ST STEPHEN'S SCHOOL

YEAR 12 MODELLING WITH MATHEMATICS PROGRAM - 2009

Textbook: Modelling with Mathematics (CAF MAWA) - T

The five subject outcomes for Modelling with Mathematics are:

1. Clarifies a problem
2. Chooses a model to solve a problem
3. Uses a model to solve a problem
4. Interprets and checks the solution to a problem
5. Communicates an obtained result

During the year the students will be covering three topics. For each topic, two projects will be set. For each project, students must address the five outcomes for Modelling with Mathematics. In addition to each project there will be one test set per topic. These tests will assess outcomes 1 to 4.

Assessment Summary

Term 1 2 Projects and one topic test
Term 2 2 Projects and one topic test
Term 3 2 Projects and one topic test

Projects assess outcomes 1 to 5 and tests assess outcomes 1 to 4

Rating and Performance Criteria

These are outlined on pages 74 and 75 of the Curriculum Council Outline of this course. For each task, the student should refer to the table on page 74 to ensure that each of the outcomes are adequately addressed

Rating Procedure for each outcome:

Outcomes 1-4

V A **V** on 5 or more tasks and at least half the remaining tasks are at **H.**
H An **H** on 5 or more tasks and at least half the remaining tasks are at **S.**
S An **S** on 5 or more tasks.
N If 5 or more tasks are **N.**

Outcome 5

V A **V** on 3 or more tasks and at least half the remaining tasks are at **H.**
H An **H** on 3 or more tasks and at least half the remaining tasks are at **S.**
S An **S** on 3 or more tasks.
N If 4 or more tasks are **N.**

Also students must demonstrate at least one **S** rating for each outcome in each of the three topics, otherwise an **N** will usually be awarded for that outcome. Students who have not achieved a **S** may be offered a supplementary assessment task in order to have another opportunity to demonstrate the outcome, provided they have submitted *all* assessment tasks.

The ratings for each outcome are then used to determine a student's grade.

Performance Criteria

U grade will be awarded if a student does not finish the course, or if insufficient assessment tasks have been submitted to be able to award a grade.

E grade will be awarded if a student gets a **N**ot demonstrated in 3 or more of the outcomes.

D grade **S**atisfactory or better in 3 of the outcomes.

C grade **S**atisfactory or better in **ALL** outcomes

B grade **H**igh in 3 of the outcomes, and **S**atisfactory or better in the remainder.

A grade **V**ery high in 3 of the outcomes, **Hi**gh or better in at least one other outcome and **no N**ot demonstrated outcomes.

Policy on late submission of work

The relevant section of the school's assessment policy states:

> It is the responsibility of students to submit assessments on the required date.
>
> Students can apply to the class teacher for an **extension.** These will be given at the sole discretion of the teacher in advance in the case of illness, critical events or significant personal issues.
>
> **Where a student fails to submit work by the due date without an extension and with no acceptable excuse**, **the work will not be accepted**.
>
> This means that the student may jeopardise completion of the unit and may not receive a numerical score nor level and band. This may impact on the student's ability to receive a Western Australian Certificate of Education and receive an appropriate school score for the purposes of university entrance when enrolled in Senior School.

Students who fail to submit *all* the assessment tasks risk receiving a "U" grade for the course. This can have implications for secondary graduation.

Proof of submission of work

If a dispute arises about whether or not a piece of work has been submitted, the onus will be on the student to prove that they have submitted the work. Students are encouraged to have their teacher write and sign a receipt in their work record when they submit completed work.

Program of Assessment

Topic	Task	Due date
Making Decisions	Project 1: Who Wrote This?	4 March 2009
	Project 2: How Much Homework?	8 April 2009
	Test 1	30 March 2009
In Three Dimensions	Project 3: Designing a Milk Carton	27 May 2009
	Project 4: Wheat Silos	24 June 2009
	Test 2	29 June 2009
Finance	Project 5: Share Trading	21 August 2009
	Project 6: Spreading Wealth	18 September 2009
	Test 3:	23 September 2009

(Planned dates may be adjusted as required throughout the year.)

Modelling With Mathematics – Course Outline – 2009

Term 1

Week	Curriculum Council Objectives	Exercises and Assessment	Notes
0 (Fri 30 Jan) **1** 2 – 6 Feb	Distribution of Program. Orientation to the course working in small groups to solve textbook problem and problems on the worksheets provided.	**T** **Orientation tasks** (pages 1-4) **WS** Orientation problems 1 to 5 Go through samples of student work.	– Australia Day – School photos Tuesday – TAFE begins on Wednesday
2 9 – 13 Feb	**Commence topic 1:** **Chance and Data: Making Decisions** Measures of Location and Presentation of Data	***T*** *Lessons 1-3* ***WS*** *Statistical Cryptography* *Graphics Calculators*	
3 16 – 20 Feb	Histograms & Measures of Spread	**T** Lessons 4 - 6 **Project 1 issued: Who wrote this?**	– Secondary house swimming carnival Monday
4 23 Feb – 27 Feb	Standard Deviation	**T** Lesson 7 **Project work**	
5 2 – 6 Mar	Bivariate Data, Relationships & Correlation Excel Use	**Project 1 Due 4th March** **T** Lessons 9 –11 Microsoft Excel	– Monday: Labour Day holiday
6 9 – 13 Mar	Sampling methods Surveys	**T** Lessons 12 – 13	– Dry/Wet trades all week
7 16 – 20 Mar	Questionnaire design	**T** Lessons 14 –15 **Project 2 Issued: How Much Homework?**	
8 23 – 27 Mar	Analysis of Results	**T** Lesson 16	– Monday 24 March: Easter Monday – Interschool swimming carnival Thursday
9 30 Mar – 3 Apr	Project Work	**Test 1** **Project Work**	
10 6 – 10 Apr	**Commence Topic 2: Space: In Three Dimensions** **Drawing 3D objects**	**Project Work** **Project 2 Due 8 April** **T** Lesson 1 p101 to 104	– Friday 10 April: Good Friday

Modelling With Mathematics – Course Outline – 2009
Term 2

Week	Curriculum Council Objectives	Exercises and Assessment	Notes
1 27 Apr – 1 May	Geometry in Three Dimensions	**T** Lesson 2 p105 to 110	– Monday is ANZAC Day Holiday – **Year 12 retreat** Wednesday–Friday – ANZAC Day service?
2 4 – 8 May	Three Dimensional Objects Nets and cross sections Revisiting Units of Measure	**T** Lesson 3 p112 to 116 **T** Lesson 4 p117 to 121 **T** Lesson 5 p122 to 125 **Project 3 issued: Designing a Milk Carton**	
3 11 – 15 May			– Dry/Wet Trades
4 18 – 22 May	3D calculations – Prisms, Pyramids and Spheres Composites and Problems Capacity	**T** Lesson 6 p126 to 130 **T** Lesson 7 p131 to 134 **T** Lesson 8 p135 to 140	
5 25 – 29 May	Trigonometry in 3D Building Applications	**T** Lesson 10 p145 –149 **T** Lesson 11 p150 - 154 **Project 3 due 27 May** **Project 4 issued: Wheat Silos**	– Friday: Staff Retreat
6 1 – 5 Jun	Project Work	**Project Work**	– Exams week – Monday 1 June: Foundation Day
7 8 – 12 Jun	Project Work	**Project Work**	– Exams week
8 15 – 19 Jun	Tessellating Shapes Plans and Elevations Building Plans	**T** Lesson 14 p170 – 177 **T** Lesson 12 p155 –159 **T** Lesson 13 p160 – 169	
9 22 – 26 Jun	Contours	**T** Lesson 15 p178 – 182 **Project 4 Due 24 June**	
10 29 Jun – 3 Jul	**Commence topic 3: Number: Finance** Introduction to the Share Market	**Test 2** **T** Lessons 2 – 3 **WS** Finance Sheets 1-3	

Modelling With Mathematics – Course Outline – 2009
Term 3

Week	Curriculum Council Objectives	Exercises and Assessment	Notes
1 20 – 24 Jul	SWL	**SWL**	– Year 12 SWL all week
2 27 Jul – 31 July	Trading Shares	**Project 5 Issued: Share Trading** **T** Lessons 4- 6 **WS** Finance Sheets 4-5	– House Athletics Carnival on Friday
3 3 – 7 Aug	Spreadsheet Basics	**T** Lessons 7- 8 **WS** ***Excel Finance*** **http://www.studyfinance.com/lessons/excel/index.mv**	
4 10 – 14 Aug	Savings	**T** Lesson 9 **Project Work**	
5 17 – 21 Aug	Simple Interest	**T** Lessons 10 - 12 **Project 5 Due 21 August**	
6 24 – 28 Aug	Compound Interest	**T** Lessons 13 - 15	– Wet trades?
7 31 – 4 Sep		**Project 6 Issued: Spreading Wealth** **Project work**	– Leavers Shield
8 7 – 11 Sep	Reducible Interest	**T** Lessons 19 - 20 **Project work**	
9 14 – 18 Sep		**Project work** **Project 6 Due 18 September**	– Interschool athletics Friday
10 21 – 25 Sept		**Any Supplementary Assessments issued** **Test 3**	

Modelling With Mathematics – Course Outline – 2009
Term 4

Week	Curriculum Council Objectives	Exercises and Assessment	Notes
1 12 – 16 Oct			– Monday is pupil free – Year 12 SWL
2 19 – 23 Oct		***Any supplementary assessments due***	– House farewell to Year 12s on Wednesday – Grads' Day 22 October

E511 MODELLING WITH MATHEMATICS

(YEAR 12) – 2006-2009

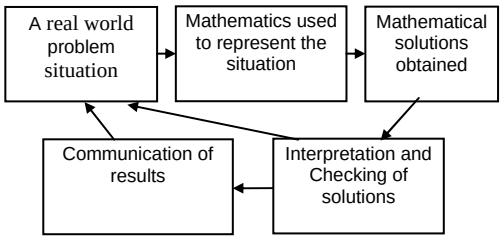
Rationale

Mathematics subjects for the final years of secondary school must fulfil a variety of needs. They should provide both a satisfying culmination of the work of earlier years and an adequate preparation for the future.

The role of Modelling with Mathematics is to provide students with a relevant and rewarding preparation for post-school situations in which mathematics is used. This subject has been specifically designed to cater for students who require preparation for a wide range of occupations within the community, or tertiary-bound students who do not require mathematics for their intended areas of study. It offers a range of topics that enable students to examine situations arising from appropriate social and physical contexts and use techniques of mathematical modelling.

Mathematical modelling involves students using mathematics to represent real situations or problems.

The topics are derived from the Major Learning Outcomes in the Mathematics Learning Area of the Curriculum Framework, in particular from the clusters *Working Mathematically*, *Number*, *Measurement*, *Chance and Data* and *Space*. Collaborative learning is to be encouraged. The responsibility is given to the student to choose appropriate mathematics and to work individually and in groups towards required solutions. The diagram below shows the stages of modelling.



This modelling approach enables students to solve real problem situations through the use of appropriate mathematical techniques, resulting in continuing development of mathematical understanding.

The subject reflects current technological developments by assuming the use of calculators and computers in the teaching-learning program.

Subject Design

Modelling with Mathematics is designed that students can develop the skills to work mathematically in many contexts. Students are therefore given opportunities to demonstrate achievement of outcomes in three or four different mathematical contexts.

For the subject *Modelling with Mathematics*, E511, the topics described are *Finance (Number)*, *In Three Dimensions* (*Space)*, *Making Decisions* (*Chance and Data*) and *Environment* (*Measurement*).

A set of indicators is included to clarify the meaning of the outcomes in the context of each topic. They provide examples of the sorts of things students who have achieved the outcome are able to do. The indicators are not intended to be a list of content but are suggestive of the level of difficulty of the subject. The indicators are neither prescriptive nor comprehensive and teachers are encouraged to develop their own indicators to each outcome.

Schools wishing to vary the specified topics should contact the Curriculum Council. It must be demonstrated that the proposed topic is derived from the Mathematics Learning Area outcomes for the designated cluster, that the subject outcomes can be achieved and that the subject is assessed through the Common Assessment Framework described.

A Common Assessment Framework, based on a series of generally defined common assessment tasks, is stipulated. Each task measures student performance on all or most of the subject outcomes. A procedure for rating student performance on each task and allocating grades is stipulated.

Modelling is a higher order process which students develop as part of their mathematics study. In the Modelling with Mathematics course a school's teaching and assessment program must take this into account by setting tasks that apply the process to structured projects. It is not intended that students become competent in applying the modelling process to unstructured projects in this course. The intent is that students become competent at making judgements about the selection and sequencing of activities in the modelling process with some supervision, although some students may demonstrate the competencies at higher levels.

Subject Outcomes

Within the context of the Modelling with Mathematics Subject, through the modelling process and in each topic, the student is provided with opportunities to meet each of the following outcomes.

Outcome 1: Clarifies a problem
Outcome 2: Chooses a model to solve a problem
Outcome 3: Uses a model to solve a problem
Outcome 4: Interprets and checks the solution to a problem
Outcome 5: Communicates an obtained result

Components of Outcomes

Outcome 1: Clarifies a problem

The following components amplify the context and meaning of the outcome. The student:

- identifies relevant information
- restates the problem
- makes appropriate assumptions.

Outcome 2: Chooses a model to solve a problem

The following components amplify the context and meaning of the outcome. The student:

- identifies variables
- identifies relationships
- selects appropriate symbols, graphs and diagrams
- selects appropriate technology.

Outcome 3: Uses a model to solve a problem

The following components amplify the context and meaning of the outcome. The student:

- carries out correct calculations
- draws graphs
- collects and analyse data
- estimates
- uses mental, written, calculator and/or computer computation
- uses technological practices where appropriate.

Outcome 4: Interprets and checks the solution to a problem

The following components amplify the context and meaning of the outcome. The student:

- translates the solution back into the language of the original problem
- identifies limitations
- checks original assumptions.
- suggests further refinements not previously considered

Outcome 5: Communicates an obtained result

The following components amplify the context and meaning of the outcome. The student:

- identifies audience and purpose of communication
- chooses an appropriate format
- describes all steps in the modelling process
- communicates clearly and coherently in a range of formats.

Number Topic: Finance

	Outcome	**Indicators** **Students will be able to, for example:**
1	Clarifies a problem • identifies relevant information • restates the problem • makes appropriate assumptions.	– identify the basic terminology of the market place (e.g. stock exchange, money market, bank investments, superannuation) – identify different types of bank interest (e.g. reducible, flat, simple, compound) – identify which types of taxes are applied on investments – identify the effect of the Consumer Price Index on investments – recognise the factors which affect savings (e.g. inflation)
2	Chooses a model to solve a problem • identifies variables • identifies relationships • selects appropriate symbols, graphs and diagram • selects appropriate technology.	– decide what relationship exists between the real value of a commodity and the CPI – decide which tax is to be applied on the profits of an investment – decide how to organise and display financial data (e.g. from the stock exchange) – decide on various forms of investments – decide how much to spend on a particular investment
3	Uses a model to solve a problem • carries out correct calculations • draws graphs • collects and analyse data • estimates • uses mental, written, calculator and/or computer computation • uses technological practices where appropriate.	– calculate the CPI for a commodity – calculate superannuation, insurance premiums, annuities and payouts – use a spreadsheet to calculate annuities – deal in a simulated market – apply the relationship between international currencies through use of exchange rates – calculate the depreciation of a commodity – calculate interest on an investment or loan
4	Interprets and checks the solution to a problem • translates the solution back into the language of the original problem • identifies limitations • checks original assumptions • suggests further refinements not previously considered.	– interpret a spreadsheet to determine the effects of different interest rates and types of interest (e.g. on home loans) – interpret the effect of inflation on savings – interpret the financial return obtained from using various types of investments – check calculations and/or data entry when unreasonable answers are obtained – draw conclusions about the appropriateness of investments
5	Communicates an obtained result • identifies audience and purpose of communication • chooses an appropriate format • describes all steps in the modelling process • communicates clearly and coherently in a range of formats.	– illustrate the financial return on investments using an appropriate format – display and discuss different types of investments considered

Space Topic: In Three Dimensions

	Outcome	**Indicators** **Students will be able to, for example:**
1	Clarifies a problem • identifies relevant information • restates the problem • makes appropriate assumptions.	– identify the properties of simple regular and irregular polyhedra nets and models – recognise whether or not simple 3-d shapes will tessellate (e.g. cuboid, sphere)
2	Chooses a model to solve a problem • identifies variables • identifies relationships • selects appropriate symbols, graphs and diagrams • selects appropriate technology.	– choose an appropriate arrangement in space – choose a 3-d system to locate points in space (e.g. rows in a supermarket, parking bay in a multi-storey car-park) – select (and make if necessary) a 3-d model to show positioning of devices (e.g. security cameras in a bank or home) – choose appropriate nets to build a physical model (e.g. house, letter-box)
3	Uses a model to solve a problem • carries out correct calculations • draws graphs • collects and analyse data • estimates • uses mental, written, calculator and/or computer computation • uses technological practices where appropriate.	– use the properties of tessellations to illustrate how a 3-d shape can be used in packaging – find the distance between points in space by using the Pythagorean result and basic trigonometric ratios – find the surface area and volume of composite shapes involving right prisms, spheres and hemispheres – use 3-d coordinates to locate an object (e.g. a jar of coffee in a supermarket) – use appropriate computer software to help solve a 3-d problem
4	Interprets and checks the solution to a problem • translates the solution back into the language of the original problem • identifies limitations • checks original assumptions • suggests further refinements not previously considered.	– evaluate the efficiency of packaging 3-d objects (e.g. stubbies in a carton) – identify limitations of a model (e.g. standard dimensions of cardboard sheeting when constructing a letter box model) – check the accuracy of the system for locating a point in space – draw appropriate conclusions to a problem (e.g. optimum shape of a carton may be determined by factors other than the shape of the contents)
5	Communicates an obtained result • identifies audience and purpose of communication • chooses an appropriate format • describes all steps in the modelling process • communicates clearly and coherently in a range of formats.	– describe or show common 3-d shapes in terms of loci (e.g. spheres, beam of light) – use appropriate terms to describe features of 3-d shapes – describe how to locate a point in space

Chance and Data Topic: Making Decisions

	Outcome	**Indicators** **Students will be able to, for example:**
1	Clarifies a problem • identifies relevant information • restates the problem • makes appropriate assumptions.	– recognise the problem requires statistical procedures – identify whether there is a bias or ambiguity – recognise whether a problem requires sample or population data
2	Chooses a model to solve a problem • identifies variables • identifies relationships • selects appropriate symbols, graphs and diagram • selects appropriate technology.	– identify appropriate summary statistics and be aware of the advantages and disadvantages of each – identify appropriate methods of sampling – decide on appropriate statistical methods – select an appropriate sampling technique to gather information – choose an appropriate graph or table to summarise and/or display data – recognise when different samples are more appropriate – decide when it is appropriate to use a survey
3	Uses a model to solve a problem • carries out correct calculations • draws graphs • collects and analyse data • estimates • uses mental, written, calculator and/or computer computation • uses technological practices where appropriate.	– collect data from a pre-determined sample – draw an appropriate graph or table to display data – efficiently gather data – calculate appropriate summary statistics – select an appropriate sample size – write unbiased survey questions
4	Interprets and checks the solution to a problem • translates the solution back into the language of the original problem • identifies limitations • checks original assumptions • suggests further refinements not previously considered.	– recognise that cause and effect and correlation are unrelated – recognise the limitations of using summary statistics to describe data – interpret statistics of samples in making decisions about a wider population – recognise when bias in survey questions may have affected results – recognise that other factors may have influenced results obtained (e.g. data collected on school lunches may vary with the time of year) – describe the limitations of survey techniques used
5	Communicates an obtained result • identifies audience and purpose of communication • chooses an appropriate format • describes all steps in the modelling process • communicates clearly and coherently in a range of formats.	– communicate, verbally or in written form, the reasons for a particular statistic being used to summarise data – communicate, verbally or in written, tabular or graphical form, conclusions drawn – display information in tabular or graphical form

Measurement Topic: Environment

	Outcome	**Indicators** **Students will be able to, for example:**
1	Clarifies a problem • identifies relevant information • restates the problem • makes appropriate assumptions.	– recognise that an approximation may be adequate – decide on a required degree of accuracy – recognise when or if a measurement needs to be optimised – identify all measurements/quantities within a problem – recognise the need for time scheduling (e.g. events at a swimming carnival) – recognise that time can be used as a measure for distance
2	Chooses a model to solve a problem • identifies variables • identifies relationships • selects appropriate symbols, graphs and diagram • selects appropriate technology.	– Decide what variables need to be measured in order to complete a practical task – choose appropriate units to establish relationships between quantities – choose a graph to represent a rate (e.g. time/distance graph) – select a graph to represent the relationship between two measurable quantities (e.g. temperature conversion graph) – identify a sequence of formulas used to solve a problem (e.g. find the area then the cost) – choose appropriate methods to find an unknown length (e.g. sine rule or cosine rule)
3	Uses a model to solve a problem • carries out correct calculations • draws graphs • collects and analyse data • estimates • uses mental, written, calculator and/or computer computation • uses technological practices where appropriate.	– use measurement data to solve a practical problem – use trigonometric methods to solve a measurement problem – use a rate to calculate quantities – use conservation of volume principles to calculate volumes/capacities of composite shapes (e.g. the capacity of a rectangular swimming pool where the depth at one end is different to that at the other, or finding the volume of a watermelon) – use timetables (e.g. calculate arrival time for a flight, given departure time and relevant information on time zones and daylight saving) – calculate the slope of a hill after gathering relevant information – make decisions about acceptable margins of error in measurement (e.g. when buying carpet by the metre)
4	Interprets and checks the solution to a problem • translates the solution back into the language of the original problem • identifies limitations • checks original assumptions • suggests further refinements not previously considered.	– interpret a time/distance graph – check quantities in light of 'expected' results – use a graph of a relationship to predict unknown quantities – interpret the relationship between the slope of a line and the size of a rate – recognise when/if inappropriate formulas have been used
5	Communicates an obtained result • identifies audience and purpose of communication • chooses an appropriate format • describes all steps in the modelling process • communicates clearly and coherently in a range of formats.	– explain the basis for measurements made and strategies used – display on a neat diagram the relationship between two measurable quantities – use appropriate units and levels of accuracy when communicating results about measured quantities

Common Assessment Framework

The framework describes the essential elements of assessment tasks which comprise the assessment program for the subject. Outcomes 1 to 4 will be assessed on all tasks, however Outcome 5 will only be assessed in the first two tasks in each topic (outcome 5 will not be assessed on tests). The topics may be addressed in any order.

Notes:

- For *Modelling with Mathematics* schools may elect to cover three or four topics.The framework will contain nine or twelve tasks accordingly.
- The assessment program in any topic must include two projects. Each project must assess all outcomes.
- Tests will assess outcomes 1 to 4 only.

Topic	Task	Outcomes	Task Details
Finance (Number)	One	1,2,3,4,5	Project involving, for example, using a spreadsheet to investigate a financial investment
	Two	1,2,3,4,5	Project involving, for example, buying shares and modifying investments based on stock market reports
	Three	1,2,3,4	An item or set of items completed under test conditions
In Three Dimensions (Space)	Four	1,2,3,4,5	Project involving, for example, placing electronic sensors in a house to maximise security
	Five	1,2,3,4,5	Project involving, for example, designing an optimal shaped letter box using specified materials
	Six	1,2,3,4	An item or set of items completed under test conditions
Making Decisions (Chance and Data)	Seven	1,2,3,4,5	Project involving, for example, determining mathematical differences between articles from different publications
	Eight	1,2,3,4,5	Project involving, for example, designing a method which uses mathematics to consider factors involved when making a career choice
	Nine	1,2,3,4	An item or set of items completed under test conditions
Environment (Measurement)	Ten	1,2,3,4,5	Project involving, for example, designing a personal fitness program based on personal fitness data
	Eleven	1,2,3,4,5	Project involving, for example, analysing predicted and actual temperatures in order to make judgements about forecasting
	Twelve	1,2,3,4	An item or set of items completed under test conditions

Common Assessment Task Booklet

The *Common Assessment Tasks* booklet for this subject further describes each task, and defines parameters for its completion. Schools are free to determine specific assessment details within these parameters. Copies of the booklet are available from the Curriculum Council and are included with the syllabus, on the Curriculum Council website (http://www.curriculum.wa.edu.au).

Performance Criteria

Three assessment tasks will be set for each of the four topics. In Outcomes 1 to 4, students will have three opportunities in each topic to demonstrate attainment of the outcomes as described in the Common Assessment Framework. In Outcome 5, student attainment of the outcome will not be rated in tests, consequently there will only be two assessments in each topic for this outcome.

Each student will be given a rating of Very High, High, Satisfactory or Not Demonstrated for each outcome on each assessment task according to the performance criteria given below.

Performance Criteria - Rating each Outcome on each Task

Outcome 1: Clarifies a problem

Satisfactory	High	Very High
The student shows evidence of a basic understanding of the problem to be solved.	The student understands the problem to be solved and identifies most of the relevant information that would be required to find a solution to the problem.	The student fully understands the problem to be solved and identifies all of the relevant information required to find a solution to the problem, and makes appropriate assumptions where necessary.

Outcome 2: Chooses a model to solve a problem

Satisfactory	High	Very High
The student chooses a model that produces a reasonable solution to the problem.	The student chooses an appropriate model to solve a problem.	The student chooses an appropriate and efficient model justifying their choice in the context of the problem to be solved.

Outcome 3: Uses a model to solve a problem

Satisfactory	High	Very High
The student demonstrates limited use of the chosen model.	The student uses the model correctly but makes careless errors.	The student uses the model efficiently and accurately.

Outcome 4: Interprets and checks the solution to a problem

Satisfactory	High	Very High
The student translates the solution back into the context of the original problem.	The student translates the solution into the context of the original problem and checks the reasonableness of the result.	The student translates the solution into the context of the original problem, checks and judges the reasonableness of the result, and evaluates the model suggesting refinements and/or modifications where appropriate.

Outcome 5: Communicates an obtained result

Satisfactory	High	Very High
The student identifies the audience and communicates the solution using a format appropriate for that audience. Both inappropriate presentation and mathematically incorrect terminology are common in all of Outcomes 1-4.	The student communicates the solution using a format appropriate for the audience but fails to use both clear presentation and mathematically correct terminology in Outcomes 1-4.	The student clearly communicates the solution using a format appropriate for the audience and uses both clear presentation and mathematically correct terminology in Outcomes 1-4.

A rating of Not Demonstrated is recorded if a student fails to demonstrate at least satisfactory performance in a task.

Rating Procedure

Before a final grade can be awarded, the final rating achieved for each outcome must be determined. This is done using the following process:

V* is attained when at least 50% of the ratings on the tasks are at a **Very High** level and at least 50% of the remainder are at a **High** level or better,

H* is attained when at least 50% of the ratings on the tasks are at a **High** level or better, and at least 50% of the remainder are at a **Satisfactory** level or better.

S* is attained when at least 50% of the ratings on the tasks are at a **Satisfactory** level or better.

ND is attained when more than 50% of the ratings on the tasks are at a **Not Demonstrated** level.

*** Students must also demonstrate at least one S rating for each outcome in each cluster. If this is not achieved they will receive a final rating for that outcome which is one lower than the process indicates. This condition may be waived if the outcome was not demonstrated in a cluster early in the year and the student demonstrated improvement in later tasks.**

Where a student fails to achieve a final rating of S for an outcome, teachers are encouraged to provide the student with an additional opportunity to demonstrate S if:

- **the student has completed all the Common Assessment Tasks incorporating that outcome, and**
- **the student has demonstrated S for that outcome in at least one task.**

The additional opportunity should not simply be a repetition of a task, but should be an equivalent task which reflects a change of context in which the task is done.

Professional judgement should then be used to determine whether a final rating of ND or S is appropriate in each situation.

Grading Procedure

At the completion of this subject grades will be awarded in the following manner:

A **Very High** in 3 of the outcomes, **High** or better in at least one other outcome, and no **Not Demonstrated** outcomes.

B **High** in 3 of the outcomes, and **Satisfactory** or better in the remainder.

C **Satisfactory** or better in all outcomes.

D **Satisfactory** or better in 3 of the outcomes.

E **Not Demonstrated** in 3 or more of the outcomes.

A final rating of ND for any outcome will result in a grade of D being awarded.

Time Allocation

The full subject has been designed to be completed through a structured educational program of approximately 110 hours in any suitable contexts and series of learning experiences. Typically the subject will be studied over the period of a school year. For administrative reasons schools wishing to vary this delivery pattern (e.g. over a shorter period or over a longer period up to two school years) are required to notify the Chief Executive Officer of the Curriculum Council.

Subject Completion

Students must complete the school's structured educational and assessment program for a subject in order to be eligible to receive a grade unless there are exceptional and justifiable circumstances. In situations where the school considers that insufficient information has been gathered to justify the award of a grade for the subject, a result of U (for unfinished) should be allocated. The Curriculum Council offers the flexibility for the U to be converted to a grade after the final grades have been submitted. Further details on assessment and grading are provided in Volume I of the Syllabus Manual.