into all aspects of this topic as appropriate | Assessment Task |
| 1-6 | 2.1  Quadratic Relationships | Discussion on quadratic relationships with reference to real life scenarios e.g. throwing a ball straight up.  Features of the graph   * Shape * Axial intercepts * Turning points * Equation of axis of symmetry   Quadratics in each of the following forms are explored   * General * Factored * Vertex   Students work on the above forms to identify as appropriate axial intercepts, turning points (vertex) and equation of axis of symmetry  Determining the zeros of a quadratic   * Factorisation of quadratics from general to factored form * Use of the quadratic formula (incorporate the meaning of non-real zeros)   Complete the square to determine turning point of a quadratic |  |
| 1-7 | Investigate the discriminant, of a function and its significance for the number and nature of the zeros of the graph of the function.   * If , two non-real distinct zeros, distinction between rational and irrational zeros * If , real repeated zero * If , two real distinct zeros, distinction between rational and irrational zeros   Relationship between the leading coefficient of a quadratic and its discriminant for positive definite and negative definite quadratics  The sum and product of real zeros   * Revision of surds   Determining quadratic functions from given zeros and a point on the quadratic  Quadratic modelling   * Determining variables such as height or time from a quadratic * Optimisation problems such as perimeter dimensions for maximum area | **INVESTIGATION**  Features of Polynomials |
| 1-8 |
| **EASTER** | | | |
| 1-9 | 2.2  Cubic and Quartic Polynomials | Definition of a cubic  Terminology, degree and forms   * General * Point of Inflection * Factored   Features   * Shape reference to leading coefficient * Behaviour as * Nature and number of zeros of the graph of a cubic   Explore features of cubics written as a product of:   * A linear factor and a quadratic (both real and non-real zeros) * Three linear factors   Determining cubic functions from given zeros and one other piece of data  Definition of a quartic  Terminology, degree and forms as an extension of the work on cubics  Cubic and quartic modelling (using technology)  Determining unknown variables  Optimisation such as dimensions for maximum volume |  |
| 1-10 |  | Revision and SAT 2  Investigation work and submission | **SAT 2 Part 1**  No calculator  Sketching graphs, factorising to solve, use of quadratic formula to obtain exact answers  **SAT 2 Part 2**  Calculator permitted determining quadratics, sum and product, modelling |

Topic 3 – Trigonometry (6 Weeks)

|  |  |  |  |
| --- | --- | --- | --- |
| Term  week | Subtopic | Concepts and Content  Technology is incorporated into all aspects of this topic as appropriate | Assessment Task |
| 1-11 | 3.1  Cosine and Sine Rules | Right-angled trigonometry   * Pythagoras’ theorem * Trigonometric ratios: sin, cos and tan   Non-right angled triangle   * Cosine rule   + Finding the length when given two sides and the included angle   + Finding an angle given all sides |  |
| 2-1 | * Sine rule   + Finding the length of a side when given two angles and one side   + Finding the angle given two sides and the non-included angle * Area of non-right angled triangle   Students complete an assortment of problems involving non-right angled triangles using cosine, sine and area rules |  |
| 2-2 | 3.2  Circular Measure and Radian Measure | Introduction to the unit circle and its properties  How the unit circle is linked to graphs of and   * The link between the unit circle and , and in degrees * The unit circle definition of , and and periodicity using degrees   Definition of radian measure   * Conversion between radian and degree measure   Calculation of the lengths of arcs and areas of sectors of circle |  |
| 2-3 | 3.3  Trigonometric Functions | Connection between unit circle and , and in radians  Determine the exact value of cosine and sine from multiples of and using unit circle or graphs  Making the connection that the functions and best describe the horizontal and vertical positions around a circle  Explore the features of and   * Amplitude and * Period and * Phase and   Solve practical problems in a range of different contexts |  |
| 2-4 | Solve trigonometric equations both algebraically and graphically   * Only consider cases such as and   Special relationships observed of sine and cosine functions  Tangent function   * Consider the relationship between the angle of inclination and the gradient of a line * The relationship * Graphs of the functions |  |
| 2-5 |  | Revision and SAT 3 | **SAT 3**  1 hour  Entire topic  Calculator permitted |
| 2-6 |  | EXAMINATION REVISION |  |
| 2-7  2-8 |  | YEAR 11 EXAMS | End Semester One |

Sample School Program 1

Stage 1 Mathematics – Semester 2

This program is for a cohort of students intending to continue to Mathematical Methods at Stage 2. This is presented as Semester 2 of a two-semester program.

Semester Two 17 Weeks Including Exam Weeks and Student Development/Activity Week

* Topic 4 - Counting And Statistics (5 Weeks)
* Topic 6 - Introduction To Differential Calculus (6 Weeks)
* Topic 5 - Growth And Decay (4 Weeks)

Topic 4 – Counting And Statistics (5 Weeks)

|  |  |  |  |
| --- | --- | --- | --- |
| Term Week | Subtopic | Concepts and Content  Technology is incorporated into all aspects of this topic as appropriate | Assessment Task |
| WEEK 9 TERM 2 START SEMESTER TWO - STUDENT DEVELOPMENT/ACTIVITY WEEK | | | |
| 2-10 | 4.1  Counting | The Multiplication Principle   * The idea that if there are **a** ways of doing something and **b** ways of doing another thing, then there are **a** × **b** ways of performing both actions. Examples of tree diagrams, tables etc   Factorials and Factorial Notation   * The factorial of a [non-negative integer](http://en.wikipedia.org/wiki/Non-negative_integer) n, denoted by n!, is the [product](http://en.wikipedia.org/wiki/Product_(mathematics)) of all positive integers less than or equal to *n*. For example, 4!=4×3×2×1=24   Permutations   * Counting of all possible arrangements of a collection of things (discrete), where the order is important * Using only discrete variables, students explore various examples. Initially algebraically, then using technology. |  |
| 3-1 | Combinations   * The number of ways to select different groups in which the order does not matter * The number of combinations of objects taken from a set of distinct objects is * Using only discrete variables, students explore various examples. Initially algebraically, then using technology.   Use of the notation   * The coefficients of the expansion of   + Expand for integers   + Recognise the numbers as binomial coefficients   + The pattern connecting the values of leading to Pascal’s triangle |  |
| 3-2 | 4.2  Discrete and Continuous Random Data | Definitions of and differences between discrete and continuous variables   * Examples considered and students identify discrete and continuous data. Consideration given to continuous variables that may appear to be recorded as discrete. |  |
| 4.3  Samples and Statistical Measures | Describing the centre of data: mean, mode and median   * Students develop an understanding of the differences from calculations for each measure of centre. Consideration is given to strength and weakness of each e.g. how extreme value(s) may distort the mean.   Describing the spread of data: range, interquartile range and standard deviation   * Students are aware of the standard deviation formula   The use of electronic technology to determine the above is implemented once the concepts are understood. |  |
| 3-3 | 4.4  Normal Distributions | Normal distributions occur when the quantity is the combined effect of a number of random errors  Features of normal distributions   * Bell-shaped * Position of mean * Symmetry about mean * Characteristic spread * Positions of one, two and three standard deviations from the mean. Technology for other values and inverse calculations if time permits. Use of the 68-95-99.7 rule.   Students use examples to understand the concepts and their implication in real life scenarios. |  |
| 3-4 |  | Revision and SAT 1 | **SAT 1**  Calculator permitted  Entire topic |

Topic 6 – Introduction to Differential Calculus (6 Weeks)

|  |  |  |  |
| --- | --- | --- | --- |
| Term Week | Subtopic | Concepts and Content  Technology is incorporated into all aspects of this topic as appropriate | Assessment Task |
| 3-5 | 6.1  Rate of Change | Discussion on rate of change as the ratio of the change in one quantity compared to another   * Consider average speeds and other quantities * Using graphical exemplars demonstrate how it is found that the average rate of change of a function on the interval from to is given by * Connection between average rate of change and the slope of the chord |  |
| 3-6 | 6.2  The Concept of a Derivative | How do we approximate the rate of change at a point (instantaneous rate of change)?   * Technology will be implemented to demonstrate this concept. Students will use tables and formula to produce graphical representations to explore how as an interval from to decreases the approximation approaches the instantaneous rate of change.   Understanding what a limit is   * The instantaneous rate of change of a function at a point is the limit of the average rate of change over an interval approaching zero. (The instantaneous rate of change at any particular point on a curve is the slope of the tangent to the curve drawn at the point.)   Understanding what a derivative is   * Introduction to the concept that a derivative can be used to calculate the instantaneous rate of change   Introduction of first principles   * Finding the derivative function from first principles * Using first principles to find the derivative at a given point using * Students use first principles to calculate derivatives of functions (only integer exponent) |  |
| 3-7 | 6.3  Computations of Derivatives | Introduction of alternative notation for the derivative of a function  Introduction of the derivative rule for simple powers   * Students use the derivative rule to calculate the derivatives of functions with integer exponents |  |
| 6.4  Properties of Derivatives | Discussion on the features of the derivative   * Is it a function? (Definition of a function readdressed from Topic 1 or briefly given if Topic 1 has not been done)   Recognition and use of the linearity of the derivative   * Students establish, by working through appropriate examples, rules of differentiation for simple powers:   If  If |
| 3-8 | 6.5  Applications of Derivatives | Using derivatives of polynomials and other linear combinations of power functions to determine the equation of a tangent to a curve at a point  Understanding the following   * Review sign diagrams * Develop the concepts of displacement and velocity (use of position versus time graphs to describe motion where velocity equates to the slope of the tangent at any point on the graph) * Rates of change - increasing and decreasing - use of sign diagram to determine intervals in which the function is increasing and decreasing * Maxima and minima - local and global * Stationary points and end points   Use of the above to find   * Velocity from displacement (first derivative of displacement) * Object is at rest when velocity is zero * When an object changes direction i.e. when velocity equals zero and there is a change of sign (sign diagram required)   Optimisation   * Examine various optimisation problems (only in consideration of simple polynomials and other linear combinations of power functions) in relation to real life situations such as cost minimisation, optimisation of dimensions of 3D objects, and water use. | **INVESTIGATION**  Modelling With Derivatives  Cake Tin Optimisation |
| 3-9 |  |
| 3-10 |  | Revision and SAT 2  Investigation submission | **SAT 2 Part 1**  No calculator  First principles and derivatives of polynomials  **SAT 2 Part 2**  Calculator permitted  6.4 and 6.5 |

Topic 5 – Growth and Decay (4 Weeks)

|  |  |  |  |
| --- | --- | --- | --- |
| Term Week | Subtopic | Concepts and Content  Technology is incorporated into all aspects of this topic as appropriate | Assessment Task |
| 4-1 | 5.1  Indices and Index Laws | Indices   * Review indices and index laws including negatives and fractional * Algebraic application to all laws including simplification using positive, negative and fractional indices * Conversions from radical to fractional indices   Surds   * Definition of rational and irrational numbers * Operations with surds and fractional indices (rational indices) * Discussion on the real number system and its inclusion of irrationals |  |
| 4-2 | 5.2  Exponential Functions | Exponentials   * Exponential functions - their algebraic properties and uses * Behaviour of exponential functions * Technology will be used to explore the qualitative features of the graph of , its translations and and dilation * Discussion on characteristics such as asymptotes, intercepts and behaviour as * \*Use of real life situations to determine variables in the contexts such as bacteria growth, radioactive decay, half-life, population models and compounding interest. Technology is used to support interpretation of situations. |  |
| 4-3 | 5.3  Logarithmic Functions | Definition of a logarithm, initially base 10   * Rules, initially base 10   Definition of a logarithm other bases   * Application of rules with other bases   Solving of logarithmic equations (base 10)  Solving exponential equations using logarithms (base 10) threaded back to exponentials dot point 5\* (from subtopic 5.2) |  |
| 4-4 |  | Revision and SAT 3 | **SAT 3**  Entire topic  Calculator permitted |
| 4-5 | EXAMINATION REVISION | | |
| 4-6 | YEAR 11 EXAMS | | |

**Stage 1 Mathematics (10 credits)**

*Aligned with teaching Program 1 – Semester 1 (pre-Methods, two semester program)*

**ASSESSMENT OVERVIEW**

Complete the table below to show details of the planned tasks. Use numbers to show where students will have the opportunity to provide evidence for each of the specific features for all assessment design criteria

| Assessment Type and Weighting | Name and details of assessment | Assessment Design Criteria | | Assessment conditions (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- |
| C&T | R&C |
| Skills and Applications Tasks  Weighting 80% | **SAT 1: Functions and Graphs.** Students demonstrate mathematical knowledge and skills from Topic 1. The content covers key questions and key concepts within subtopics 1.1, 1.2, 1.3 and 1.4.  Students apply their knowledge and skills to a range of routine and complex questions.  Conjecture development and testing will be addressed.  The complex questions require students to apply the key concepts to solve problems in a variety of contexts and some require interpretation of the results. Appropriate and effective use of electronic technology is expected. Clear and logical communication of solutions and correct use of notation and terminology are required. | 1,2,3,4 | 1,2,3,4,5 | Supervised written assessment.  Total time: 60 minutes  Calculator permitted  1 A4 page of handwritten notes |
| **SAT 2: Polynomials.** Key questions and key concepts from Topic 2. The content covers key questions and key concepts within subtopics 2.1, and 2.2.  SAT 2 is divided into two parts:  Part 1: Focus on the first components (up to completing the square) from subtopic 2.1. Calculations without electronic technology (e.g. factorisation to find zeros, use of quadratic formula for exact solutions, sketching with identification of axial intercepts, turning points, axis of symmetry for simple quadratics).  Part 2: Focus on components from the latter part of 2.1 (the discriminant onwards) and the entire subtopic 2.2. Calculations with access to electronic technology.  Part 1 will focus on routine type questions whilst Part 2 will focus on questions more complex in nature. The complex questions require students to apply the key concepts to solve problems in a variety of contexts and some require interpretation of the results. Construction of graphical representations may be required to support their problem-solving strategies.  Appropriate and effective use of electronic technology is expected. Clear and logical communication of solutions and correct use of notation and terminology are required. | 1,2,3,4 | 1,2,3,4 | Supervised written assessment.  Part 1 : 20 minutes  No calculator permitted  Part 2 : 40 minutes  Calculator permitted  1 A4 page of handwritten notes |
| **SAT 3: Trigonometry.** Key questions and key concepts from Topic 3. SAT 3 will cover content from the entire topic.  The complex questions require students to apply the key concepts to solve problems in a variety of contexts and some require interpretation of the results. Construction of graphical representations may be required to support their problem-solving strategies.  Appropriate and effective use of electronic technology is expected. Clear and logical communication of solutions and correct use of notation and terminology are required. | 1,2,3,4 | 1,2,3,4 | Supervised written assessment.  Total time: 60 minutes  Calculator permitted  1 A4 page of handwritten notes |
| Mathematical Investigation  Weighting 20% | **Investigating the Features of Polynomials.** This investigation is predominately based on Topic 2. Students use graphing techniques to form conjectures based on the number of turning points and points of inflection for polynomials of varying degrees.  Polynomials of two forms of degree four introduce the investigation. The task then progresses allowing the opportunity for students to explore polynomials with factors and degrees of their choice. For each polynomial form, students form a conjecture about the number of turning points and points of inflection, and then support this through further investigation. The final section of the task provides scope for students to determine which further polynomial forms they will investigate. | 1,2,3,4 | 1,2,3,4,5 | 1 week to complete. Some class time is allowed to support verification.  Maximum of 8 A4 pages.  Appropriate investigation report format as described in the Mathematics subject outline. |

***Four assessments****. Please refer to the Mathematics Subject Outline.*



**Stage 1 Mathematics (10 credits)**

*Aligned with teaching Program 1 – Semester 2 (pre-Methods, two semester program)*

**ASSESSMENT OVERVIEW**

Complete the table below to show details of the planned tasks. Use numbers to show where students will have the opportunity to provide evidence for each of the specific features for all assessment design criteria

| Assessment Type and Weighting | Name and details of assessment | Assessment Design Criteria | | Assessment conditions (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- |
| C&T | R&C |
| Skills and Applications Tasks  Weighting 80% | **SAT 1: Counting and Statistics.** Students demonstrate mathematical knowledge and skills from Topic 4. The content covers key questions and key concepts within subtopics 4.1, 4.2, 4.3 and 4.4.  Students apply their knowledge and skills to a range of routine and complex questions.  The complex questions require students to apply the key concepts to solve problems in a variety of contexts and some require interpretation of the results. Appropriate and effective use of electronic technology is expected. Clear and logical communication of solutions and correct use of notation and terminology are required. | 1,2,3,4 | 1,2,3,4 | Supervised written assessment.  Total time: 60 minutes  Calculator permitted  1 A4 page of handwritten notes |
| **SAT 2: Calculus.** Key questions and key concepts from Topic 6. The content covers key questions and key concepts within subtopics 6.1, 6.2, 6.3, 6.4 and 6.5.  SAT 2 is divided into two parts:  Part 1 will be completed without a calculator and involve first principles and the derivatives of polynomials.  Part 2 will be completed with a calculator and focus on more complex derivations, the properties of derivatives and applications. Conjecture work will be incorporated.  Routine questions will address questions on rate of change and computation of polynomial functions. Complex questions will involve first principles and application of derivatives. Conjecture question(s) will be presented.  Appropriate and effective use of electronic technology is expected. Clear and logical communication of solutions and correct use of notation and terminology are required. | 1,2,3,4 | 1,2,3,4,5 | Supervised written assessment.  Part 1 : 20 minutes  No calculator permitted  Part 2 : 40 minutes  Calculator permitted  1 A4 page of handwritten notes |
| **SAT 3: Growth and Decay.** Key questions and key concepts from Topic 5. SAT 3 will cover content from the entire topic.  Routine questions will focus on the use of logarithm and indices rules and surd to index form and visa-versa. Complex questions will involve exponential functions, their features and characteristics. It will also consider the application of logs in base 10 and the interpretation of real-life scenarios.  The complex questions require students to apply the key concepts to solve problems in a variety of contexts and some require interpretation of the results.  Appropriate and effective use of electronic technology is expected. Clear and logical communication of solutions and correct use of notation and terminology are required. | 1,2,3,4 | 1,2,3,4 | Supervised written assessment.  Total time: 60 minutes  Calculator permitted  1 A4 page of handwritten notes |
| Mathematical Investigation  Weighting 20% | **Modelling With Derivatives – Cake Tin Optimisation.** This investigation is based on Topic 6 – Introduction to Calculus. Students develop a conjecture on how to optimize the volume of an open cake tin, given it is to be made from cutting the corners of a piece of square tinplate. The model is further explored when students consider cutting the corners from a rectangular plate to form the cake tin. Conjectures will be made based on observations made from calculations completed. Students are then given the opportunity to prove their conjectures through the use of calculus. | 1,2,3,4 | 1,2,3,4,5 | 1 week to complete. Some class time is allowed to support verification.  Maximum of 8 A4 pages.  Appropriate investigation report format as described in the Mathematics subject outline. |

***Four assessments****. Please refer to the Mathematics Subject Outline.*

Stage 1 Mathematics

Assessment Type 2: Mathematical Investigation

Investigating The Features of Polynomials

Task

A real polynomial function of degree 4 is a function of the form  where and are real numbers, .

Every real polynomial of degree 4 can be factorised into one of seven forms. In your investigation you will consider a number of the seven forms.

The aim of this project is to investigate the graphs of real polynomial functions of degree 4 with particular reference to:

* the number of turning points
* the number of inflection points.

Part A

1. Investigate, using an appropriate graphing package, at least ***three*** real polynomials with four distinct real linear factors of the form.

Present the information and a small graph of each into a table. An example of the table you could use is presented below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function** | **Roots used** | **Number of turning points** | **Number of points of inflection** | **Graph** |
|  |  |  |  |  |

1. Investigate at least ***three*** real polynomials with five distinct real linear factors of the form

. Present the information in a table as above.

1. Present a possible conjecture in regard to the number of turning points and points of inflection for a polynomial of degree, , with distinct real linear factors.
2. Support your conjecture by investigating another polynomial with a degree of your choice.

Part B

1. Investigate at least ***three*** real polynomials with a squared real linear factor and two distinct real linear factors, . Present the information in a table as above.
2. Extend this investigation to polynomials of degree five and beyond, with only one squared real linear factor.

.

1. Present a possible conjecture in regard to the number of turning points and points of inflection for a polynomial of this form.
2. Support your conjecture by investigating another polynomial with a degree of your choice.

Part C

There are several other possible combinations of factors for a quartic polynomial. Continue your investigation into at least two of these other possibilities, including a polynomial having a real quadratic factor with complex conjugate roots.

Conclusion

You must write a conclusion summarising your findings.

The format of an investigation report may be written or multimodal.

The investigation report should be a **maximum of 8 pages** if written, or the equivalent in multimodal form.

Your report on the mathematical investigation should include the following:

* an outline of the problem and context
* the method required to find a solution, in terms of the mathematical model or strategy used
* the application of the mathematical model or strategy, including:
  + relevant data and/or information
  + mathematical calculations and results, using appropriate representations
  + the analysis and interpretation of results, including consideration of the reasonableness and limitations of the results
* the results and conclusions in the context of the problem
* a bibliography and appendices, as appropriate.

Assessment Design Criteria

Concepts and Techniques

CT1 Knowledge and understanding of concepts and relationships

CT2 Selection and application of mathematical techniques and algorithms to find solutions to problems in a variety of contexts

CT3 Application of mathematical models

CT4 Use of electronic technology to find solutions to mathematical problems

Reasoning and Communication

RC1 Interpretation of mathematical results

RC2 Drawing conclusions from mathematical results, with an understanding of their reasonableness and limitations

RC3 Use of appropriate mathematical notation, representations, and terminology

RC4 Communication of mathematical ideas and reasoning to develop logical arguments

RC5 Development and testing of valid conjectures

Stage 1 Mathematics

Assessment Type 2: Mathematical Investigation

Optimisation – Introductory Calculus

A cake tin manufacturer will be making cake tins ranging in size from “tiny” to “gigantic”. Some tins will be square based, others will be rectangular based. In all cases the manufacturer wants to maximise the volume of each cake tin.

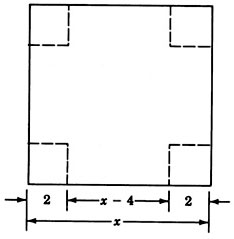
Task

This task investigates the size of a square cut into a piece of tinplate to form an open top cake tin which optimises the volume. Through the use of various mathematical calculations involving calculus and the quadratic formula, a conjecture will be made and potentially proven.

Part A

Investigate the square piece of tinplate.

An open top cake tin is to be made by cutting a square from each corner of a square piece of tinplate with side lengths . Once the cut is made the sides are folded to form an open top cake tin. Let cm be the side length of the square cuts to be made.



*cm*

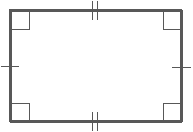
1. Given the length of each side of the tinplate is 5cm, show that the volume of the cake tin can be expressed as cm3

Hence, determine and, using the quadratic formula, find the exact value of which will maximise the volume of the cake tin.

1. Further this investigation by determining the exact value of for ***at least three*** other values of, the side lengths of the original square tinplate.
2. Present a conjecture based on a square piece of tinplate of side length , which when a square is cut from each corner of length a maximum volume for the resulting open top cake tin will be obtained.

Part B

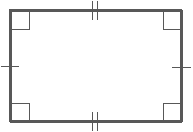
Consider the following rectangular piece of tinplate. An open top cake tin is to be made by cutting a square from each corner.

****

Develop a conjecture about the relationship between (the cut to be made for the square) and the length of each side of the rectangle such that the cake tin has a maximum volume.

The sides of the rectangle are in a ratio . Consider a rectangle where one side is twice the length of the other (i.e. 2:1). Find the value of that gives the maximum volume for the cake tin. Repeat this process for rectangular tinplates with sides in at least two other ratios.

Hint: find exact solutions for (i.e. use the quadratic formula).



Further extension

Prove, using the principles of calculus (and the quadratic formula), one or both of the conjectures you have found from Part A and/or Part B.

**Notes**

Your report on the mathematical investigation should include the following:

* an outline of the problem and context
* the method required to find a solution, in terms of the mathematical model or strategy used
* the application of the mathematical model or strategy, including:
  + relevant data and/or information
  + mathematical calculations and results, using appropriate representations
  + the analysis and interpretation of results, including consideration of the reasonableness and limitations of the results
* the results and conclusions in the context of the problem
* a bibliography and appendices, as appropriate.

The format of an investigation report may be written or multimodal.

The investigation report should be a **maximum of 8 pages** if written, or the equivalent in multimodal form.

Assessment Design Criteria

Concepts and Techniques

CT1 Knowledge and understanding of concepts and relationships

CT2 Selection and application of mathematical techniques and algorithms to find solutions to problems in a variety of contexts

CT3 Application of mathematical models

CT4 Use of electronic technology to find solutions to mathematical problems

Reasoning and Communication

RC1 Interpretation of mathematical results

RC2 Drawing conclusions from mathematical results, with an understanding of their reasonableness and limitations

RC3 Use of appropriate mathematical notation, representations, and terminology

RC4 Communication of mathematical ideas and reasoning to develop logical arguments

RC5 Development and testing of valid conjectures

Stage 1 **Mathematics**

**Sample School Program 2 – Semester 1 of 2 (pre-Specialist Maths)**

Topic 7: Arithmetic and Geometric Sequences and Series, Topic 8: Geometry, and Topic 9: Vectors in the Plane

**NOTES**

* Schools may have a different week breakdown per term/semester.
* Not all schools will have a semester examination.
* Excursions, sports days, extra-curricular activities are not specified.
* The investigation opportunities are a guide for ideas.

**TOPIC TIME DURATION**

Arithmetic and Geometric Sequences and

Series – 3 weeks

Geometry – 4 weeks

Vectors in the Plane – 8/9 weeks

**ASSESSMENT**

**Assessment for one semester (10 credits):**

* at least 2 SATs
* at least one investigation
* each Assessment Type has weighting of at least 20%
* **total of four tasks** for assessment

|  |  |  |  |
| --- | --- | --- | --- |
| **Term 1**  **Week** | **Topic** | **Content** | **Assessment** |
|  | **Topic 7: Arithmetic and Geometric Sequences and Series (3 weeks)** |  |  |
| 1 | Subtopic 7.1  Arithmetic Sequences and Series | Find and use the general formula for an arithmetic sequence.  Find the value of a term or the position of a term.  Graphs of the growth and link with algebraic rule.  Sum of series and associated problems. |  |
| 2 | Subtopic 7.2  Geometric Sequences and Series | Formula for a geometric sequence in recursive form and general form, noting exponential nature.  Graphs and the notion of limit as , shape of the graph. |  |
| 3 | Subtopic 7.2  Geometric Sequences and Series | Sum of the sequence and investigation of the case when |r|<1 as .  Revision. | **SAT 1: Arithmetic and Geometric Sequences and Series** |
|  | **Topic 8: Geometry**  **(4 weeks)** |  |  |
| 4 | Subtopic 8.1  Circle Properties | Investigate properties of circles using Geogebra (or other technology). |  |
| 5 | Subtopic 8.1  Circle Properties | Undertake problem solving using the properties. | **Investigation opportunity**  Best angle for a shot at goal standing on an arc or at a penalty spot in a variety of sports (soccer, hockey, rugby)  Best position to sit in a picture theatre  Best positions for art work in a gallery  Viewing the height of a tower |
| 6 | Subtopic 8.2  The Nature of Proof | Using a variety of proof techniques justify the circle properties. |  |
| 7 | Subtopic 8.2  The Nature of Proof | Using a variety of proof techniques justify the circle properties. | **SAT 2: Geometric Proof** |
|  | **Topic 9: Vectors in the Plane**  **(8 weeks)** |  |  |
| 8 | Subtopic 9.1  Vector Operations | Introduce vectors:  Magnitude and direction.  Vector addition, subtraction, scalar multiplication. |  |
| 9 | Subtopic 9.1  Vector Operations | Parallel vectors, ratio of division. |  |
| 10 | Subtopic 9.2  Component and Unit Vector Forms | Ordered pair notation, column vector notation, combination of vectors, unit vectors, and position vectors. |  |
| 11 | Subtopic 9.2  Component and Unit Vector Forms | Vectors in component form and unit vector form.  Length and direction of a vector from its components. |  |
| **Term 2**  **Week** |  |  |  |
| 1 | Subtopic 9.3  Projections | Dot (scalar)product, angle between two vectors |  |
| 2 | Subtopic 9.3  Projections | Perpendicular vectors, parallel vectors. |  |
| 3 | Subtopic 9.4 Geometric Proofs using Vectors | Vector proofs for  • The diagonals of a parallelogram meet at right angles if and only if it is a rhombus  • Midpoints of the sides of a quadrilateral join to form a parallelogram |  |
| 4 | Subtopic 9.4 Geometric Proofs using Vectors | • The sum of the squares of the lengths of the diagonals of a parallelogram is equal to the sum of the squares of the lengths of the sides. |  |
| 5 |  | Revision |  |
| 6 |  |  | **SAT 3: Vectors in the Plane**  *SAT 3 (Vectors) may be taken earlier and a section of Vectors not assessed in the SAT considered for an Investigation.* |
| 7 |  | Investigation | **Investigation opportunity**  Applications of vectors, e.g. Bezier Curves, Two Boats |
| 8 | Semester Examination Preparation |  |  |

Stage 1 Mathematics

Sample School Program 2 – Semester 2 of 2 (pre-Specialist Maths)

Topic 10: Further Trigonometry, Topic 11: Matrices, and Topic 12: Real and Complex Numbers

**ASSESSMENT**

**Assessment for one semester (10 credits):**

* at least 2 SATs
* at least one investigation
* each Assessment Type has weighting of at least 20%
* **total of four tasks** for assessment

**NOTES**

* Schools may have a different week breakdown per term/semester.
* Not all schools will have a semester examination.
* Excursions, sports days, extra-curricular activities are not specified.
* The investigation opportunities are a guide for ideas.

**TOPIC TIME DURATION**

Further Trigonometry – 5 weeks

Matrices – 5 weeks

Real and Complex Numbers– 6 weeks

|  |  |  |  |
| --- | --- | --- | --- |
| **Term 3**  **Week** | **Topic** | **Content** | **Assessment** |
|  | **Topic 10: Further Trigonometry**  **(5 weeks)** |  |  |
| 1 | Subtopic 10.1  Further Trigonometric Functions  *(Assumes Topic 3: Trigonometry has been covered before this topic)* | Explore the effects of A, B, C and D in the general formula  compared to  and extend to cosine and tangent functions.  Sketch graphs with and without technology. |  |
| 2 | Subtopic 10.1  Further Trigonometric Functions | Sketch graphs with and without technology (continued).  Solve trigonometric equations graphically and with technology. |  |
| 3 | Subtopic 10.2  Trigonometric Identities | Use the unit circle, compare graphs and use addition and subtraction formulae to deduce identities. |  |
| 4 | Subtopic 10.2  Trigonometric Identities | Use identities algebraically to establish relationships.  Derive and find expressions for . |  |
| 5 | Subtopic 10.2  Trigonometric Identities | Sketch graphs and of the reciprocal trigonometric functions.  Revision. | SAT 1: Further Trigonometry |
|  | Topic 11: Matrices  (5 weeks) |  |  |
| 6 | Subtopic 11.1  Matrix Arithmetic | Order of matrices.  Addition, subtraction and scalar multiplication.  Matrix multiplication |  |
| 7 | Subtopic 11.1  Matrix Arithmetic | Identity matrix.  Inverse of square matrices, concept of singular matrices. |  |
| 8 | Subtopic 11.1  Matrix Arithmetic | Find the inverse of 2x2 matrices.  Solve AX=B or XA=B when the inverse exists. |  |
| 9 | Subtopic 11.2  Transformations in the Plane | Ordered pairs as column or row matrices.  Translations; dilations, rotations, reflections. |  |
| 10 | Subtopic 11.2  Transformations in the Plane | Inverses of linear transformations.  Application of encrypting codes and decrypting.  Revision | SAT 2: Matrices  Investigation opportunity  Hills cipher using 2x2 matrices and modulo 26 |
| Term 4  Week |  |  |  |
|  | Topic 12: Real and Complex Numbers  (6 weeks) |  |  |
| 1 | Subtopic 12.1  The Number Line | Rational and Irrational numbers.  Prove some simple results.  Interval notation. |  |
| 2 | Subtopic 12.2  Introduction to Mathematical Induction | Ladder/Dominoes example.  Initial statement, inductive step. |  |
| 3 | Subtopic 12.2  Introduction to Mathematical Induction | Initial statement, inductive step.  Examples – with reference to Topic 7: Arithmetic and Geometric Sequences and Series |  |
| 4 | Subtopic 12.3  Complex Numbers | Introducing  and reasons for its use.  Complex numbers: real and imaginary parts.  Conjugates, addition, subtraction, multiplication and use  , division. |  |
| 5 | Subtopic 12.4  The Complex (Argand) Plane | as (a, b) or [a, b].  Use vector addition in the complex plane.  Conjugate of  and modulus  . | Investigation opportunity  Quadratic iterations and patterns produced |
| 6 | Subtopic 12.5  Roots of Equations | Factorise quadratics into linear factors; use of quadratic formula involving *i.* |  |
| 7 |  | Revision | SAT 3: Real and Complex Numbers |
| 8 | Semester Examination Preparation |  |  |

Stage 1 Mathematics (10 credits)

*Aligned with teaching Program 2 – Semester 1 (pre-Specialist, two semester program)*

**ASSESSMENT OVERVIEW**

Complete the table below to show details of the planned tasks. Use numbers to show where students will have the opportunity to provide evidence for each of the specific features for all assessment design criteria

| Assessment Type and Weighting | Name and details of assessment | Assessment Design Criteria | | Assessment conditions  (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- |
| C&T | R&C |
| Skills and Applications Tasks  Weighting 80% | SAT 1 Students demonstrate mathematical knowledge and skills from Topic 7: Arithmetic and Geometric Sequences and Series. The content covers key questions and key concepts within subtopics 7.1, and 7.2. Students apply their knowledge and skills to a range of routine and complex questions.  The complex questions require students to apply the key concepts to solve problems in a variety of contexts and some require interpretation of the results. Construction of graphical representations may be required to support their problem-solving strategies.  The discerning use of electronic technology is expected. Clear and logical communication of solutions and correct use of notation and terminology are required. | 1, 2, 4 | 1, 2, 3, 4 | Supervised written assessment.  Students will be provided with the arithmetic and geometric formulae.  Total time: 50 minutes Part 1: 15 minutes (no calculators) Part 2: 35 minutes (calculators permitted) |
| SAT 2 Key questions and key concepts from Topic 8: Geometry are the focus of a range of routine and complex questions. Students demonstrate their knowledge of circle properties from subtopics 8.1 and 8.2 by selecting and using appropriate mathematical ideas and processes to solve problems. The development and testing of valid conjectures will be a feature of this assessment. Correct notation and diagrammatic representation are required. | 1, 2 | 1, 2, 3, 4, 5 | Supervised written assessment.  One A4 page of handwritten notes permitted.  Total time: 50 minutes |
| SAT 3 Mathematical knowledge and skills based upon the key ideas and key content from subtopics 9.3 and 9.4 from Topic 9: Vectors in the Plane are assessed.  The assessment includes both routine and complex problems, some requiring interpretation. Construction of diagrammatic representations may be required to support problem-solving.  The discerning use of electronic technology is expected. Clear and logical communication of solutions and correct use of notation and terminology are required. | 1, 2, 4 | 1, 2, 3, 4 | Supervised written assessment.  Students will be provided with the projection, dot product and angle between two vectors formulae.  Total time: 50 minutes Part 1: 25 minutes (no calculators) Part 2: 25 minutes (calculators permitted) |
| Mathematical Investigation  Weighting 20% | Tower Investigation  Students look at an application of previous knowledge from Trigonometry Subtopic 3.1 and Geometry Subtopics 8.1 and 8.2. Students investigate the relationship between the position of a person viewing the top of a tower and the maximum angle of view from the person to the top of the tower. Students make conjectures and provide proofs using geometric and triangle properties. | 1, 2, 3, 4 | 1, 2, 3, 4, 5 | 1 week to complete. Verification checks during that time as well as some class time. Maximum of 8 A4 pages.  Appropriate investigation report format as described in the Mathematics subject outline. |

***Four assessments****. Please refer to the Mathematics Subject Outline.*

**Stage 1 Mathematics (10 credits)**

*Aligned with teaching Program 2 – Semester 2 (pre-Specialist, two semester program)*

**ASSESSMENT OVERVIEW**

Complete the table below to show details of the planned tasks. Use numbers to show where students will have the opportunity to provide evidence for each of the specific features for all assessment design criteria.

| **Assessment Type and Weighting** | **Name and details of assessment** | **Assessment Design Criteria** | | **Assessment conditions** (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- |
| **C&T** | **R&C** |
| **Skills and Applications Tasks**  **Weighting**  **80%** | **SAT 1: Further Trigonometry.** Students demonstrate mathematical knowledge and skills from Topic 10: Further Trigonometry. The content covers key questions and key concepts within subtopics 10.1 and 10.2. Students apply their knowledge and skills to a range of routine and complex questions.  The SAT is divided into two parts:  Part 1: Calculations without electronic technology (graphing sinusoidal functions, using trigonometric identities to establish results algebraically)  Part 2: Calculations with access to electronic technology (solving trigonometric equations and applications).  The complex questions require students to apply the key concepts to solve problems in a variety of contexts and some require interpretation of the results. Construction of graphical representations may be required to support their problem-solving strategies.  Clear and logical communication of solutions and correct use of notation and terminology are required. | 1, 2, 3, 4 | 1, 2, 3 | Supervised written assessment.  Students will be provided with the trigonometric formulae.  Total time: 50 minutes   * Part 1: 25 minutes (no calculators) * Part 2: 25 minutes (calculators permitted) |
| **SAT 2: Matrices.** Key questions and key concepts from Topic 11: Matrices are the focus of a range of routine and complex questions. Students demonstrate their knowledge of matrix arithmetic and transformations from subtopics 11.1 and 11.2 by selecting and using appropriate mathematical ideas and processes to solve problems.  Conjecture work will be incorporated. The discerning use of electronic technology is expected. Correct notation and diagrammatic representation are required. | 1, 2, 4 | 1, 2, 3, 5 | Supervised written assessment.  Transformation formulae will be supplied.  Total time: 45 minutes |
| **SAT 3: Real and Complex Numbers.** Mathematical knowledge and skills based upon the key ideas and key content from subtopics 12.1 to 12.5 are assessed.  The assessment includes both routine and complex problems, some requiring interpretation.  Conjectures will be developed and tested. The discerning use of electronic technology is expected. Clear and logical communication of solutions and correct use of notation and terminology are required. | 1, 2, 4 | 1, 2, 3, 4, 5 | Supervised written assessment.  Total time: 50 minutes   * Part 1: 20 minutes (no calculators) * Part 2: 30 minutes (calculators permitted) |
| **Mathematical Investigation**  **Weighting 20%** | **Cipher Investigation**  Students investigate the Hills Cipher (2x2) by coding a message using modulo 26 and decoding a message using reciprocal modulo arithmetic. Students will use techniques from subtopics 11.1 and 11.2. Opportunities to explore further techniques of coding.is part of the investigation. | 1, 2, 3, 4 | 1, 2, 3, 4 | 1 week to complete. Verification checks during that time as well as some class time.  Maximum of 8 A4 pages.  Appropriate investigation report format as described in the Mathematics subject outline. |

***Four assessments****. Please refer to the Stage 1 Mathematics Subject Outline.*

Stage 1 Mathematics

Assessment Type 2: Mathematical Investigation

Trigonometry

NAME:

Your report on the mathematical investigation should include the following:

* an outline of the problem and context
* the method required to find a solution, in terms of the mathematical model or strategy used
* the application of the mathematical model or strategy, including:
  + relevant data and/or information
  + mathematical calculations and results, using appropriate representations
  + the analysis and interpretation of results, including consideration of the reasonableness and limitations of the results.
* the results and conclusions in the context of the problem
* a bibliography and appendices, as appropriate.

The format of an investigation report may be written or multimodal.

The investigation report should be a **maximum of 8 A4 pages** if written, or the equivalent in multimodal form.

Assessment Design Criteria

Concepts and Techniques

CT1 Knowledge and understanding of concepts and relationships

CT2 Selection and application of mathematical techniques and algorithms to find solutions to problems in a variety of contexts

CT3 Application of mathematical models

CT4 Use of electronic technology to find solutions to mathematical problems

Reasoning and Communication

RC1 Interpretation of mathematical results

RC2 Drawing conclusions from mathematical results, with an understanding of their reasonableness and limitations

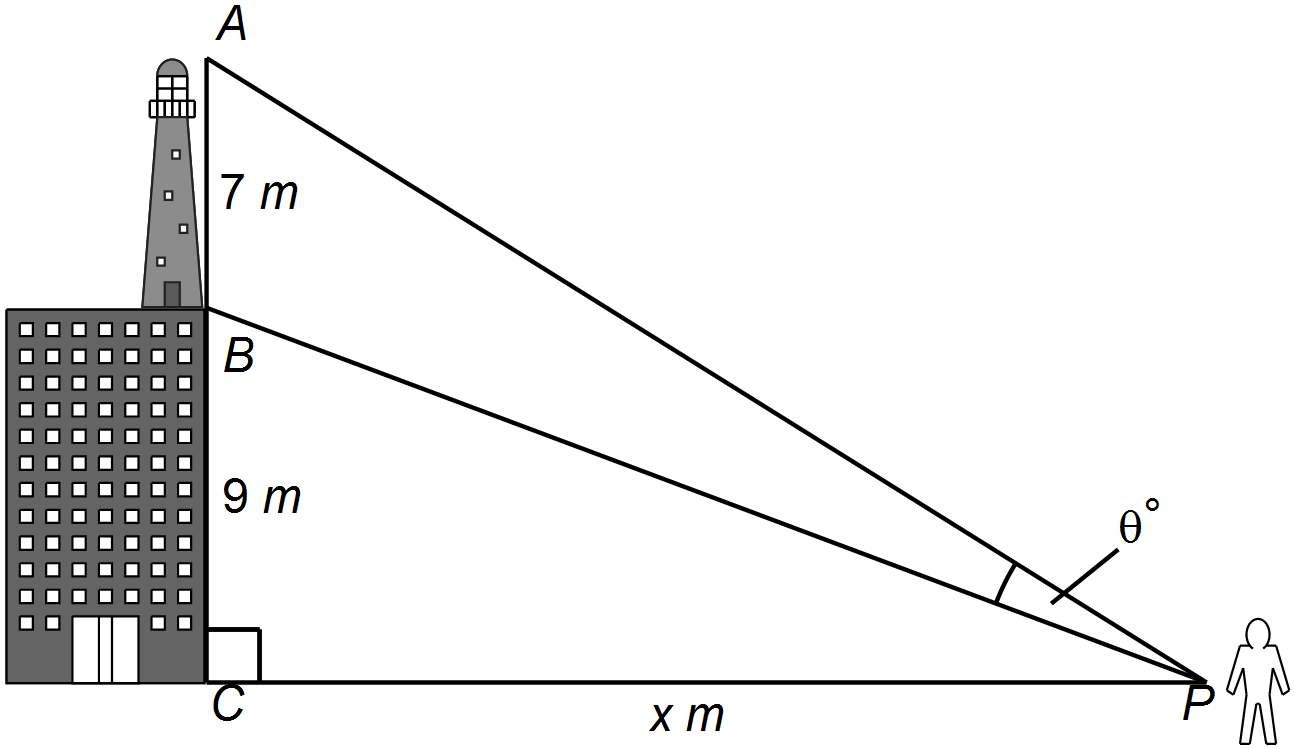
RC3 Use of appropriate mathematical notation, representations, and terminology

RC4 Communication of mathematical ideas and reasoning to develop logical arguments

RC5 Development and testing of valid conjectures

**TRIGONOMETRY INVESTIGATION**

A tower, 7*m* high, stands on top of a building 9*m* high. An observer at the bottom of the building notices that, as she walks away from the building, the angle  which the tower subtends at her eyes seems to increase in size for a certain distance and then to decrease.



In the two right angled triangles above, P is a variable distance, *x* *m* , from C.

**Part 1 – Trigonometry Approach**

For different values of *x* determine the size of angle  and then investigate what position of *x* maximizes the angle . Consider strategies that can be used and give clear explanations of the method you then used to find this position, annotating your steps of working.

**Part 2 – Trigonometry and Algebra Approach**

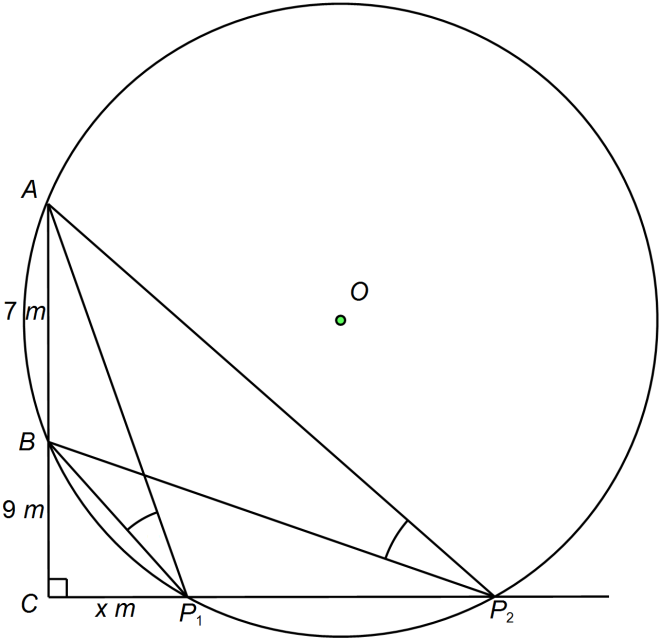
Using  and  find an algebraic expression for  in terms of *x*. Graph this algebraic expression to determine the value of *x* which maximizes .

Compare the results from Part 1 and Part 2.

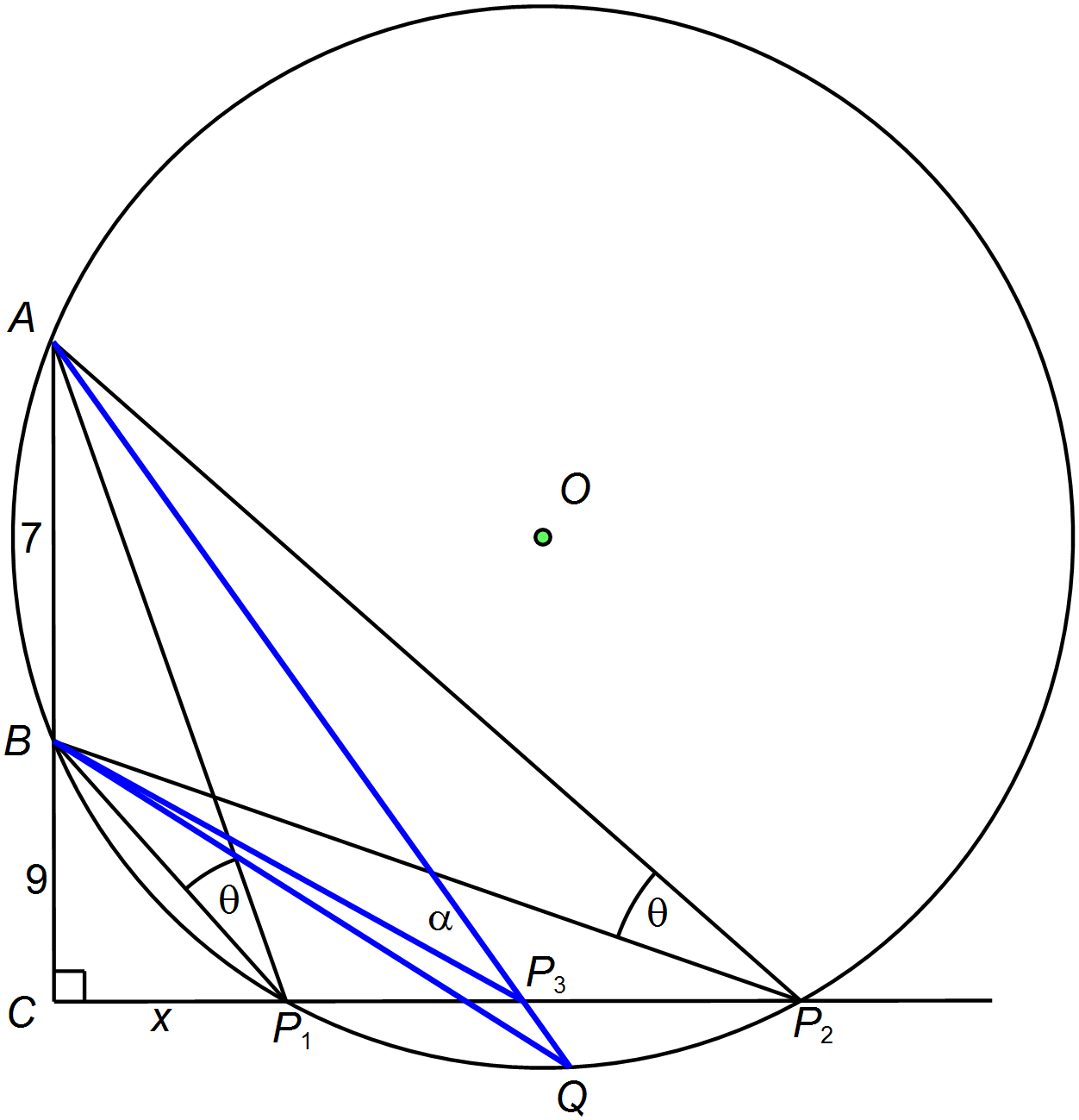
**Part 3 – Geometry Proof Approach**



A circle is drawn through points A and B cutting the base line at P1 and P2.

If the observer is at position P1 or P2 then make a conjecture about the relationship between the angles from the observer to A and B. Provide a formal proof for the conjecture.

This would indicate that, at P1, has not yet reached its greatest value and that at P2, it has gone beyond it. At any point between P1 and P2,  will be greater than at P1 and P2.

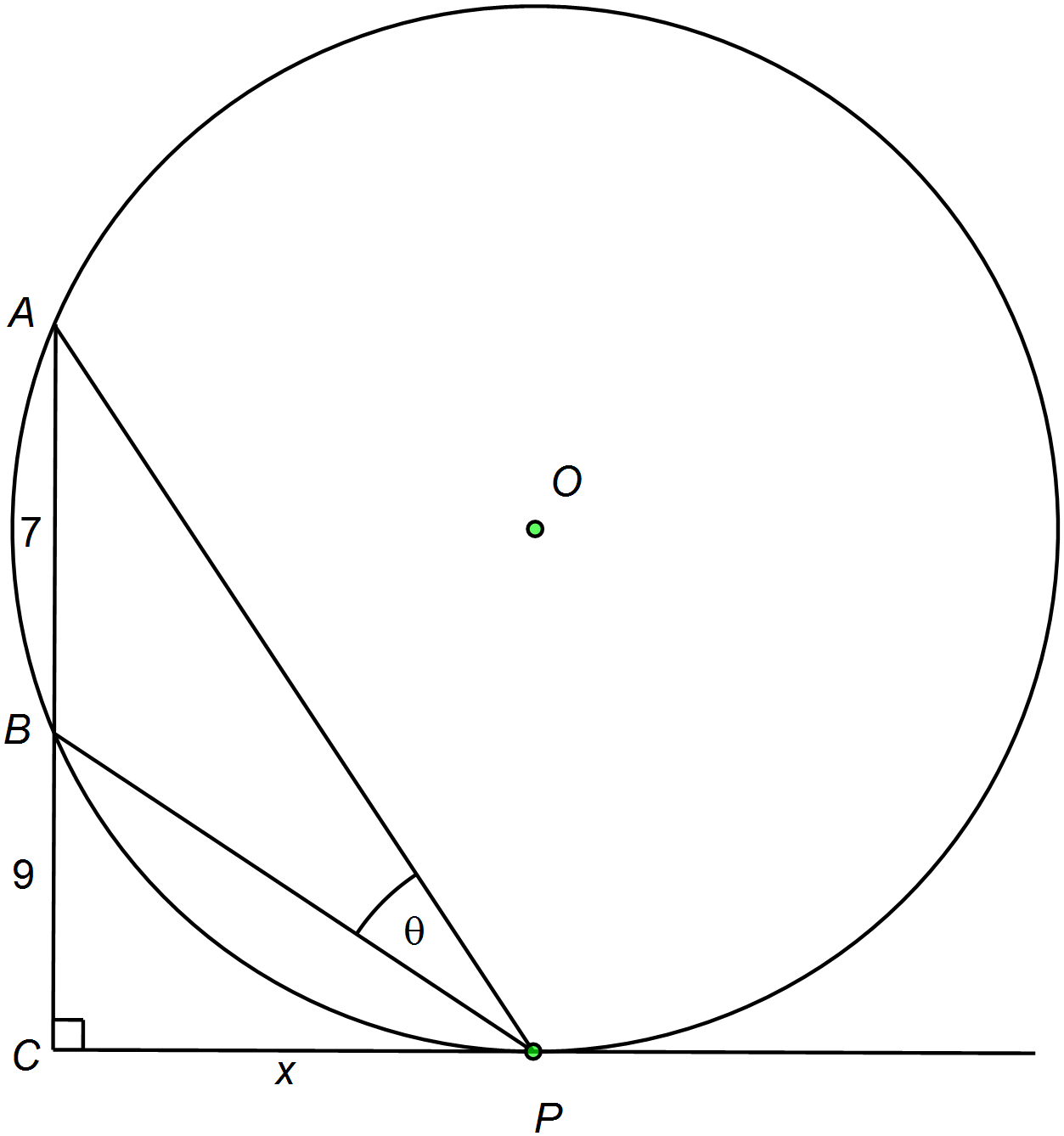


Use geometry to explain why, referring to the diagram on the right.

Let ****

By considering  BP3 Q, explain why

 and then explain why .



Points P1 and P2 are brought closer to each other so that they eventually are *touching* at P as shown in the diagram on the right.

Give a conjecture about the relationship between *BPC* and *CAP.* Prove the conjecture.

Prove that the triangles ACP and PCB are similar.

Hence, determine the relationship between *x* and your results from Part 1 and Part 2.

**Part 4 – Drawing Conclusions**

Summarize results from Parts 1, 2 and 3, making links where appropriate. Draw conclusions and discuss and limitations or assumptions made.

Stage 1 Mathematics

Assessment Type 2: Mathematical Investigation

Matrices

NAME:

Your report on the mathematical investigation should include the following:

* an outline of the problem and context
* the method required to find a solution, in terms of the mathematical model or strategy used
* the application of the mathematical model or strategy, including:
  + relevant data and/or information
  + mathematical calculations and results, using appropriate representations
  + the analysis and interpretation of results, including consideration of the reasonableness and limitations of the results
* the results and conclusions in the context of the problem
* a bibliography and appendices, as appropriate.

The format of an investigation report may be written or multimodal.

The investigation report should be a **maximum of 8 A4 pages** if written, or the equivalent in multimodal form.

Assessment Design Criteria

Concepts and Techniques

CT1 Knowledge and understanding of concepts and relationships

CT2 Selection and application of mathematical techniques and algorithms to find solutions to problems in a variety of contexts

CT3 Application of mathematical models

CT4 Use of electronic technology to find solutions to mathematical problems

Reasoning and Communication

RC1 Interpretation of mathematical results

RC2 Drawing conclusions from mathematical results, with an understanding of their reasonableness and limitations

RC3 Use of appropriate mathematical notation, representations, and terminology

RC4 Communication of mathematical ideas and reasoning to develop logical arguments

RC5 Development and testing of valid conjectures

Coding and Decoding using Matrices

Part 1

This part of the investigation will show you by example how to produce a coded message (enciphering) and how to decode a message (deciphering).

The 26 letters of the alphabet are chosen and a value assigned as show below:

Letters: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Value: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 0

Assign numbers to some plain text and then arrange these numbers in column matrices. For example:

ALGEBRA becomes AL GE BR AA and with code and column matrix form becomes

To encipher this message or word we need a coding matrix which is a 2x2 matrix with a determinant that is not divisible by 2 or 13.

An example is. Pre-multiply each column matrix by this 2x2 matrix. For example,

. AL has been enciphered as KN.

This gives an enciphered message of KNVSDVDC.

To decipher a code with the enciphering matrix known, rewrite the code in number form and produce column matrices. Then with the enciphering matrix, find its determinant and then the reciprocal modulo 26 of that number. For example, consider the enciphering matrix which has a determinant of 5. This has a reciprocal modulo 26 value of 21. The following table will help with other values for the determinant:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Determinant and the reciprocal modulo 26 | | | | | | | | | | | | |
| Determinant | 1 | 3 | 5 | 7 | 9 | 11 | 15 | 17 | 19 | 21 | 23 | 25 |
| Reciprocal modulo 26 | 1 | 9 | 21 | 15 | 3 | 19 | 7 | 23 | 11 | 5 | 17 | 25 |

Now convert the enciphering matrix to a deciphering matrix:

Use this deciphering matrix to pre-multiply coded column matrices and hence decode the message.

Part 2 – Coding and Decoding

Encipher your own message using Part 1 and give it to another member of the class along with your enciphering matrix. In return obtain their coded message, enciphering matrix and decode their message.

Consider and discuss any limitations with this method of encryption.

Part 3 Further Considerations

Below is a list of suggestions for further consideration within the scope of this investigation.

* Consider Part 1: Why is it necessary when using modulo 26 to have a determinant which is not a factor of 26?
  + An investigation into relevant modulo arithmetic
  + Production of a calculator program or computer program to find reciprocal modulo numbers.
* Consider how larger amounts of text may be coded/decoded rather than two letters at a time.
* Consider allowing the use of punctuation.

Program 1 - Stage 1 General Mathematics – Semester 1

Topic 1: Investing and Borrowing, Topic 2: Measurement, and Topic 3: Statistical Investigation

|  | **Lesson 1 – Single Lesson** | **Lesson 2 – Single Lesson** | **Lesson 3 – Double Lesson** |
| --- | --- | --- | --- |
| **Term 1**  **Week 1** | Course Overview and Expectations   * Including what to bring to class * Appropriate calculators   **TOPIC ONE: INVESTING AND BORROWING**  Investing money   * Why invest? * Where can we invest? * Types of investments * Fees and charges | What is simple interest and how do we do simple interest calculations   * Simple interest * Principal * Interest rate * Time invested in years * Total return | Simple interest skills practice  Introduction to compound interest via spreadsheet calculations |
| **Week 2** | Compound interest   * Derive the formula * Use the formula to find future value, interest earned and present value | Use the compound interest formula to find future value, interest earned and present value | Effect of changing the compounding period  Problems-based skills practice |
| **Week 3** | Annualised rates to compare investments | Compound interest using the graphic calculator   * Future value * Present value * Interest rate * Time * Comparison rate on savings | Compound interest using the graphic calculator  Problems-based skills practice  Simple interest versus compound interest, which is better? |
| **Week 4** | Share Investments   * The basics about the share market * Costs * Risks | Cost of buying and selling shares | Share calculations   * Breakeven point using brokerage rate and flat fee brokerage (formula only) * Dividend return on shares |
| **Week 5** | Expressing the return on an investment as a percentage of the original investment | The effect of tax and inflation on the real growth of the investment | Credit cards   * Why use credit? * Types of cards * Costs   Personal loans   * Fees/Charges * Interest |
| **Week 6** | Loans and credit cards (Borrowing) versus Saving | REVISION | **INVESTING AND BORROWING**  **SAT 1** |
| **Week 7** | **TOPIC TWO: MEASUREMENT**  Measurement review   * Measuring devices * Metric system conversion | Accuracy of measurements   * Estimating and approximation * Rounding to significant figures | Absolute and percentage error calculations  Scientific notation  Pythagoras theorem review |
| **Week 8** | Pythagoras’ theorem | Perimeter of standard and composite shapes including circles, sectors, quadrilaterals and triangles | Perimeter and Pythagoras’ theorem  Problems-based skills practice |
| **Week 9** | Area units and their conversion  Area of standard and composite shapes including circles, sectors, ovals, trapeziums and triangles | Area of standard and composite shapes  Problems-based skills practice | Calculating the surface area of standard and composite solids including prisms, pyramids, cones, cylinders and spheres |
| **Week 10** | Approximating areas of irregular shapes using simple shapes | Approximating areas of irregular shapes using Simpson’s rule | Volume   * Units and how to convert between them * Connection between volume and capacity and conversion between them * Calculating the volume of standard and composite solids including prisms, pyramids, cones, cylinders and spheres |
| **Week 11** | Calculating volume  Problems-based skills practice | Irregular volume calculations   * Prismatic model * Conical model | **MATHEMATICAL INVESTIGATION 1** |
| **Term 2**  **Week 1** | Scale   * How does a scale factor work * Calculating actual lengths and scaled measurements | Scale   * Drawing scaled diagrams * Determining scale factor | **MATHEMATICAL INVESTIGATION 1** |
| **Week 2** | REVISION | **MEASUREMENT**  **SAT 2** | **TOPIC THREE: STATISTICAL INVESTIGATION**  Students look at statistics presented and the statistical process that would have underpinned these statistics |
| **Week 3** | Samples   * What is a sample? * Why do we sample? * Bias in samples | Sampling methods and their advantages and disadvantages   * Simple random * Stratified * Systematic | Categorical data (Ordinal and Nominal) and how we present this data (table, bar and pie chart) |
| **Week 4** | Numerical data (Discrete and Continuous) and how we present this data (dot plot, stem plot and histogram) | Numerical data   * Shapes of distributions * Outliers, the effect on distributions and what should we do with them. | Calculation of measures of central tendency   * Mean * Median   How do we tell what is the most appropriate measure of the average? |
| **Week 5** | Calculation of measures of spread   * Range * Interquartile range * Standard deviation | Box-and-whisker diagrams | Impact of sample size |
| **Week 6** | Putting it all together for numerical data   * Graphical representation * Dealing with outliers * Shape of the distribution * Measures of centre and spread * Argument to support conjecture | Putting it all together for categorical data   * Table of counts * Graphical representation * Identification of the mode * Calculation of proportions * Argument to support conjecture | Problems-based skills practice and revision |
| **Week 7** | **STATISTICAL INVESTIGATION**  **SAT 3** | EXAM REVISION and/or timetabling flexibility | EXAM REVISION and/or timetabling flexibility |
| **Week 8** | EXAM REVISION | EXAM REVISION | **MID YEAR EXAM - FORMATIVE** |

**Program 1 – Stage 1 General Mathematics – Semester 2**

Topic 4: Applications of Trigonometry Topic 5: Linear and Exponential Functions and their Graphs, and Topic 6: Matrices and Networks

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Lesson 1 – Single Lesson** | **Lesson 2 – Single Lesson** | **Lesson 3 – Double Lesson** |
| Term Two  **Week 9** | (Timetable flexibility – e.g. Work Experience) | | |
| **Week 10** | **TOPIC FOUR: APPLICATIONS OF TRIGONOMETRY**  Review the use of Pythagoras’ theorem and trigonometric ratios to solve contextual problems in 2D | Pythagoras’ theorem and right triangle trigonometry: problem-based skills practice | Applying Pythagoras’ theorem and trigonometric ratios to solve contextual problems in 3D |
| Term Three  **Week 1** | Area of non-right angled triangles using one angle and two sides | Area of non-right angled triangles using its three sides (Heron’s rule) | The cosine rule   * Finding an unknown side |
| **Week 2** | The cosine rule   * Finding an unknown angle | The sine rule   * Finding an unknown side | The sine rule   * Finding an unknown angle and the ambiguous case |
| **Week 3** | Contextual applications of the sine and cosine rules | REVISION | **APPLICATIONS OF TRIGONOMETRY**  **SAT 1** |
| **Week 4** | **TOPIC SIX: MATRICES AND NETWORKS**  What is a matrix? Where are matrices used?   * Columns and rows * Order | Multiplication by a scalar  Adding and subtracting matrices | Using matrices to set up costing and inventory control problems |
| **Week 5** | Matrix multiplication by hand | Multiplying by a row or column matrix of 1’s | Matrices using a graphic calculator   * Adding and subtracting * Scalar and matrix multiplication |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Lesson 1 – Single Lesson** | **Lesson 2 – Single Lesson** | **Lesson 3 – Double Lesson** |
| **Week 6** | Costing matrices problems | Costing matrices problems | **MATRICES SAT 2** |
| **Week 7** | Networks   * What are networks? * Reading information from a network * Notation and terminology * Types of networks | Number of paths in directed networks   * With and without restrictions | Shortest and longest paths through a network   * With and without restrictions |
| **Week 8** | Maximum flow algorithm   * Finding maximum flow | Maximum flow algorithm   * Finding maximum flow | Spanning trees   * Greedy algorithm * Prim’s algorithm |
| **Week 9** | **MATHEMATICAL INVESTIGATION 1** | **MATHEMATICAL INVESTIGATION 1** | **MATHEMATICAL INVESTIGATION 1** |
| **Week 10** | **TOPIC FIVE: LINEAR AND EXPONENTIAL FUNCTIONS AND THEIR GRAPHS**  Introduction to linear relationships   * Description of the contextual linear relationship * Creating a table of values * Taking the table of values to a graph | Linear relationships   * Graphical representation * Algebraic formula | Solving linear relationship problems in context using graphs  Limitations of the graphical method |
| Term Four  **Week 1** | Solving problems using the algebraic formula   * Substitution and evaluation * Rearrangement * Solving linear equations | Looking at the links between the four methods of representing a linear relationship   * Y-intercept * Slope | Linear Functions  Problem-based skills practice |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Lesson 1 – Single Lesson** | **Lesson 2 – Single Lesson** | **Lesson 3 – Double Lesson** |
| **Week 2** | Examination of numerical sequences where growth is via multiplication by a positive constant   * The use of powers to calculate terms in such sequences | Differences of growth and decay from linear relationships  Introduction to exponential functions | Examining the four ways to represent exponential relationships   * Contextual description * Table of values * Graph * Algebraic formula |
| **Week 3** | Looking at the links between the four methods of representing an exponential relationship   * Features of the graph * Parameters in the algebraic function   Using the graphic calculator to solve problems involving exponential functions   * Graphically * Using the equation solver | Solving problems involving compound interest | Other growth models   * Population growth * Inflation |
| **Week 4** | Models of decay   * Radioactive decay * Cooling | Finding percentage growth or decay | Solving problems involving exponential growth and decay |
| **Week 5** | REVISION | **LINEAR AND EXPONENTIAL FUNCTIONS**  **SAT 3** | EXAM REVISION and/or flexibility in schedule for make-up lessons |
| **Week 6** | EXAM REVISION and/or flexibility in schedule for make-up lessons | | |
| **Week 7** | EXAMINATION (formative)  For students going onto Stage 2 General Maths, undertaking an exam is good preparation for the external assessment. | | |

Stage 1 General Mathematics (10 credits)

*Aligned with teaching Program 1 – Semester 1*

**ASSESSMENT OVERVIEW**

Complete the table below to show details of the planned tasks. Use numbers to show where students will have the opportunity to provide evidence for each of the specific features for all assessment design criteria.

| **Assessment Type and Weighting** | **Name and details of assessment** | **Assessment Design Criteria** | | **Assessment conditions (e.g. task type, word length, time allocated, supervision)** |
| --- | --- | --- | --- | --- |
| C&T | R&C |
| **Skills and Applications Tasks**  **Weighting 65%** | Students demonstrate mathematical knowledge and skills from **Topic One: Investing and Borrowing**. The content covers key questions and key concepts within subtopics 1.1 and 1.2. Students apply their knowledge and skills to a range of routine and complex questions.  The complex questions require students to apply the key concepts to solve problems in a variety of contexts and some require interpretation of the results.  Appropriate and effective use of electronic technology is expected. Clear and logical communication of solutions and correct use of notation and terminology are required. | 1, 2, 4 | 1, 2, 3 | Supervised written assessment.  One A4 page of handwritten notes permitted.  Total time: 50 minutes |
| Key questions and key concepts from **Topic Two: Measurement** is the focus of a range of routine and complex questions in SAT 2. Students demonstrate mathematical knowledge and skills of key questions and key concepts from measurement subtopics 2.1, 2.2, 2.3 and part of 2.4 (scales). Students apply their knowledge and skills to a range of routine and complex questions in a variety of contexts. Most questions require the aid of electronic technology. Correct use of notation and terminology are required. | 1, 2, 4 | 1, 2, 3, 4 | Supervised written assessment.  Students will be provided with formulae for perimeter, area and volume and surface area.  Total time: 50 minutes |
| **Topic Three: Statistical Investigation.**  Mathematical knowledge and skills based upon the key questions and key concepts from all subtopics are assessed. The assessment includes both routine and complex problems, some requiring interpretation and comparison of two or more sets of data.  Appropriate and effective use of electronic technology is expected. Clear and logical communication of solutions and correct use of notation and terminology are required. | 1, 2, 4 | 1, 2, 3, 5 | Supervised written assessment.  One A4 page of handwritten notes permitted.  Total time: 50 minutes |
| **Mathematical Investigation**  **Weighting 35%** | In this task students are required to design one piece for an outdoor chess set using a combination of mathematical solids. They will then cost the construction of their design including casting in lightweight concrete and coating in a decorative paint. Scope for complexity is provided by the choice of piece to model and the mathematical solids used. Students are required to consider the reasonableness of their results by examining the underlying assumptions of their mathematical model. | 1, 2, 3 | 1, 2, 3, 4, 5 | 3 weeks to complete. Some class time is allowed to support verification.  **Maximum of 8 A4 pages.**  Appropriate investigation report format as described in the General Mathematics subject outline. |

***Four assessments****. Please refer to the General Mathematics Subject Outline.*

Stage 1 General Mathematics (10 credits)

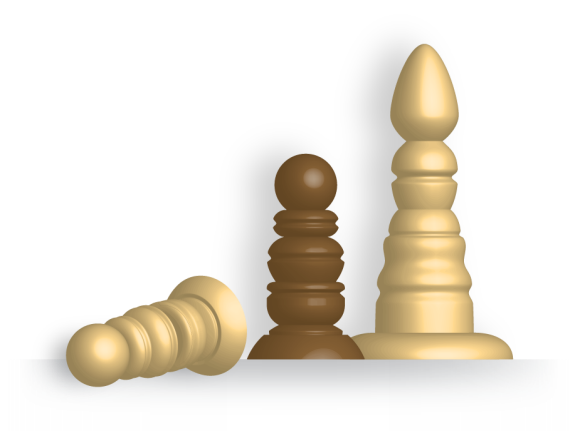
*Aligned with teaching Program 1 – Semester 2*

**ASSESSMENT OVERVIEW**

Complete the table below to show details of the planned tasks. Use numbers to show where students will have the opportunity to provide evidence for each of the specific features for all assessment design criteria.

| Assessment Type and Weighting | Name and details of assessment | Assessment Design Criteria | | Assessment conditions (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- |
| C&T | R&C |
| Skills and Applications Tasks  Weighting 65% | Students demonstrate mathematical knowledge and skills from **Topic Four: Applications of Trigonometry**. The content covers key questions and key concepts within subtopics 4.2, 4.3, and 4.4. Students apply their knowledge and skills to a range of routine and complex questions.  The complex questions require students to apply the key concepts to solve problems in a variety of contexts and some require interpretation of the results and considerations of limitations and assumptions.  Appropriate and effective use of electronic technology is expected. Clear and logical communication of solutions and correct use of notation and terminology are required. | 1, 2, 4 | 1, 2, 3, 4 | Supervised written assessment.  One A4 page of handwritten notes permitted  Total time: 50 minutes |
| Key questions and key concepts from **Topic Six: Matrices and Networks** is the focus of a range of routine and complex questions in SAT 2. Students demonstrate mathematical knowledge and skills in the key concepts of matrices (subtopic 6.1). Students apply their knowledge and skills to a range of routine and complex questions in a variety of contexts. Correct use of notation and terminology are required. | 1, 2, 4 | 1, 2, 3, 4 | Supervised written assessment.  One A4 page of handwritten notes permitted  Total time: 50 minutes  Part 1: 15 minutes (no calculator)  Part 2: 35 minutes (calculator permitted) |
| **Topic Five: Linear and Exponential Functions and their Graphs.**  Mathematical knowledge and skills based upon the key ideas and key content from subtopics 5.1 and 5.2 are assessed. The assessment includes both routine and complex problems, some requiring interpretation of results in context. Construction of graphical representations may be required to support their problem-solving strategies.  Appropriate and effective use of electronic technology is expected. Clear and logical communication of solutions and correct use of notation and terminology are required. | 1, 2, 4 | 1, 2, 3, 4 | Supervised written assessment.  One A4 page of handwritten notes permitted  Total time: 50 minutes |
| Mathematical Investigation  Weighting 35% | Students are required to demonstrate their understanding and skills in applying concepts from subtopic 6.2 to formulate and solve a network-based problem drawn from their local environment. Once a solution has been found they are expected to consider the effects of modifying the original parameters of the problem. This could be either because of a change in conditions or a desire to upgrade the system under consideration. | 1, 3 | 1, 2, 3, 4, 5 | 3 weeks to complete. Some class time is allowed to support verification.  **Maximum of 8 A4 pages**.  Appropriate folio format as described in the General Mathematics subject outline. |

***Four assessments****. Please refer to the General Mathematics Subject Outline.*

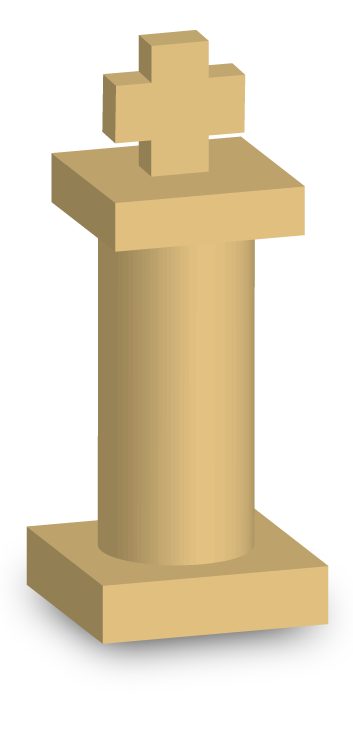


Stage 1 General Mathematics

Assessment Type 2: Mathematical Investigation

Topic 2: Measurement

Outdoor Chessmen



Your task is to design one chess piece for an outdoor chess set.

You need to decide which piece you are going to design –

Pawn, Knight, Rook (castle), Bishop, King or Queen.

You might like to have a look at designs that other people have used before you make your own design. There are plenty of outdoor chess set images on the internet for you to get some inspiration from. There’s a really way out set made for outdoor playing in a desert at night to be seen at the web site <http://www.curple.com/chess/> if you’re interested.

Your design is required to be composed of mathematical solids.

These can be as simple or as complex as you like but the design must utilise at least two types of shape (see below), and have at least 4 parts :

* one of which has *planar* faces
* one which has a *curved surface*
* you could consider one shape which is ‘pointy’ or part of a pointy shape (for example a pyramid or truncated cone) for more complexity.

The complexity of the shapes you use in your design will determine the level of complexity in the calculations you have to carry out. Using only simple shapes may lead to calculations that are all routine in nature. Your chess piece must show pleasing proportions and fit comfortably on a paver which measures 290mm square. The chess piece needs to be a comfortable height for an adult to pick up and walk with to move it.

**Part One – The Design**

Create a design following the guidelines above. Draw a reasonable sketch of what your piece will look like and include the ***relevant*** measurements (no calculations are needed at this point).

***Have your design approved by your teacher before you proceed with the investigation.***

**Part Two – Estimating and Calculating Volume**

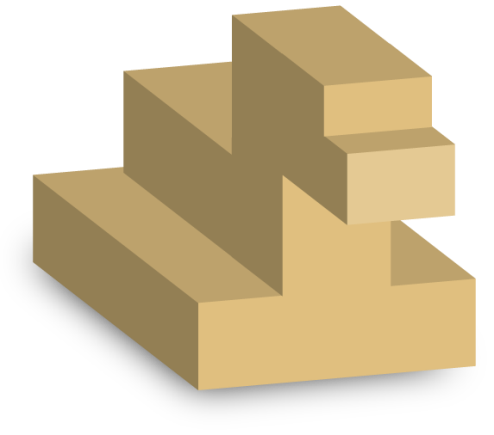
a) Consider what kind of simple solid would have approximately the same volume as your chess piece design. Using a few appropriate measurements from your design and your chosen approximate shape, find an estimate of the volume of the piece. For example, the shape on the left could be considered to be approximately cylindrical so an estimate of its volume could be calculated using height and *average* width. Show the process you use to do this.

b) Carry out all the calculations needed to find the *actual* volume of lightweight concrete that would be needed to manufacture your chess piece. You must show all working, formulas used, and measurement units. Set the calculations out clearly.

c) Compare your answers for parts a) and b) and discuss how accurate your prediction was. Are there are any ways that you could make a more accurate prediction without carrying out the full calculations?

**Part Three – Calculating Surface Area**

Carry out all the calculations needed to find the ***surface area*** that would need to be painted to protect and decorate your chess piece (this area includes all surfaces that are exposed to the air). As in *Part Two*, you must show all working, formulas used and measurement units, and set the calculations out clearly.



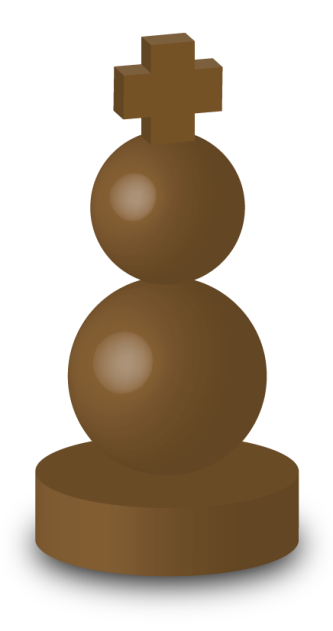
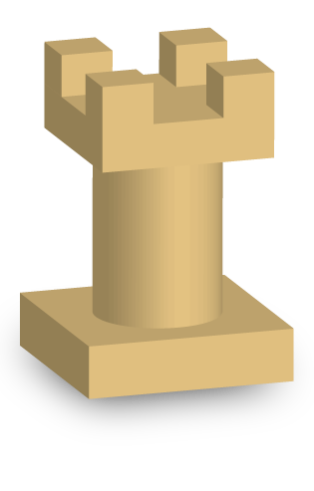
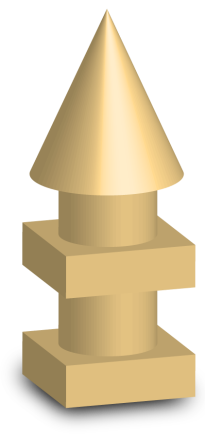
**Part Four – Calculating Cost**

The lightweight concrete has a density of 0.0823 g/cm3 and costs $34.95 for a 15kg bag. The special ‘glow in the dark’ decorative paint is $27.25 for a 500ml tin and can cover 16 m2 per litre.

Use the information above to calculate the ***cost*** of making your chess piece. Show all your calculations clearly.

**Part Five – The Report**

* Write an **introduction** which explains in your own words what this project is about and how you went about deciding onyour design.
* Include the 3D sketch of your design from **Part 1** (this can be done on a computer if you have software that will do 3D drawing) and a ***scaled*** diagram of the ***profile(s****)* of your design showing the measurements.
* Provide all calculations and any discussion from **Parts 2 to 4**.
* A **conclusion** summarising your results, and a discussion of any assumptions that you have made and limitations to your results for this task.

*The specific features assessed in this task are: CT1, CT2, CT3, RC1, RC2, RC3, RC4 and RC5*

Stage 1 General Mathematics

Assessment Type 2: Mathematical Investigation

A Network Problem

In this topic (Matrices and Networks) you have studied ways of solving several different types of network problems. For this investigation you are required to devise a network problem of your own, set in a context from your local environment. For the purposes of this investigation, ‘local environment’ means somewhere you are familiar with – it could be in your home or school grounds, local council area or it could include the whole state or country. This will depend on the problem you choose to solve. Your mathematical investigations will be recorded in a report. The suggested format for the report is provided on the second page.

Part 1: Formulate the problem to be solved

You have a great deal of choice here. Some possible examples are given below to get you started. Check your proposed problem with the teacher before proceeding to Part 2.

Example 1: The students at your school have requested that drinking fountains fed from a rainwater tank be placed at convenient places around the grounds. Using a map of the school, decide where the fountains would be located and how they can be connected to the tank in the most cost efficient way.

Example 2: A charity walk is planned for your council area. Part of the proposed route has all the walkers passing through a local park that has a network of paths of different widths. Analyse the maximum possible flow rate of people through the park and report to the council on the implications of your findings.

Example 3: You are planning a road trip between two major cities in Australia (or towns in your state). There are several routes that can be taken without backtracking. Determine the ‘best’ route to take using a variety of different ‘costs’ (such as distance, time, road conditions, number of tourist attractions available, etc) along each of the arcs of the road network.

Part 2: Solve the basic problem

Create the network diagram from the information you have collected and solve the problem(s) you have posed.

Part 3: Investigate the effects of possible changes

Devise one or more changes to conditions in the initial problem, and make a prediction about the possible effect these changes would have on the original solution. These changes to conditions could include:

* Restrictions on the original conditions
* Using a different algorithm to find the solution
* Possible upgrades to improve the solution to the original problem.

Part 4: Conclusion

Analyse and compare your results from Parts 2 and 3 above, including the reasonableness of your prediction. Your discussion should include a consideration of the effects of simplifying assumptions and the limitations on the practicality or reliability of your solution.

Your report on the mathematical investigation should include the following:

* an outline of the problem to be explored
* the method used to find a solution
* the application of the mathematics, including
* generation or collection of relevant data and/or information, with a summary of the process of collection
* mathematical calculations and results, using appropriate representations
* discussion and interpretation of results, including consideration of the reasonableness and limitations of the results
* the results and conclusions in the context of the problem
* a bibliography and appendices, as appropriate.

The format of an investigation report may be written or multimodal.

The investigation report should be a **maximum of 8 pages** if written, or the equivalent in multimodal form.

Concepts and Techniques

The specific features are as follows:

CT1 Knowledge and understanding of concepts and relationships

CT3 Application of mathematical models

Reasoning and Communication

The specific features are as follows:

RC1 Interpretation of mathematical results

RC2 Drawing conclusions from mathematical results, with an understanding of their reasonableness and limitations

RC3 Use of appropriate mathematical notation, representations, and terminology

RC4 Communication of mathematical ideas and reasoning to develop logical arguments

RC5 Forming and testing of predictions

Stage 1 Essential Mathematics – Numeracy Program 1

This program is designed to be completed in one semester. However flexibilities in this program could enable students to proceed through the course at an accelerated pace, or be extended over a full year for those students who need extra time to achieve the numeracy requirement.

The focus is on collecting evidence that demonstrates their learning when they are ready. Evidence will be collected to form one Skills and Applications assessment in Topic 1.

Topic 1

|  |  |  |
| --- | --- | --- |
| Subtopic | Content | Assessment |
| 1.1: Calculations | How can basic mathematics skills help us in our everyday lives?   * solve practical problems requiring basic number operations * apply arithmetic operations according to their correct order | Skills and Applications Task 1  Section 1 – Provides evidence of ability to perform basic operations without the use of a calculator.   * Multi digit addition and subtraction * Single and double digit multiplication * Single digit division |
| How can we determine the reasonableness of our calculations?   * use leading-digit approximation to obtain estimates of calculations * apply approximation strategies * ascertain the reasonableness of answers to arithmetic calculations * check results of calculations for accuracy * multiplication and division by multiples of 10 | Skills and Applications Task 1  Section 2 – Provides evidence of ability to perform basic rounding to a leading digit to estimate arithmetic calculations without use of technology.  Calculators are then used within this section to check the accuracy. |
| Understanding and using decimal numbers.   * recognise the significance of place value after the decimal point * round up or round down numbers to the required number of decimal places * solve practical problems requiring basic number operations involving decimals | Skills and Applications Task 1  Section 3 – Provides evidence of the ability to round simple decimal numbers appropriately and to operate on simple decimal numbers in everyday contexts.   * Introduction of worded problems * Without access to calculator |
| How can a calculator be used to carry out multi-step calculations? | Appropriate and effective use of calculators is the focus in problems involving multiple steps. This could be extended to use of spreadsheets which will be utilised in the Folio task later in the program. |
| 1.2: Time and rates | Estimate and calculate time:   * use units of time, conversions between units, fractional, digital, and decimal representations * represent time using 12-hour and 24-hour clocks * calculate time intervals, such as time between, time ahead, time behind | Skills and Applications Task 1  Section 4 – Provides evidence of the ability to perform conversions between time representations and use timetables.  This section could be extended into estimation of duration of journey by plane, including understanding and ability to consider time zone differences. (The context could be varied to support local expertise or opportunities). |
| How can we use rates to make comparisons?   * use rates to make comparisons and to solve problems | Skills and Applications Task 1  Section 5 – Problems requiring conversion of prices to a unit price to enable comparisons between products. Students then use this information to determine the best buy. Questions requiring students to discuss the appropriateness of their choice given considerations such as wastage. |
| 1.3: Ratio and Scale | What is a ratio and how do we use them to solve problems?   * the relationship between fractions and ratio * express a ratio in simplest form * find the ratio of two quantities * divide a quantity in a given ratio | Skills and Applications Task 1  Section 6 – Provides evidence of the ability to express two quantities as a ratio and to express that ratio in the simplest form. |
| The six sections above are presented in a single booklet to the students. Students complete one section at a time as they complete the learning for each section. These combine to form the collection of evidence that is **Skills and Applications Assessment 1**. |
| How does a scale factor work?   * Scale factor * Scale diagrams * Calculation of actual and scale distances | **Folio 1:** A practical activity in which students create a scaled diagram of their bedroom (or another room in their house), then create scaled cut-outs of items (chosen from catalogues or a visit to a furniture store) to furnish their room. Two designs are constructed and justification of which is the better design is included in the individual response. **Maximum of 6 A4 pages.** |

Topic 2: Earning and Spending

|  |  |  |
| --- | --- | --- |
| Subtopic | Content | Assessment |
| 2.2: Spending | How can a percentage be expressed as a decimal or fraction?  How can the calculation of a percentage provide us with information?   * finding a percentage of a given amount * determining one amount expressed as a percentage of another   What impact do percentage increases and decreases have on the price of goods and services?   * percentage increases and decreases * calculations involving mark-ups, discounts, GST. |  |
| 2.1 Earning | In which different ways can income be earned and received?  Salary  Wages  Hourly paid  Commission  Piecework | Folio 2:  Pizza shop telephone order operator.  Students investigate two scenarios of earning income and determine which option would be the best.   * Paid per hour * Paid per order taken   Calculations are carried out by hand for the first week of data, and then a spreadsheet is created to investigate the earnings over a 4 week period of time.  An option to extend the task is provided with a brief scenario on earning by commission.   * Paid on commission (retainer plus % orders)   Students discuss which of the options investigated would be best under different circumstances. |

**Topic 3: Geometry**

|  |  |  |
| --- | --- | --- |
| Subtopic | Content | Assessment |
| 3.1: Shapes | How do we identify and classify different 2D shapes?   * naming of 2D shapes * classification of shape as regular or irregular * classification and naming of different triangles (e.g. equilateral, isosceles, scalene, right-angled) * naming of different representations of circles (e.g. semicircle and sector) |  |
| How do we identify and classify different 3D shapes?   * naming of 3D shapes * classification of 3D shapes (e.g. prisms, pyramids, sphere, cone) * properties of prisms * properties of pyramids |  |
| 3.3: Geometry and Construction | How do we use mathematical equipment to construct geometrical figures?   * construction techniques for lines * construction techniques for angles | Skills and Applications Task 2  Accessing the Maths Open Reference website at the following hyperlink [www.mathopenref.com/constructions.html](http://www.mathopenref.com/constructions.html) , students complete a set of constructions leaving construction marks in place as evidence of technique. This will be provided to students as an assignment style task in which students complete the constructions at their own pace. |
| How do we use mathematical equipment to construct geometrical shapes?   * construction of triangles (e.g. equilateral, isosceles, scalene, right-angled) * constructions involving circles * construction of a variety of polygons |

**Stage 1 Essential Mathematics (10 credits)**

*Aligned with teaching Program 1 – Numeracy focus*

**ASSESSMENT OVERVIEW**

Complete the table below to show details of the planned tasks. Use numbers to show where students will have the opportunity to provide evidence for each of the specific features for all assessment design criteria.

| Assessment Type and Weighting | Name and details of assessment | Assessment Design Criteria | | Assessment conditions (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- |
| C&T | R&C |
| Skills and Applications Tasks  Weighting 60% | Assignment 1 incorporates a selection of key questions and key concepts covering Topic 1: Calculations, Time and Ratio. The assignment is divided into 6 sections, allowing for the collection of ongoing evidence of the students ability to carry out computations with and without technology within the context of everyday living.  Section 1: Basic number operations without technology  Section 2: Using rounding techniques to estimate arithmetic calculations\*  Section 3: Calculations using decimal numbers without technology  Section 4: Time conversions and calculation of time lapsed  Section 5: Use of unit price to make comparisons between products \*  Section 6: Ratio.  This assignment includes questions in both familiar and unfamiliar contexts.  \* Opportunities are provided in Section 2 and 5 for students to demonstrate evidence of their understanding of the mathematical results and their appropriateness to the problem (RC2), and this could be included in the assessed ADC’s if desired. | 1, 2 | 1, 3 | Students complete each section of the task booklet at their own pace as they achieve the learning.  Students have access to all work completed while undertaking the task. |
| A selection of key questions and key concepts are assessed in an assignment covering subtopic 3.3: Geometry and Construction. This allows for the collection of evidence of the students ability to use a range of techniques to construct geometrical figures and shapes. Students access: [www.mathopenref.com/constructions.html](http://www.mathopenref.com/constructions.html) for instruction in construction techniques, and use the instructions provided to construct a range of different geometric representations. Students are required to leave all construction marks to support the evidence of the steps used in each construction. | 2 | 3 | Students complete the assignment at their own pace through accessing the website indicated. |
| Folio  Weighting 40% | Students use scaling techniques to redesign the layout of a room or garden space relevant to their individual interests. The task covers concepts from Subtopic 1.3: Ratio and Scale. The space chosen could include a bedroom, lounge room, redesigning a small study area or classroom space at school, or designing a garden space at home or school. Students use scaled cut-outs of furniture items to create two designs, and then justify which is the better design. | 2, 3 | 2, 3 | Report format outlined in task up to a maximum of 6 A4 pages.  Time allocated to be negotiated with the class. |
| A folio task covering key questions and key concepts from Subtopic 2.1: Earning. Students investigate two or three scenarios about earning income by taking pizza orders. They determine which earning option is best – payment by hour or piece work, and may also consider payment by commission. Students discuss which of the earning options would be better under different circumstances. The assessment of CT4 will include the appropriate use of spreadsheets in representing mathematical information with appropriate notation. | 1, 4 | 1, 4 | Report format outlined in task up to a maximum of 6 A4 pages.  Time allocated to be negotiated with the class. |

***Four assessments****. Please refer to the Essential Mathematics Subject Outline.*

Stage 1 Essential Mathematics

Assessment Type 1: Skills and Applications Tasks

Assignment 1: Calculations, Time and Ratio

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

This assignment has six sections.

Section 1: Basic Number Operations

Section 2: Rounding and Estimating

Section 3: Decimals

Section 4: Time and Timetables

Section 5: Unit Pricing

Section 6: Ratio

Complete each section when you have completed the class work provided to you by your teacher and you are ready to show your understanding.

You must provide clear evidence of all calculations.

Take careful note of when you are allowed to use a calculator and when you are not.

Return the booklet to your teacher as you complete each section.

*Note: Only part of this task is reproduced in the Implementation Workshop Booklet.*

Section 5

**Calculator allowed**

**Unit Pricing**

1. Batteries come in many different size packs.
2. Calculate how much, in cents, it is for a single battery (the unit price) in each of the following packs:

|  |  |  |  |
| --- | --- | --- | --- |
| Twin Pack (2)  $1.99 | Pack of 4  $3.50 | Dozen (12)  $8.99 | Bulk Pack of 100  $65 |
|  |  |  |  |

1. The Bulk Pack offers the best value for money. Explain why.
2. Even though the Bulk Pack offers the best value for money, give two examples when it might be more reasonable to choose to buy a smaller pack instead.
3. Flour comes in various different size bags.
4. Find the unit price (price per kg) for each of the packs of flour below:

|  |  |  |  |
| --- | --- | --- | --- |
| 1kg  $2.50 | 500gm  $1.45 | 3kg  $7.80 | 250gm  $1.20 |
|  |  |  |  |

1. Which bag offers the best value for money?
2. Phone companies all charge different rates for texts, calls and data use.
3. Determine the charges for three different students for three different phone companies:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Bob**  110 texts  85 minutes on calls  0 data use | **Kaylah**  314 texts  5 minutes on calls  500 MB of data | **Chris**  50 texts  12 minutes on calls  2 GB of data |
| **TEXTA Phone Company**  $30  includes 500 free texts  Extra texts cost 15c each  Calls cost 35c per minute  Data costs 15c per MB |  |  |  |
| **YABBA Phone Company**  $30  includes 80 min free calls  Extra calls are 20c per minute  Texts cost 10c each  Data costs $5 per 500 MB |  |  |  |
| **GAMER Phone Company**  $30  Includes 2GB of data  Extra data costs $5 per 500 MB  Texts cost 18c each  Calls cost 40c per minute |  |  |  |

1. Which company should each student choose?
2. Bob starts using facebook on his new phone. He decides he now also wants 500MB of data. Which company should he choose now? Show how much his new choice will cost him.

You have completed Section 5 of the assignment. Return your assignment booklet to your teacher.

Stage 1 Essential Mathematics

Assessment Type 2: Folio

How to Pay a Pizza Shop Telephone Operator

The Task

You have been offered a job with a large pizza chain to take telephone orders for their wide range of pizzas.

You have two choices in the method of payment:

* Paid per hour with overtime (wages)
* Paid a set amount per order taken (piecework).

Your employer has provided you with the hours worked and sales data over a 4 week period for the previous telephone operator. The employer is giving you the information so that you can make an informed decision about which method of payment to choose.

All information for the mathematical investigations is provided over the page. Read the information below about the report you will create, and then get started!

The Report

You will complete a report to submit to your teacher which will include the following:

Introduction

In your own words *clearly explain* what you have to do in this task.

Mathematical Calculations

Use the information on the following page, and the rates your teacher gives you, to calculate the payments you would receive in each scenario in Part 1 and Part 2, and the extension activity if you complete it.

* You must *show all working* for Part 1 (including any equations used and the steps in the calculation).
* You must include the spreadsheet used for Part 2, showing the figures you were asked to calculate. A copy of the formula used in the spreadsheet should be included in an appendix.
* Any work you complete on the extension activity.

Discussion

*Clearly state* which method of payment you would choose and *why* you would choose it. Make sure that you refer to figures (values) from your calculations in your discussion.

You might also explain why this method of payment was the best in the calculations you carried out, and under what circumstances the other methods of payment might be more attractive.

Conclusion

*Write a short letter* to your new employer, accepting the job.

Make sure you clearly state the payment method you have chosen and the rates of pay you are agreeing to.

Your entire report should not be more than a maximum of 6 A4 pages.

Ask your teacher to complete the table below with all the information you need to complete the calculations for Week 1.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Week** | **Standard hours worked** | **Overtime hours worked** | **Number of orders taken** | **Standard hourly rate** | **Overtime rate** | **Rate per order taken** |
| **1** |  |  |  |  |  |  |

**Part 1** Showing all of your working out, and the equations you have used, work out the payment you would receive for the **first week** if you were paid:

* A wage – paid at an hourly rate plus overtime
* Piecework – where you are paid for every order you take.

|  |  |  |  |
| --- | --- | --- | --- |
| **Week** | **Standard hours worked** | **Overtime hours worked** | **Number of orders taken** |
| **2** | 15 | 3 | 495 |
| **3** | 20 | 1.5 | 530 |
| **4** | 12.5 | 6 | 481 |

The employer also gave you the information for Weeks 2, 3 and 4 in the table alongside.

You decide it would be more efficient to work out the weekly payments over the **four weeks** of payment information and sales data using a spreadsheet.

**Part 2** (i) Create a spreadsheet with the following headings and fill in all given information for Weeks 1 to 4.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Week** | **Standard hours worked** | **Overtime hours worked** | **Number of orders taken** | **Standard hourly rate** | **Overtime rate** | **Rate per order taken** | **Weekly wage** | **Weekly piecework**  **payment** |

Note: Use the *Standard hourly rate*, *Overtime rate*, and *Rate per order taken* given to you by your teacher for the Week 1 calculations.

(ii) Using appropriate formulae determine the:

* wage for each week
* piecework payment for each week
* **total** wage over the 4 weeks
* **total** piecework payment over the 4 weeks.

**Extension**

A friend has told you about a payment method called commission. Using the commission method of payment you will receive a small *retainer payment*, plus a percentage of the *total value of the orders* you take over the week.

The employer has provided you with the *total value of the orders* that were taken each week (provided in the table below). Your teacher will provide you with the retainer payment and the percentage commission that you will receive. Using this information calculate the payment that you would receive each week.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Week** | **Total Value of orders** | **Retainer** | **Commission % of orders** | **Total weekly payment** |
| **1** | $15000 |  |  |  |
| **2** | $12000 |  |  |  |
| **3** | $19500 |  |  |  |
| **4** | $11700 |  |  |  |

You can complete the commission calculations by hand (showing all working out) or using a spreadsheet.

**Assessment Design Criteria**

**Concepts and Techniques**

CT1 Knowledge and understanding of mathematical information and concepts

CT4 Use of electronic technology to find solutions to practical problems.

**Reasoning and Communication**

RC1 Interpretation of mathematical results

RC4 Communication of mathematical ideas and information.

**For teacher use only:**

**Master list of student data: teachers to issue unique data to each student**

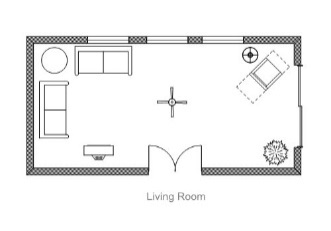


Stage 1 Essential Mathematics

Assessment Type 2: Folio

Design your own space

The Task:

[](http://www.google.com.au/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0CAcQjRw&url=http://www.ezblueprint.com/examples.html&ei=Swh1Vav5K4vy8QWDvIDQCw&bvm=bv.95039771,d.dGc&psig=AFQjCNFpjEJUUvXIb59H40k7Jms2XDCT3w&ust=1433819551542280)You are to construct 2 different scaled diagrams using skills and techniques you have learned in the study of Topic 1.3 – Ratio and Scale. On two identical scale plans, each drawn on separate sheets of A3 paper, you will create two different designs for the same space. You will then compare the two designs and decide, giving reasons, which is the better design. You could choose to redesign:

* your bedroom
* your home backyard
* any other room or area of your home
* your classroom or an area in the school yard
* any other space of your choice (consult with your teacher).

You will create a report to submit to your teacher. The requirements of the report are on the back of this sheet.

Part 1

Select a space that you wish to redesign. Take measurements of all boundaries (walls in rooms, garden fences or paths etc.). Fixed structures such as doors, windows and wardrobes in building structures or garden walls and paths in garden spaces must be included in your measurements.

**Part 2**

Create two scale diagrams showing the boundaries of the space you are redesigning, each one on a single A3 sheet. Include any fixed structures in the scale diagrams. Label all measurements carefully and include the scale you have used.

**Part 3**

Select items that you wish to place into your redesigned space. You could research brochures and/or the internet for examples of items to use. You may include items that already exist in those spaces.

You will need the measurements of any items you intend to use.

**Part 4**

Cut out scaled diagrams of each item you have chosen and **construct 2 different designs**, using different arrangements of items, for the one space you have chosen. Label all measurements carefully. Your designs must be as accurate as possible. You must include the scale you have used.

NOTE: You do not have to use the same items in each design, for example you may use a single bed in one design and a queen bed in another.

**Part 5**

Complete the report outlined over the page and submit it to your teacher.

**The Report**

The report is to be a **maximum of 6 A4 pages**. The two A3 pages displaying the scale diagrams are the equivalent to four A4 pages.

Introduction

Describe which area you have chosen to redesign. You might like to explain why you chose this area.

Explain carefully what features or items you consider important for your design. Include information about where you obtained your measurements, and the scale you have used to construct your diagrams.

**Mathematical Investigations**

The two separate scaled designs must include all real measurements and the scale used.

Details such as doors and windows and how they open should be included.

All items and their dimensions used in the designs should be clearly identified.

**Discussion**

Decide which of the two designs you like the most, and discuss in detail why you think it is the best design.

Include a discussion of any limitations to your designs, problems you had to consider and/or issues you had to work around.

You must consider access, storage and how reasonable your design is for the area it is designed for.

**Appendix**

Evidence of all items shown in each design must be included in the form of photographs or pictures copied from internet sites or brochures. These are to be included in the appendix, and clearly identified and labelled. Ideally these will include real measurements.

**Extension Opportunity**

You may consider the cost of the refurbishment, considering costs such as carpeting and/or painting the space.

If you are redesigning an outdoor space you may consider the cost of lawn, edging, paving and softfill, or other landscaping required.

Evidence of all calculations must be included.

Assessment Design Criteria

Concepts and Techniques

The specific features are as follows:

CT2 Application of mathematical skills and techniques to find solutions to practical problems in context

CT3 Gathering, representation, and interpretation of data in context

Reasoning and Communication

The specific features are as follows:

RC2 Use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions

RC3 Use of appropriate mathematical notation, representations, and terminology

**Stage 1 Essential Mathematics – Semester 1 – Trade focus**

Topic 1: Calculations, Time and Ratio, Topic 2: Earning and Spending, and Topic 3: Geometry

|  | **Lesson 1 – Single Lesson** | **Lesson 2 – Single Lesson** | **Lesson 3 – Double Lesson** |
| --- | --- | --- | --- |
| **Term One**  **Week 1** | **Course Overview and Expectations**   * Including what to bring to class | **TOPIC ONE: CALCULATIONS, TIME AND RATIO**  Revision of rounding | Addition and subtraction including fractions, decimals, square roots (perfect squares only) and basic indices without technology |
| **Week 2** | Multiplication including fractions, decimals, square roots (perfect squares only) and basic indices without technology | Division including fractions and decimals without technology (including long division if applicable to students) | Using estimation strategies to come up with approximate solutions (for self-checking and predicting etc.)  Non-calculator Activity (15 mins) |
| **Week 3** | BODMAS Revision – Multistep calculations without technology | Solving problems using a calculator – including multistep calculation | Using a calculator to convert fractions to decimals  Review of scientific notation  Multiplication and division by multiples of 10 |
| **Week 4** | What units do we use for time?  Conversion between fractional, digital and decimal representation | Representing time using both 12 hour and 24 hour clocks  Calculating time intervals (including time between, time ahead, time behind | Non-calculator Activity (15 mins) and Revision time for SAT 1  Rates Introduction – Units and converting between units  Comparing rates |
| **Week 5** | **SAT ONE – Subtopics 1.1 and 1.2 (time)**  Part A: Non-calculator (30 mins)  Part B: Calculator (15 mins) | Solving practical problems involving rates, including interpreting rate graphs | **FOLIO ONE**  **Filling containers task – an investigation of water level changes in containers when water is added at a constant rate, and their representation as height vs volume graphs** |
| **Week 6** | **FOLIO ONE continued** | Seeing the connection between fractions and ratios and how ratios are expressed   * Ratios in the simplest form | Using ratio to solve problems   * Finding the ratio of two quantities * Dividing a quantity into a given ratio |

|  |  |  |  |
| --- | --- | --- | --- |
| **Week 7** | **FOLIO ONE continued** | Scale   * Why do we use scales? * Where do we see scales? * Reading maps and diagrams that have scales to answer questions | **Practical activity** - Creating a scaled diagram of part of the school grounds  Focus on:   * Scales in ratio * Indication of dimensions * Appropriate labelling |
| **Week 8** | **Practical Activity** continued | **Practical Activity** extension  Verify measurements taken from the scaled diagram created in previous lesson (and homework) by comparing with actual measurements | **TOPIC TWO: EARNING AND SPENDING**  Types of ways we earn money and what additional entitlements we may have  QandA Forum: *Guest speakers (tradesperson, fitness coach to talk about the way they earn money, or alternatively a local employer who makes payments to staff using different payment methods).*(30 mins) |
| **Week 9** | Calculating weekly and fortnightly wages (including consideration of overtime rates) | Calculating annual gross income for wages including consideration of annual leave loading, allowances and bonuses | Calculating remuneration for income earned by   * Piecework * Contracts * Commission   Use and construct spreadsheets to carry out repetitive remuneration calculations more efficiently |
| **Week 10** | Calculating fortnightly or weekly income from a salary | Introduction to tax and types of deductions employees may have   * Personal taxation * Medicare Levy * Other deductions   Calculating taxable income (deductions) | Calculating Medicare Levy and tax payable  Further tax payable calculations and checking with confirmation from a website calculator such as http://www.paycalculator.com.au/ |
| **Week 11** | Final tax owing or tax refund due for given scenarios | **SAT TWO**  **Guided investigation on remuneration for a variety of jobs**  (Students investigate current minimum wage information, and then are provide links and structure for two jobs, and investigate a third individually)  \*access to internet required for research of pay rates | **SAT TWO**  **Guided investigation - continued** |
| Term Two  **Week 1** | Introduction to where we spend money. What are the costs associated with the way we spend money (e.g. cash, credit, lay-by, purchase on terms and hire purchase) | Review of percentage to decimal and percentage to fractions | Calculating Percentage  Increase / Decrease / Mark up / Discount / GST  Calculating trade discounts |
| **Week 2** | Calculating series discounts | Introduction to personal budgets, their importance and what is included in them  Creating budgets by hand and using excel | Creating budgets in excel  Excel budget Activity (30 mins) |
| **Week 3** | Business budgets, their importance and what may be included in them | **TOPIC THREE: GEOMETRY**  2D Shapes and their properties   * Regular/irregular * Circle representations | Continuing 2D Shapes and their properties.   * Types of triangles   Where possible, use interactive methods to develop these concepts  <http://www.mathsisfun.com/geometry/triangles-interactive.html>  Measuring and naming angles: acute, right, obtuse, straight, reflex and revolution |
| **Week 4** | Measuring and naming angles: acute, right, obtuse, straight, reflex and revolution | **Practical activity** - Construction of lines and angles using compass and straight edge  http://www.mathopenref.com/constructions.html | Non-calculator Activity (15 mins)  **Practical activity** - Construction of circles and polygons using compass and straight edge  http://www.mathopenref.com/constructions.html |
| **Week 5** | **Practical activity** - Construction of circles and polygons continued  http://www.mathopenref.com/constructions.html | 3D Shapes and their properties  3D Nets  **Practical activity** - Have a range of solid shapes available, and a wide range of descriptor cards (e.g. has at least one triangular face). Shapes are grouped according to descriptors, and then named according to properties. | 3D Shapes 3D Nets continued – using a net to construct a basic solid such as a cube.  **FOLIO TWO**  Investigate the construction of existing novelty packaging for sweets or other foodstuffs. By examining the packaging, students understand how the nets are designed. |
| **Week 6** | **FOLIO TWO continued**  Students create their own design for a novelty container. They make the net using construction techniques and present the finished model. | Complementary and supplementary angles  <https://interactivemaths.wikispaces.com/2D#int_2d>  Select 2D interactive activities, angle activities | **FOLIO TWO**  Continued |
| **Week 7** | Parallel line rules – Use interactive applets to determine the relationships between:   * Corresponding angles * Alternate angles * Vertically opposite angles * Co-interior angles   <http://www.saltire.com/applets/geometry.htm> | **FOLIO TWO**  Continued | Solve a range of problems   * Complementary and supplementary angles * Parallel line rules |
| **Week 8** | Non-calculator Activity | Flexibility in schedule | Flexibility in schedule |

**Stage 1 Essential Mathematics – Semester 2 – Trade focus**

Topic 4: Data in Context, Topic 5: Measurement, and Topic 6: Investing

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Lesson 1 – Single Lesson** | **Lesson 2 – Single Lesson** | **Lesson 3 – Double Lesson** |
| Term Two  **Week 9** | **TOPIC FOUR: DATA IN CONTEXT**  Why do we collect data?  Classification of data   * Categorical data: Nominal and Ordinal * Numerical data: Discrete and Continuous | Understanding and extracting information from tables including Two-way tables  An activity such as ‘Is Australia the Greatest Olympic Sporting Nation?’ on ABS website may assist in engaging students  <http://www.abs.gov.au/websitedbs/CaSHome.nsf/Home/MAT14+Is+Australia+the+Greatest+Olympic+Sporting+Nation> | How do you read graphs including the information that can be accessed from:   * Titles * Axes labels * Scales and keys   Understanding and extracting information from graphs (including line graphs, step graphs, column graphs, picture graphs and pie graphs) |
| **Week 10** | **Practical activity 1** – Collecting categorical data (brand of mobile phone used, methods of transport to school etc). Individual or groups of students can collect different data for use in the following lesson. Students should have some question in mind that they wish the data collected to answer. | **Practical activity 1** continued  Students’ tabulate their own data and that of other groups and display it in different ways graphically using charts in excel. They analyse the different representations of the data and discuss which representation best displays the information. | **Practical activity 1** continued  Students consider the data they have collected and displayed, and discuss whether it supports an answer to the question(s) they were initially considering.  Further activities involving the representation of categorical data graphically if time permits. |
| Term Three  **Week 1** | **Practical activity** **2** – Collecting numerical data  Students measure their reaction time in pairs over 20 trials each | **Practical activity 2** continued  Students’ tabulate their own data and that of their partner and display it in different ways graphically. (stem and leaf plots and histograms) | **Practical activity 2** continued  Students discuss the question of who in their pair has the better reaction time using evidence from their graphs to support their argument. Informal consideration of accuracy and consistency can lay the groundwork for the concepts of central tendency and spread later in the topic.  Further activities involving the representation of numerical data graphically |
| **Week 2** | Line graphs **–** Displaying continuous data | Line graphs – How do we use them?   * Growth charts * Share prices * Temperature over a 24-hour period | Charts presented in media and texts, including looking at the ways in which data can be misrepresented. The ABS has a worksheet available at:  <http://www.abs.gov.au/websitedbs/CaSHome.nsf/Home/MAT06+Misleading+Graphs> |
| **Week 3** | Begin with the data collected in practical activity 2: students consider how they can calculate the ‘typical’ reaction time of each student so that their performances can be compared. (Median and Mean)  Further problems as time permits | Begin with the data collected in practical activity 1: students consider how they can determine the best representative for each data set collected when an average value cannot be calculated. (Mode or Modal group)  Further problems involving measures of central tendency | Outliers and their effect on measures of central tendency  Students consider the idea of measuring ‘consistency’ in the reaction time data collected previously using range and interquartile range.  **Learning activity** – Standard Deviation *(see support materials for details)* |
| **Week 4** | Further problems involving measures of spread  Discussion of the sensitivity to outliers of the various measures of central tendency and spread | **FOLIO ONE**  **Quality control in manufacturing – Consistency in Baking** | Describing data without statistical measure  Revision |
| **Week 5** | **DATA IN CONTEXT – SAT ONE** | Characteristics and shapes of distributions  (histograms, stem plots, dot plots) | Five-number summary and box plots  (including symmetry and skewedness)  **FOLIO ONE** |
| **Week 6** | Five-number summary and box plots continued | **FOLIO ONE** | **TOPIC FIVE: MEASUREMENT**  Review linear measurement   * Units * Conversion between the units km, m, cm and mm. Cover inches feet and miles if relevant to students * Devices for Measurements * When to use estimates for measurements |
| **Week 7** | **Practical Activity –** estimation of distances  *(See support materials for activity)*  Errors in measurement   * Absolute errors * Relative errors | Calculating perimeter – Triangles, squares, rectangles, with and without technology | Calculating perimeter – Triangles, squares, rectangles, with and without technology  Circumference of circles – introduced through a practical measuring activity |

|  |  |  |  |
| --- | --- | --- | --- |
| **Week 8** | Problems involving circumference of circles (including rearranging the formula to find unknown radius/diameter) | Perimeter of more complex shapes (including composite shapes) | Area – What are the appropriate units for area and how do we convert between them? (Including metric to imperial)  How can we calculate areas using grids as well as formulas for shapes such as squares, rectangles, triangles with and without using technology? |
| **Week 9** | **Practical activity** – Investigating the area of a circle | Calculating the area of circles with and without technology | Finding the area of composite shapes  (Heron’s Formula if time) |
| **Week 10** | Discussion of the concepts of mass and weight  Units for mass and conversion between them (tonnes, kg, gm, mg)  **Practical activity** – Estimation of the mass of objects | Relationship between volume and capacity  Units for volume and capacity and conversion between them (kL = m3, litres, ml = cm3)  Estimating volume – practical activity and discussion of the difficulties involved in estimating volume in everyday situations (e.g. selecting an appropriate container for storing left-overs in a cooking pot) | Calculating the volume of cubes, prisms and cylinders  Using formulae (with and without technology) to solve problems posed in practical contexts |
| Term Four  **Week 1** | **FOLIO TWO**  **Designing and Costing a Deck** | Discussion of the connection between energy and power  Understanding energy – units, where they are used, and basic calculations (watts, kilowatts, megawatts, and gigawatts) | Kilowatt hours and the conversion from watts to kilowatt hours  Class watch *(BBC1)* program *Human Power Station* and discuss the connection between human energy and electrical power |
| **Week 2** | **FOLIO TWO**  **Designing and Costing a Deck** | Investigation of energy rating labels on electrical appliances. Utilise the information on average electricity tariffs for each state, and example energy consumption calculations at  [www.energyrating.gov.au](http://www.energyrating.gov.au). | Calculations of the costs of electricity to a house   * Daily supply charge * Tariff   Electricity bills which include solar feed-in tariffs could be looked at and discussed (the solar feed-in tariffs should not be included in any calculations required of the students). |
| **Week 3** | **FOLIO TWO**  **Designing and Costing a deck** | **TOPIC SIX: INVESTING**  Why do we save?  Calculating simple interest (with and without technology) | Simple interest – Rearranging the formula to find principal, interest and time invested in years |
| **Week 4** | Calculating simple interest using spreadsheets | Investigation into understanding the differences between simple and compound interest | Compound interest   * Using the formula to calculate amount accrued * Rearranging the formula and to find principal |
| **Week 5** | Impact of changing the number of compounding periods per year | Using technology to calculate amount accrued, principal, rate and time | Using technology to calculate amount accrued, principal, rate and time, including an in-depth look at the impact of changing principal, interest rate and time  Compound interest using spreadsheets |
| **Week 6** | Looking at simple interest verses compound interest graphically | REVISION | **INVESTING – SAT TWO** |
| **Week 7** | Exam week  *If students are continuing on to Stage 2 Essential Mathematics, undertaking an exam would be good preparation for the Stage 2 examination.* | | |

**Stage 1 Essential Mathematics (10 credits)**

*Aligned with teaching Program 2 – Semester 1 – Trade focus*

**ASSESSMENT OVERVIEW**

Complete the table below to show details of the planned tasks. Use numbers to show where students will have the opportunity to provide evidence for each of the specific features for all assessment design criteria.

| Assessment Type and Weighting | Name and details of assessment | Assessment Design Criteria | | Assessment conditions (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- |
| C&T | R&C |
| Skills and Applications Tasks  Weighting 50% | **SAT One:** Students demonstrate mathematical knowledge and skills from **Topic One: Calculations, Time and Ratio**. The content covers key questions and key concepts within subtopics 1.1 and 1.2 (time). Students apply their knowledge and skills to a range of routine and complex questions in problems based on trade relevant contexts. This SAT will have two parts:  **Part A:** Non-calculator section (30 Minutes) and **Part B:** Calculator section (15 minutes)  Students will be required to use mathematical reasoning to draw conclusions and consider the appropriateness of solutions, particularly in questions using approximation techniques.  Clear and logical communication of solutions and correct use of notation and terminology are required. | 1, 2 | 1, 2, 3 | Supervised written assessment.  One A4 page of handwritten notes permitted.  Total time: 45 minutes  Appropriate calculator technology (graphics calculator is not required) |
| **SAT Two:** Key questions and key concepts from **Topic Two: Earning and Spending** are assessed in a guided investigation. Students require access to technology to find minimum wage information, and the pay rates for three different jobs. Links may be provided to the students to assist them in efficiently finding the pay rate information for two of the three jobs. They will use this information and provided hours of work to calculate weekly, fortnightly and annual incomes in spreadsheets that they create. This is extended to determining the tax payable either using an internet tool such as <http://www.paycalculator.com.au> or by hand. Most calculations require the aid of electronic technology. | 1, 3, 4 | 1, 3 | Supervised guided investigation.  Students will have access to excel and the internet throughout the task.  Total time: 3 lessons |
| Folio  Weighting 50% | **Topic One: Calculations, Time and Ratio**  In this folio task students consider key questions and key concepts from Subtopic 1.2 – Time and Rates. Students investigate filling containers at a constant rate with water, and use measurements taken to represent the change in the height of water in the container against the volume of water added graphically. Students investigate the link between the shape of the container filled and the resulting graph, and then use their investigations to make a prediction about the graph that would be produced from filling a more complicated container. Clear and logical communication of data collected and appropriate graphical representations are required in a basic report format. Students are encouraged to discuss their results. | 1, 3 | 1, 3, 4 | 3 weeks to complete. Class time is provided for the practical aspects of the investigation to be completed.  **Maximum of 6 A4 pages**  A basic investigation report format is required. |
| **Topic Three: Geometry**  In this folio task students are required to design a novelty container. They investigate a range of containers for products such as chocolates and other boxed items. They create their own novelty container design, and use construction techniques to create the 3D net for their novelty container. Students need to consider the placement of tabs to allow the novelty container to be constructed. Further scope for complexity can be provided by the consideration of innovations in the novelty container design such as mechanisms that hold their novelty container closed once it has been opened. Depending on the size of the novelty container designed, the net may need to be drawn over more than one piece of paper, and consideration given to how tabs will be used to attach the separate parts. Students consider the effectiveness of the net they have constructed, and discuss any problems they encountered. | 1, 2 | 3, 4 | 3 weeks to complete. Class time is provided.  Maximum of 1 A4 page of written response plus:   * a copy of the 3D net * the constructed novelty container. * appendices with sketches of possible novelty containers and nets |

***Four assessments****. Please refer to the Essential Mathematics Subject Outline.*

**Stage 1 Essential Mathematics (10 credits)**

*Aligned with teaching Program 2 – Semester 2 – Trade focus*

**ASSESSMENT OVERVIEW**

Complete the table below to show details of the planned tasks. Use numbers to show where students will have the opportunity to provide evidence for each of the specific features for all assessment design criteria.

| Assessment Type and Weighting | Name and details of assessment | Assessment Design Criteria | | Assessment conditions (e.g. task type, word length, time allocated, supervision) |
| --- | --- | --- | --- | --- |
| C&T | R&C |
| Skills and Applications Tasks  Weighting 50% | **SAT One:** Students demonstrate mathematical knowledge and skills from **Topic Four: Data in Context**. The content covers key questions and key concepts within subtopics 4.1 to 4.4. Students apply their knowledge and skills to a range of routine and complex questions in problems based on trade relevant contexts. This SAT will have two parts:  **Part A:** Non-calculator section (30 Minutes) – Subtopic 4.1 to 4.4  **Part B:** Calculator section (15 minutes) - Subtopic 4.4  Students will be required to use mathematical reasoning to draw conclusions and consider the appropriateness of solutions when interpreting data and conclusions that can be drawn from it. Clear and logical communication of solutions and correct use of notation and terminology are required. | 1, 3 | 1, 2, 3 | Supervised assessment.  One A4 page of handwritten notes permitted.  Total time: 45 minutes  Appropriate calculator technology (graphics calculator is not required) |
| **SAT Two:** problems requiring the application of skills learned in subtopics 6.1 and 6.2 **Topic Six: Investing** will be assessed in this SAT. Students require access to technology solve a range of financial calculations on investments using both simple and compound interest. Problems will be set in context, and investment rate information will be provided explicitly in some question contexts, and in others students will need to acquire the investment rate information from tables sourced from banks and other financial institutions that will be provided with the test. Opportunities for interpretation of the mathematical results will be provided throughout the test. Correct use of notation and terminology are required. | 1, 2, 4 | 1, 3 | Supervised assessment.  Students will have access to a calculator and 1 A4 page of handwritten notes is permitted. |
| Folio  Weighting 50% | **Topic Four: Data in Context**  In this folio task students consider aspects of manufacturing (in this case the baking of a batch of muffins) which impact on variation in the product. They will work in groups, each group deciding on a method they hope will ensure the most consistent muffins in their batch. They will measure each muffin and analyse the data statistically. Using tables and graphs they will compare their results with those of two other groups in the class and use statistically supported arguments to rank the consistency of the three batches. Clear and logical communication of data and reasoned arguments are required in a basic report format. Students are encouraged to consider limitations of the initial investigation. | 2, 3 | 1, 3, 4 | 3 weeks to complete. Class time is provided for the practical and group aspects of the task to be completed.  **Maximum of 6 A4 pages**  A basic investigation report format is required. |
| **Topic Five: Measurement**  In this folio task students utilise skills that they have developed in Subtopics 5.1 and 5.2. They design two different outdoor decks on which a dining table and chairs will be placed and create a scaled plan for each design. Students investigate the basic design structure of a deck to assist them in determining all of the materials that they will need to construct the deck. Showing all calculations students determine the cost of materials required to construct both of the designs. They compare different aspects of their designs, and discuss in detail which of the two designs they would recommend to a client.  Clear and logical communication of data collected and appropriate graphical representations are required in a basic report format. Students are encouraged to discuss their results. | 2, 3 | 1, 2, 3 | 3 weeks to complete. Class time is provided to support the students and to support verification of student work.  **Maximum of 6 A4 pages**  A basic investigation report format is required. |

***Four assessments****. Please refer to the Essential Mathematics Subject Outline.*

Stage 1 Essential Mathematics

Assessment Type 2: Folio

Investigate the rate of change of the height

**The Task**

You are going to investigate how the water level changes as water is added to a container at a constant rate. You will select a range of containers to record the height of water over time and then graph the results. From the behaviour of these graphs you will try to predict what the graph would look like for more complex containers.

**Part 1**

It is difficult to take measurements if water is continuously running into the container (say from a tap), and so you will add water using a small container of known volume (e.g. no larger than a 1/4 cup measure). Start off with a simple container with a constant width for most of its height. Beakers or measuring cylinders that would be available in the science lab would be great for this part of the investigation.

After each measure of water is added, record the height of the water in the container. Continue this process until the container is full or you have reached the point at which the width of the container changes. Record the data in a table like the one below.

|  |  |
| --- | --- |
| Total Volume of water added (ml) | Height (cm)  **h**  **V** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
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|  |  |
|  |  |

You will now sketch a graph of the data in the table with volume (ml) on the horizontal axis and height (cm) on the vertical axis.

**Part 2**

Repeat this process for two other containers of constant width, one wider than the original container, one narrower.

Write a discussion about the graphs constructed in Part 1 and Part 2 for the three different containers. How does the width of the container seem to affect the graph?

**Part 3**

Now consider the following containers. Sketch a prediction of the height vs Volume graph for each of these containers. Explain your reasoning for the shape of each graph.

**Container A Container B Container C**

**Part 4**

Container C is similar to a conical flask which can be found in the science lab. Using a conical flask take measurements as you did in Part 1, and use these to construct a graph of height vs volume. Discuss the accuracy of your prediction in Part 3 for Container C.

**Part 5 – Optional Extension**

Choose your own container of an interesting shape unlike the ones considered so far (e.g. fancy bottle or vase) and make and test a prediction about what the height vs volume graph would look like. Discuss your results.

**Part 6**

Complete the report outlined below and submit it to your teacher.

**The Report**

**Introduction**

Describe the task in your own words.

**Mathematical Investigations**

Record your results for Parts 1 – 4 (or Parts 1 – 5).

**Discussion**

Explain what relationships you found between the shape of the container and the shape of the graph of height vs volume.

**The report is to be a maximum of 6 A4 pages.**

|  |  |
| --- | --- |
| Concepts and Techniques  The specific features are as follows:  CT1 Knowledge and understanding of mathematical information and concepts  CT3 Gathering, representation, and interpretation of data in context | Reasoning and Communication  The specific features are as follows:  RC1 Interpretation of mathematical results  RC3 Use of appropriate mathematical notation, representations, and terminology  RC4 Communication of mathematical ideas and information. |

Stage 1 Essential Mathematics

Assessment Type 2: Folio

Topic 3: Geometry

Nifty Novelty Container

Your task is to design a nifty novelty container, create the 3D net from which the container can be constructed, and construct the actual novelty container you have designed.

**Part 1**

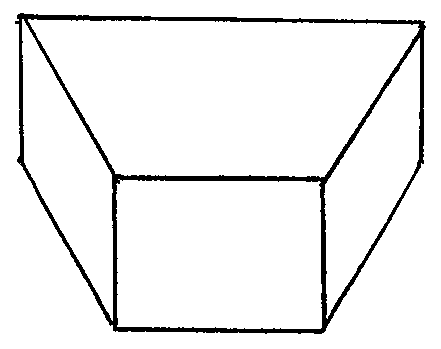
Investigate a range of different containers that are currently being used for packaging food or other goods such as chocolates, biscuits and toys.

Decide what will be packaged in your novelty container. If you choose to package something that is long and cannot bend (like a musk stick lolly) you will need to ensure that your package allows them to be stored appropriately.

Draw at least three rough sketches of possible novelty container that you will consider. Identify the 2D shapes that will be used, and possible dimensions (length, height and depth).

Trapezium base and top

**Your designs must:**

* use at least two types of shapes – consider various polygons and circles

Lid opening

Height 8cm

* have at least 6 faces.

1. Identify what will be stored in your novelty container.
2. Decide on which of your designs you will use for the rest of this investigation. Give reasons for your choice of design to continue with.
3. The rough sketches you created need to be placed in the appendix of your report.

**Part 2**

1. Draw a reasonable sketch of what your novelty container will look like and include the ***relevant*** measurements (e.g. width, height, and length of edges).

***Have your design approved by your teacher before you proceed with the investigation.***

1. Sketch several possible nets from which your container could be formed. Consider things like where the lid or opening of the container is and how the net will need to be designed so that the lid can open and edges can be glued together.
2. Decide which of these net designs you will use, and give your reasons for your choice.

**Part 3**

Using a compass and straight edge (or other mathematical equipment such as a geoliner) and the construction techniques you have learned in this topic, create a full scale, accurate net from which your novelty container design from Part 2 can be formed.

You will need to consider where the tabs will be located on the net to ensure that:

* the novelty container can be constructed and will not fall apart
* it does not have openings or gaps in the container which will allow the packaged material to fall out.

You could consider innovations in your design such as the lid having the ability to be closed securely after the novelty container has been opened.

**Note:** Your accurate net will need to be submitted to your teacher with your completed folio task.

**Part 4**

Draw the net that you have designed on thicker paper (e.g. poster paper) and construct your nifty novelty container! You could consider getting the product that you have designed the novelty container for and placing it in the container. Feel free to be creative with the outside of your novelty container (e.g. put on your own brand name and images if you wish).

**Note:** Your constructed novelty container will need to be submitted with your completed folio task.

**Part 5**

Write a short summary about the effectiveness of your nifty novelty container design. Include things like problems that you had in designing the novelty container, and in creating the design for the net. Also discuss any problems that you may have had with your final net design, and how you could improve it.

What you need to submit:

A **written section** which is to be no more than 1 A4 page including your responses to:

* Part 1 (a) and (b)
* Part 2 (c)
* Part 5

The **accurate net** for your nifty novelty container design.

The constructed novelty container.

The appendices including the rough sketches from Part 1 and Part 2.

*The specific features assessed in this task are: CT1, CT2, RC3 and RC4*

Stage 1 Essential Mathematics

Assessment Type 2: Folio

Consistency in Baking

The Task

In this task you will look at the importance of being consistent when making a product. This would be especially important if you were intending to sell that product commercially. You are going to investigate this by baking muffins. In groups you will choose a method to try to ensure that the muffins you make will be consistent in size and shape. You will then take measurements from your batch of muffins, and by considering your data, and that of other groups in the class, you will determine which method produced the most consistent muffins.

**Part 1**

You will all use the same recipe or the same boxed muffin mixture to ensure that the mixture is as consistent as possible. Decide on how many muffins each group will make from their mixture (e.g. 12 muffins are fairly common from a packet mixture). Now choose the method that your group will use to try to ensure the best consistency in the muffins you make. You could consider one or a combination of the following to try to ensure consistency in your muffins:

* Using a particular size of spoon or scoop to measure the mixture for each muffin
* Using a piping bag for measuring out the mixture for each muffin
* Using different types of patty pans or using a muffin cooking tray without lining when cooking the muffins
* Weighing each amount of mixture on a set of electric scales before cooking.

Every group should use the same procedure when baking the muffins:

* Tapping the trays to level out the mixture or smoothing the top of each muffin so they rise the same
* Using the same temperature to cook the muffins
* Rotating in the oven **once** in case some areas are hotter.

**Part 2**

Now you will take your muffins and analyse them statistically. Use a method to number each muffin in your batch – this will be important when collecting the data.

1. You will need to take measurements of your freshly cooked muffins – this could include: the height, weight and spread (how wide the muffin is across the top). Record all of your measured data for each of the muffins made in a table such as the one below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Muffin No.** | **Weight (gm)** | **Height (cm)** | **Spread (cm)** |
| **1** |  |  |  |
| **2** |  |  |  |

1. Using the group’s collected data calculate the measures of central tendency (mean and median) and the measures of spread (range, interquartile range (IQR) and standard deviation) for each of the characteristics that you measured (weight/height/width).
2. Discuss how consistent your muffins are. Did your method work well? Are there any outliers in your batch of muffins? Use your statistics to support your answers to these questions.

**Part 3**

You will now compare your performance with that of other groups in the class. Obtain a copy of the data table from ***two other groups*** and make a note of what method they used to keep their muffins consistent in each case.

Summarise the statistics (mean, median, range, IQR, standard deviation) of the three groups in a suitable table.

Use parallel box-and-whisker plots to display the three data sets graphically for the different variables measured (weight, height, width).

Compare the performance of the three groups and discuss which group you think produced the best set of muffins and which produced the worst. Support your decisions using evidence from your table and graphs.

**Part 4**

As a **class exercise** have all the batches of muffins displayed and then compared and ranked according to how consistent they *looked*. The class should try to reach a consensus on this ranking and the reasons for it. Write down a summary of what happened in this class exercise.

You should now compare the rank of the three batches in your investigation with the way they ranked in the class exercise. Was it the same or different? Why might this be? What does this suggest about the data you collected? What does it suggest about how people buying muffins might make their decisions about which is the better product?

**Part 5**

Complete the report outlined below and submit it to your teacher.

The Report

Introduction

Write an introduction that outlines your task and include information about the data you are going to collect. Explain what method your group intends to use to keep the muffins consistent. Discuss what you think are the important things you need to focus on to make your muffins the most consistent. What are the critical steps in the process?

Mathematical Investigations

Complete Parts 1-4

Include all calculations, data, graphs and discussions.

Include a photo of your finished muffins.

Discussion

After completing all parts of the investigation, discuss why you think the methods used by the groups to keep their muffins consistent may have led to the results of your comparison. Consider what other things may have contributed to differences between the three batches of muffins.

In your conclusion consider the limitations to your investigation. Some possible questions you could consider are:

Which data was the most useful in deciding ‘consistency’ between the muffins?

What would you do differently if you did this again? How could you make it better?

What do you think are the most critical things to do to ensure consistency in making muffins?

**The report is to be a maximum of 6 A4 pages.**

*The specific features assessed in this task are: CT2, CT3, RC1, RC3 and RC4*

Stage 1 Essential Mathematics

Assessment Type 2: Folio

Design and Cost a Deck

The Task

You are to design and cost a deck to be placed in a garden space for a client who wants a deck for outdoor dining. The client wants a deck that would comfortably fit a table and chairs that will seat at least 6 people. The ground that the deck will be built over is level.

You will investigate two different options in terms of size and/or shape for the deck, and make a recommendation to the client on which design to go with. The client has given you a budget of up to $8,000.

You will investigate the costs of the materials and take this into consideration when delivering your final report with quotes for both options.

Part 1

Investigate the size of outdoor dining settings and determine the approximate size that your deck will need to be to allow for the table and chairs to be comfortably used on your deck.

Create two different deck designs based on one or more 2D shapes. One of the designs can be a quite simple shape (e.g. a rectangle) and the other should combine two or more shapes (e.g. an L-shape or a square with a semicircle each end).

Part 2

Investigate the basic design structure of a deck. The following link may be useful:

<http://www.bunnings.com.au/diy-advice/outdoor-garden/backyard/decking/how-to-build-your-own-deck>

You will need to investigate things like:

* how deep to dig the footings
* how far apart to have the floor joists
* the height of the deck floor above ground level.

**Familiarise yourself with the following terms:**

Timber posts (90mm x 90mm), bearers (125mm x 75mm), joists (100mm x 50mm), decking, dry concrete, stirrup bracket, Dynabolts, coach screws, framing anchors, timber finish paint or oil, decking nails.

Part 3

1. Draw a scaled plan (the view of the deck from above) for each of the decks that you have designed. Each scaled diagram should be drawn no smaller than half of a single A4 sheet of paper.
2. For each design, calculate the total amount of each material you are going to use and list it (showing any calculations).
3. Determine the total cost of each design. Use a local building website (Stratco, Home, Bunnings etc.) to assist you with costings. Make sure to consider error margins when costing your materials.
4. Create a costings report or quote for each design.

Part 4

Complete the report outlined below and submit it to your teacher.

The Report

Introduction

Read the whole task and write an introduction that outlines what you will be doing in this task in your own words. Explain what you are planning on constructing and your budget.

Mathematical Investigations

Complete Parts 1, 2 and 3.

The two separate designs must include all real measurements and the scale used.

All items used in the designs should be clearly identified and costed appropriately.

Discussion

Compare different aspects of the two designs and discuss in detail which you would recommend the client build.

Include a discussion of things that could affect the accuracy of the results.

Appendix

Include evidence of your costings etc. in the appendix.

**The report is to be a maximum of 6 A4 pages.**

|  |  |
| --- | --- |
| Concepts and Techniques  The specific features are as follows:  CT2 Application of mathematical skills and techniques to find solutions to practical problems in context  CT3 Gathering, representation, and interpretation of data in context | Reasoning and Communication  The specific features are as follows:  RC1 Interpretation of mathematical results  RC2 Use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions  RC3 Use of appropriate mathematical notation, representations, and terminology |