Statement on choice of Mathematics subjects

There are three Authority subjects available to schools for students of senior Mathematics. Choice of subject may be helped by considering the following statements on prior study and future pathways.

The Senior Syllabus in Mathematics A is a recommended precursor to further study and training in the technical trades such as toolmaking, sheet-metal working, fitting and turning, carpentry and plumbing, auto mechanics, tourism and hospitality, and administrative and managerial employment in a wide range of industries. It is also suitable as a precursor to tertiary studies in subjects with moderate demand in mathematics.

The Senior Syllabus in Mathematics B is a recommended precursor to tertiary studies in subjects with high demand in mathematics, especially in the areas of science, medicine, mining and engineering, information technology, mathematics, finance, and business and economics.

The Senior Syllabus in Mathematics C is a recommended companion subject to Mathematics B. It provides additional preparation for tertiary studies in subjects with high demand in mathematics, especially in the areas of science, medicine, mining and engineering, information technology, mathematics, finance, and business and economics.
Contents

1. Rationale 1
   Why study this subject? 1
   Changes in society 2
   Key competencies 2

2. Global aims 3

3. General objectives 4
   3.1 Introduction 4
   3.2 Objectives 4
   3.3 Principles of a balanced course 5

4. Course organisation 7
   4.1 Introduction 7
   4.2 Selecting the topics 8
   4.3 Time allocation 8
   4.4 Sequencing 8
   4.5 Technology 8
   4.6 Composite classes 9
   4.7 Work program requirements 9

5. Topics 10
   5.1 Introduction 10
   5.2 Core topics 11
   5.3 The elective topics 19

6. Assessment 26
   6.1 Underlying principles of exit assessment 26
   6.2 Planning an assessment program 28
   6.3 Implementing assessment 29
   6.4 Assessment techniques 31
   6.5 Special consideration 33
   6.6 Exit criteria 34
   6.7 Determining exit levels of achievement 34
   6.8 Requirements for verification folio 35
   6.9 Standards associated with exit criteria 36

7. Language education 38

8. Quantitative concepts and skills 39

9. Educational equity 40

10. Resources 41

Glossary 43
### Summary of syllabus amendments January 2014

The following table outlines the amendments made to Mathematics A Senior Syllabus 2008. These amendments are a consequence of the directions of the Minister as outlined in the *Queensland Government Response to the Education and Innovation Committee Report No. 25: The assessment methods used in senior mathematics, chemistry and physics in Queensland schools.*

<table>
<thead>
<tr>
<th>Syllabus section</th>
<th>2014 update</th>
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| Section 1: Rationale              | Mathematics A aims to provide the opportunity for students to continue to participate fully in lifelong learning. It is designed for those students who want to extend their mathematical skills beyond Year 10 level but whose future studies or employment pathways do not require knowledge of calculus. The subject is designed for students who have a wide range of educational and employment aspirations, including continuing their studies at university or TAFE. Mathematics A is a recommended precursor to further study and training for professions and technical trades in a range of industries and employment areas including:  
  - manufacturing and processing  
  - building and construction  
  - hospitality and tourism  
  - administration and management  
  - education and training  
  - health services  
  - retail services  
  - mechanics and engineering. |
| Section 6.3.4: Authentication of student work | It is essential that judgments of student achievement be made on genuine student assessment responses. Teachers must take reasonable steps to ensure that each student’s work is their own, particularly where students have access to electronic resources or when they are preparing responses to collaborative tasks.  
  The QSA’s A–Z of Senior Moderation contains a strategy for authenticating student work <www.qsa.qld.edu.au/10773.html>. This provides information about various methods teachers can use to monitor that students’ work is their own. Particular methods outlined include:  
  - teachers seeing plans and drafts of student work  
  - student production and maintenance of evidence for the development of responses  
  - student acknowledgment of resources used.  
  Teachers must ensure students use consistent, accepted conventions of in-text citation and referencing, where appropriate. |
| Section 6.8: Requirements for a verification folio | • a student profile completed to date. |
1. Rationale

Mathematics is an integral part of a general education. It can enhance understanding of our world and the quality of our participation in a rapidly changing society. Mathematics pervades so many aspects of daily life that a sound knowledge is essential for informed citizenship. Through enhanced understanding of mathematics, individuals can become better informed economically, socially and politically in an increasingly mathematically oriented society.

Mathematics A emphasises the development of positive attitudes towards the student’s involvement in mathematics. This development is encouraged through the use of relevant personal and work-related learning experiences. There is also a focus on the development of mathematical knowledge and understanding through investigative and explorative approaches to learning. These approaches provide opportunities to work collaboratively and cooperatively in teams as well as individually.

Mathematics A involves the study of Financial Mathematics, Applied Geometry, and Statistics and Probability. These are used to develop:

- knowledge and skills of computation, estimation and measurement
- simple algebraic manipulation
- a capacity to interpret and analyse information presented in a variety of forms
- the ability to make judgments based on evidence and reasoning
- a capacity to justify and communicate results in a variety of forms.

Why study this subject?

Mathematics A aims to provide the opportunity for students to continue to participate fully in lifelong learning. It is designed for those students who want to extend their mathematical skills beyond Year 10 level but whose future studies or employment pathways do not require knowledge of calculus. The subject is designed for students who have a wide range of educational and employment aspirations, including continuing their studies at university or TAFE.

Mathematics A is a recommended precursor to further study and training for professions and technical trades in a range of industries and employment areas including:

- manufacturing and processing
- building and construction
- hospitality and tourism
- administration and management
- education and training
- health services
- retail services
- mechanics and engineering.
Changes in society

Mathematics continues to develop in response to changes in society and, in turn, influences further societal development. Technology, including calculators, computers and electronic means of communicating information, has had a significant impact on this development. This will be increasingly reflected in future-oriented classrooms and the way mathematics is taught and learned.

Key competencies

Mathematics A provides opportunities for the development of the key competencies in contexts that arise naturally from the general objectives and learning experiences of the subject. The seven key competencies are:

- collecting, analysing and organising information
- communicating ideas and information
- planning and organising activities
- working with others and in teams
- using mathematical ideas and techniques
- solving problems
- using technology.
2. Global aims

The Global aims are statements of the long-term achievements, attitudes and values that are developed by students through studying Mathematics A but which are not directly assessed by the school.

By the end of this course, students should develop:

• an appreciation of the value of mathematics to the lifelong learner
• sound number sense and an ability to view and interpret the world from a quantitative perspective
• the ability to recognise when situations in their everyday life can be dealt with through mathematical analysis and procedures, and be able to attempt such analysis or procedures with confidence and success
• an awareness of the elements of chance which exist in some aspects of life and an ability to make decisions informed by this awareness
• an ability to manage their financial affairs to empower them to make informed consumer decisions
• an ability to visualise and represent spatial relationships in two and three dimensions
• an ability to comprehend mathematical information which is presented in a variety of forms to become informed and critical citizens.
3. General objectives

3.1 Introduction

The general objectives of this course are organised into four categories:

- Knowledge and procedures
- Modelling and problem solving
- Communication and justification
- Affective.

3.2 Objectives

The general objectives for each of the categories are detailed below. These general objectives incorporate several key competencies. The first three categories of objectives, Knowledge and procedures, Modelling and problem solving, and Communication and justification, are linked to the exit criteria in Section 6.6.

3.2.1 Knowledge and procedures

The objectives of this category involve recalling and using results and procedures.

By the end of the course, students should be able to:

- manipulate simple rules and formulas
- access, select and apply rules and formulas
- recall, select and apply mathematical procedures to situations that are similar to situations already encountered
- apply a sequence of mathematical procedures in situations that are similar to situations already encountered
- use mathematical technology and geometrical instruments.

3.2.2 Modelling and problem solving

The objectives of this category involve the uses of mathematics in which the students will model mathematical situations and constructs, solve problems and investigate situations mathematically.

In achieving these objectives, the emphasis should be on using observations, data, diagrams, formulas, and graphical and other representations to investigate and model situations, and hence make informed decisions.

By the end of the course, students should be able to:

- interpret, clarify and analyse problems
- use strategies to model and solve problems
- investigate alternative solutions and/or procedures to problems
- make decisions informed by mathematical reasoning
- reflect on the effectiveness of mathematical models, including the recognition of strengths and limitations.
3.2.3 Communication and justification

The objectives of this category involve presentation, communication (using both mathematical and everyday language), logical arguments, interpretation and justification of mathematics.

By the end of the course, students should be able to:

- interpret and use appropriate mathematical terminology, symbols and conventions
- organise and present information for different purposes and audiences, in a variety of representations (such as written, symbolic, pictorial and graphical)
- analyse information displayed in a variety of representations (such as written, symbolic, pictorial and graphical) and translate information from one representation to another
- develop logical sequences within a response expressed in everyday language, mathematical language, or a combination of both, as required, to justify conclusions, solutions or propositions
- justify the reasonableness of results obtained through technology or other means using everyday language, mathematical language or a combination of both, when appropriate.

3.2.4 Affective

Affective objectives refer to the attitudes, values and feelings which this subject aims to develop in students. Affective objectives are not assessed for the awarding of exit levels of achievement.

By the end of the course, students should appreciate the:

- diverse applications of mathematics
- precise language and structure of mathematics
- contribution of mathematics to human culture and progress
- power and value of mathematics.

3.3 Principles of a balanced course

The categories of Knowledge and procedures, Modelling and problem solving, and Communication and justification incorporate the principles of application, technology, initiative, and complexity. Each of the principles has a continuum for the particular aspect of mathematics it represents. A balanced course of study developed from this syllabus must give expression to these principles over the two years. It is expected that all students will be given the opportunity to experience mathematics along the continuum within each of the principles outlined below.

Application

Students must have the opportunity to recognise the usefulness of mathematics through its application. Learning experiences and the corresponding assessment must include mathematical tasks across a variety of situations from real-world through to contrived or simplified life-related tasks. Whilst some purely mathematical situations may be needed, the emphasis should be on life-related tasks and activities.

Technology

A range of technological tools must be used in the learning experiences and the corresponding assessment. These range from pen and paper, compasses, measuring instruments and tables through to technologies such as scientific calculators, global positioning systems, graphing calculators and computer programs.
Initiative

Learning experiences and the corresponding assessment must provide students with the opportunity to demonstrate their capability in dealing with tasks that range from well-rehearsed (routine) through to those that require demonstration of insight and creativity (non-routine).

Complexity

Students must be provided with the opportunity to work on simple, single-step tasks through to complex tasks. Complexity may derive either from the nature of the concepts involved or from the number of ideas or techniques that must be sequenced in order to produce an appropriate conclusion.
4. Course organisation

4.1 Introduction

The syllabus contains core and elective topics. The core topics to be studied are arranged into strands and are listed below. Although the first topic listed in each strand contains material which is required in later topics, the order in which the topics are presented does not imply a teaching sequence.

Core topics

The core topics within each strand are:

**Financial mathematics strand**
- Managing money 1
- Managing money 2

**Applied geometry strand**
- Elements of applied geometry
- Linking two and three dimensions

**Statistics and probability strand**
- Data collection and presentation
- Exploring and understanding data

Elective topics

The elective topics are (two to be selected):

- Maps and compasses: *Either*
  - Navigation *or*
  - Land measurement
- Operations research: *Either*
  - Linear programming *or*
  - Networks and queuing
- Introduction to models for data
- School elective

Study in elective topics is a requirement for the award of the exit levels of achievement of High Achievement and Very High Achievement. The core and elective topics are discussed in detail in Section 5.

Quantitative concepts and skills

Throughout the course, certain concepts and skills are required to be maintained. This maintenance takes time and should be allowed for when designing the course of study. These have been listed in Section 8.
4.2 Selecting the topics

The course of study offered by a school must consist of all core topics plus two elective topics. Choice of electives should be made so that they best suit the interests and needs of the particular cohort of students, the expertise and interests of the teaching staff and the resources and geographical location of the school. This might mean that different choices are offered for different classes within the one cohort, or that the choices differ from year to year. If the school wishes to allow for this flexibility, the possibilities should be detailed in the work program.

4.3 Time allocation

The minimum number of hours of timetabled school time, including assessment, for a course of study developed from this syllabus is 55 hours per semester. A course of study will usually be completed over two years (220 hours).

Notional times are given for each topic. These times are included as a guide, and minor variations to these times may occur.

4.4 Sequencing

After considering the subject matter and the appropriate range of learning experiences to enable the general objectives to be achieved, a spiralling and integrated sequence should be developed which allows students to see links between the strands of mathematics rather than seeing them as discrete. For example, costing, budgeting and financing a loan for house renovations provide an obvious link between the Applied geometry and Financial mathematics strands. As a means of logically ordering the subject matter to be studied, the syllabus presents the subject matter grouped into topics but it is not necessary, and often not desirable, to complete one topic before starting another. Obviously any prerequisite material in earlier topics must be covered before proceeding with material in later topics.

The following guidelines for the sequencing of the subject matter should be referred to when developing a sequence for the course.

- No subject matter should be studied before the relevant prerequisite material has been covered.
- To allow development in each area over time, no topic should be studied immediately after another topic in the same strand.
- Sequencing may be constrained by a school’s ability to provide physical resources.
- Subject matter across topics should be linked when possible.
- Time will be needed for maintaining quantitative concepts and skills.

4.5 Technology

The advantage of mathematics-enabled technology in the mathematics classroom is that it allows for the exploration of the concepts and processes of mathematics. Scientific calculators and spreadsheeting, for example, let students explore and investigate; they help students understand concepts, and they complement traditional approaches to teaching.

The Mathematics A syllabus is rich in learning experiences which may be enhanced by the use of technology. Continuous access is not a requirement, but access where appropriate to this technology is desirable.
Technology enhances the learning and assessment opportunities in Mathematics A in many ways, including:

- adapting instruction to meet students’ needs
- facilitating the organisation and analysis of data
- handling of routine and/or computationally intensive calculations
- saving time that can be used to study effects, outcomes and extensions
- supporting investigations across topics
- allowing a focus on decision making, reflection, reasoning, and problem solving
- exploring conjectures
- extending the range of problems accessible to students.

4.6 Composite classes

In some schools, it may be necessary to combine students into a composite Year 11 and 12 class. This syllabus provides teachers with an opportunity to develop a course of study that caters for a variety of circumstances such as combined Year 11 and 12 classes, combined campuses, or modes of delivery involving periods of student-directed study.

The multilevel nature of such classes can prove advantageous to the teaching and learning process because:

- it provides opportunities for peer teaching
- it allows teachers to maximise the flexibility of the syllabus
- it provides opportunities for a mix of multilevel group work, and independent work on appropriate occasions
- learning experiences and assessment can be structured to allow students to consider the key concepts and ideas at the level appropriate to their needs, in both Year 11 and Year 12.

The following guidelines may prove helpful in designing a course of study for a composite class:

- The course of study could be written in a Year A/Year B format, if the school intends to teach the same topic to both cohorts.
- Place a topic at the beginning of each year that will allow new Year 11 students easy entry into the course.
- Learning experiences and assessment items need to cater for both year levels throughout the course. Even though tasks may be similar for both year levels, it is recommended that more extended and/or complex tasks be used with Year 12 students.

4.7 Work program requirements

A work program is the school’s plan of how the course will be delivered and assessed based on the school’s interpretation of the syllabus. It allows for the special characteristics of the individual school and its students.

The school’s work program must meet all syllabus requirements and must demonstrate that there will be sufficient scope and depth of student learning to meet the general objectives and the exit criteria.

The requirements for work program approval can be accessed on our website, <www.qsa.qld.edu.au>. This information should be consulted before writing a work program. The requirements for work program approval may be updated periodically.
5. Topics

5.1 Introduction

Each topic has a focus statement, subject matter and suggested learning experiences which, taken together, clarify the scope, depth and emphasis for the topic.

Focus

This section highlights the intent of the syllabus with respect to the topic and indicates how students should be encouraged to develop their understanding of the topic.

Subject matter

This section outlines the subject matter to be studied in the topic. All subject matter listed in the topic must be included, but the order in which it is presented is not necessarily intended to imply a teaching sequence.

Learning experiences

This section provides some suggested learning experiences which may be effective in using the subject matter to achieve the general objectives of the course. The numbers provided with the subject matter link to suggested learning experiences. Included are experiences which involve life-related applications of mathematics with both real and simulated situations, use of instruments and opportunities for \textit{Modelling and problem solving}. The listed learning experiences may require students to work individually, in small groups or as a class.

The learning experiences are suggestions only and are not prescriptive. Schools are encouraged to develop alternative learning experiences, especially those which relate to the school’s location, environment and resources. Students should be involved in a variety of activities, including those which require them to write, speak, listen or devise presentations in a variety of forms. A selection of learning experiences that students will encounter should be shown in the work program. Learning experiences which have a technology component beyond the use of a scientific calculator have been labelled by the use of this icon: \ding{231}.

\textbf{NB. The learning experiences must provide students with the opportunity to experience mathematics along the continuum within each of the principles for a balanced course (see Section 3.3).}

Some of the key competencies, predominantly Using mathematical ideas and techniques, Solving problems, and Using technology, are to be found in the learning experiences within the topic areas. Opportunities are provided for developing the key competencies in contexts that arise naturally from the general objectives and learning experiences of the subject. The key competencies: Collecting, analysing and organising information; Planning and organising activities; and Working with others and in teams, are also involved in some of the learning experiences.
5.2 Core topics

The order in which topics and items within topics are given do not imply a teaching sequence. Numbers listed after each item of subject matter refer to suggested learning experiences (SLEs).

Managing money 1 (notional time 25 hours)

Focus

Students should be encouraged to develop a working knowledge of and a critical approach to financial situations and operations they are most likely to encounter. Students’ learning will be enhanced by the use and simple manipulation of associated financial formulas as required, and the use of electronic technology.

Subject matter

- earnings, including salary, wages, overtime, commission, piece rate, and means-tested income; an industrial award should be used where appropriate (SLEs 1, 2, 8, 10–12, 14–16)
- taxation, including taxable income, gross income, net income, goods and services tax (GST), deductions, rebates, and levies (SLEs 2, 4, 5, 8, 10, 15)
- budgeting, including the preparation of a personal budget plan (SLEs 4, 6, 7, 9–15)
- spending, including discount and foreign exchange (SLEs 3, 7, 16)
- business applications, including profit, loss, mark-up (SLEs 5, 9, 16)

Suggested learning experiences (SLEs)

The following suggested learning experiences may be developed as individual student work, or may be part of small-group or whole-class activities. Learning experiences will include opportunities for students to use and manipulate mathematical models.

1. Use an industrial award which covers workers in a relevant industry, such as the cafe, restaurant and catering award, to determine the correct rates of pay and the conditions of work; identify the obligations of employers and employees in the hospitality industry.

2. Use an industrial award associated with part-time work undertaken by students to determine correct rates of pay and conditions of work.

3. Convert Australian dollars into another currency (and the reverse) using buy-and-sell tables.

4. Calculate taxation due from a taxation guide or using the online form.

5. Follow the price of an article from its manufacture to the retail purchaser, giving consideration to taxes applied.

6. Investigate the costs of owning a car, including insurance, registration, running costs and maintenance; compare the estimated costs with those published by organisations such as the RACQ.

7. Formulate and use simple mathematical models such as:
   - calculations for discount
   - foreign exchange
   - the cost of hiring a car.

8. Investigate the effect of income and family size on family allowance payments.
9. Prepare a budget for:
   • a holiday in Australia or overseas
   • catering for an event
   • school canteen.

10. Investigate financial experiences of students immediately on leaving school.

11. Investigate superannuation options.

12. Investigate options for salary sacrificing.

13. Adjust a given personal or business budget to allow for changed economic circumstances.

14. Investigate the effects of students’ part-time employment and parents’ incomes on youth allowances.

15. Investigate the costs involved in independent living — rent, household telecommunications, insurance, electricity, groceries, transport.

16. Investigate types and costs of electronic transactions.

**Elements of applied geometry (notional time 25 hours)**

**Focus**

Students should be encouraged to develop a working knowledge of some geometrical concepts and relationships in two and three dimensions. This is to be accomplished in relevant personal and work-related learning experiences. Students’ learning will be enhanced by the use and simple manipulation of associated formulas as required, and the use of electronic technology.

**Subject matter**

- applications of trigonometry using sine, cosine and tangent ratios (SLEs 1–3, 9, 12)
- applications of Pythagoras’ Theorem (SLEs 1–3)
- area, volume and capacity in life-related situations (SLEs 3–11)
- latitude, longitude and measurement of time and distance (SLEs 12–18)
- simple algebraic manipulation of relevant formulas for this topic (SLEs all).

**Suggested learning experiences**

The following suggested learning experiences may be developed as individual student work, or may be part of small-group or whole-class activities. Learning experiences will include opportunities for students to use and manipulate mathematical models.

1. Use trigonometric ratios and Pythagoras’ Theorem in life-related situations such as the calculation of heights of trees, and width of roads/landmarks.

2. Use shadow reckoning and triangulation in life-related situations such as the calculation of heights of trees and buildings, and widths of valleys and landmarks.

3. Calculate and compare areas of compound figures involving rectangles, trapeziums, triangles, circles, semicircles and quadrants in life-related situations e.g. landscaping.

4. Explore surface areas of prisms and cylinders in life-related situations e.g. water storage, packaging.

5. Investigate volumes of compound figures involving prisms, pyramids, cylinders, cones and spheres in life-related situations given necessary formulas, for example: water storage, packaging using spreadsheet software.
6. Design, make and display jewellery (from 3D shapes) using air-dry clay, then find surface area and volume.
7. Investigate the volume of water in swimming pools of different shapes and the inherent water loss through evaporation.
8. Find the volume of soil which must be removed to construct a canal.
9. Calculate the number of cubic metres of mulch for garden beds.
10. Investigate the issues to be considered in determining the optimum size of a rainwater tank and relevant refunds.
11. Determine the volume of material used to construct water or sewerage pipes.
12. Locate positions on the earth’s surface given latitude and longitude, e.g. incorporating the use of GPS, Google Earth or relevant technology.
13. Find the time differences for a range of cities as given in the telephone directory and compare them with those predicted from the longitude.
14. As a travel agent, prepare an itinerary for an overseas holiday for a customer, including time differences and distances travelled.
15. Find the distance in kilometres between points on the earth’s surface (same latitude or same longitude).
16. Investigate the effect of daylight saving and time zones in Australia.
17. Use maps of different landholdings, e.g. Aboriginal, Torres Strait Islander, pastoral or National Parks, to determine the relative areas of different land uses.
18. Investigate the time systems (daily and seasonal) used by Indigenous peoples of Australia and compare them with those used by various other peoples.

**Linking two and three dimensions (notional time 25 hours)**

**Focus**
Students should be encouraged to develop a working knowledge of the practical considerations inherent in a variety of construction areas. Particular emphasis should be given to the representation of three-dimensional constructions in two dimensions. Students’ learning will be enhanced by the use and simple manipulation of associated formulas as required and the use of electronic technology.

**Subject matter**
- interpretation of scale drawings and plans (SLEs 1, 3)
- drawing simple scale drawings and plans (SLEs 2, 4, 11–13, 15)
- the geometry of bracing for rigidity (SLEs 3, 5, 8)
- practical tests for squareness, plumbness and levels (SLEs 6, 7)
- estimation of quantities and costs in a variety of construction areas (SLEs 9–12, 14, 16–21)
**Suggested learning experiences**

The following suggested learning experiences may be developed as individual student work, or may be part of small-group or whole-class activities.

1. Use various scale plans (house, site, registered, shire) to obtain actual dimensions.
2. Draw a scale plan and use it to determine layouts, for example, placement of furniture in a room.
3. Investigate cross-bracing for rigidity by construction of straw, spaghetti or paper towers and bridges.
4. Use registered plans to site house plans.
5. Design and/or construct a small replica of a wall or gate.
6. Investigate methods for testing whether an item is level using, for example:
   - clear plastic tubing filled with water to obtain a level between posts on uneven ground
   - a builder’s plumb-bob to test whether a wall is vertical
   - spirit level
   - laser level.
7. Investigate methods for testing squareness of a picture frame, house slab.
8. Investigate methods of calculating gradients and pitches.
9. Visit a display village, obtain a plan of a display home and use this as the basis for all other experiences that follow.
10. Estimate the cost of brickwork for a wall; have a bricklayer talk about quoting.
11. Given a scale plan and carpet width, determine the number of metres of carpet required to carpet a house.
12. Determine the number of litres of paint and the minimum cost for painting a room given the scale plan.
13. Gain permission to take dimensions in a display home and produce an elevation of one wall using scale 1:50.
14. Estimate the volume of soil which must be removed to prepare the site due to slope.
15. Design a single-level car park given the dimensions of vehicles and the size of the vehicles’ turning circles (between walls and between kerbs).
16. Calculate the amount of concrete required and the costs for the footings and the slab of a structure (include reinforcing).
17. Complete construction safety induction course and visit various stages of house construction.
18. Prepare a quote for the construction of a simple shed, including slab, footings, walls and roof.
19. Design an office layout, given the staff and their functions, the furniture and the legal space requirements for each employee.
20. Investigate the modular system for layout of furniture in a room.
21. Use a computer package to create a landscape design.
**Data collection and presentation** (notional time 25 hours)

**Focus**
Students should be encouraged to develop a working knowledge of the practicalities and concepts involved in collecting, handling, preparing, describing, presenting and summarising data, and of some elementary concepts in data quality and exploring data to describe key features. Students should be encouraged to develop skills in recognising data quality and practical problems, and in commenting on data in context. It is expected that calculators (or computers) will be used routinely for calculations and graphical displays. The emphasis should be on the practicalities, concepts and interpretation of data, and also on students developing confidence through a range of scenarios.

**Subject matter**

- types of data and variables (continuous and discrete) (SLEs 1–6)
- practical aspects of collecting and handling data for observation, experimentation or survey, including possible data problems (SLEs 1–6, 9, 12)
- what a sample represents, how it relates to populations and whether it is appropriate (SLEs 1–6)
- descriptions of key features of data with reference to suitable selections of graphical and tabular displays (SLEs 3, 10, 11, 12)
- data displays including scatterplots, simple and compound stem-and-leaf plots, and box-and-whisker plots (SLEs 4, 12)
- sample means and medians as measures of central tendency (SLEs 7–12)
- sample standard deviations and interquartile range as descriptors of spread (SLEs 7–12)

**Suggested learning experiences**
The following suggested learning experiences may be developed as individual student work, or may be part of small-group or whole-class activities.

1. Design a survey to collect data relevant to social questions of interest to teenagers such as:
   - web usage
   - TV and movie preferences and habits
   - work income.
2. Identify and critically evaluate survey questions and rewrite as necessary.
3. Examine data for non-compliant responses, recording errors, validity and reliability.
4. Use spreadsheets or databases for data handling, display and interpretation.
5. Design an observational study such as:
   - a traffic study
   - use of a computer lab or library
   - prices of different brands and/or at different outlets
   - use of school canteen.
6. Design an experiment, such as a tasting experiment, with experimental conditions either clearly accounted for or allowed for in the experiment so as to produce data of good quality with no hidden effects.
7. Research the frequency and severity of cyclones in Queensland to identify low-risk sites for eco-resort building.
8. Examine material presented in government publications such as CensusAtSchool, year books and reports from the Australian Bureau of Statistics.

9. Identify the effect of different sampling situations in pursuit of a random sample e.g. Gallup poll compared with a phone-in poll.

10. Examine reports by the Real Estate Institute (e.g. house prices in different areas) and explain their choice of measure of central tendency.

11. Examine the relationship between two variables, e.g. daily temperature and degrees from the equator and discuss factors which could affect the relationship.

12. Identify and critically evaluate graphical displays from print media, e.g. newspapers and prospectuses.

**Managing money 2 (notional time 30 hours)**

**Focus**
Students should be encouraged to develop a working knowledge of the mathematics involved in financial transactions and be aware of their underlying conditions to enable them to make informed decisions on credit and investments. Consumer and financial literacy is important for all students to empower them to make informed consumer decisions and to understand the financial consequences of observed increases in household spending. Students’ learning will be enhanced by the use and simple manipulation of associated financial formulas as required and the use of electronic technology.

**Subject matter**
- simple interest and compound interest for various compounding periods; effective and nominal rates (SLEs 1–6, 10, 18)
- inflation, appreciation and depreciation (SLEs 8, 9)
- notion of present value of a lump-sum payment (SLEs 5, 6, 9, 10, 15, 16, 18, 19)
- consumer credit including personal loans, credit cards, debit cards and housing loans (including fees and charges) (SLEs 1–4, 6, 7, 11, 12, 17, 18)
- investments such as savings accounts, term deposits, real estate and stockmarket (SLEs 13, 14, 17, 19)
- simple algebraic manipulation of financial formulas (SLEs 6, 7, 11, 15, 16).

**Suggested learning experiences**
The following suggested learning experiences may be developed as individual student work, or may be part of small-group or whole-class activities. Learning experiences will include opportunities for students to use and manipulate mathematical models.

1. Use a repayments table to investigate the effects of different interest rates and varying terms of a loan.

2. Use a calculator and/or computer package to produce part of a repayment schedule for a loan with interest calculated on a reducing balance, and demonstrate the effects of changing interest rates during the period of the loan.

3. Use the printout from a spreadsheet to compare the mathematical models describing simple and compound interest.

4. Investigate and compare the relative cost of finance for a vehicle from a bank, vendor-arranged loans, credit union and finance company.
5. Investigate the ethical considerations involved in consumer credit.

6. Use the simple-interest formula to solve problems involving interest, amount, principal, interest rate and time.

7. Use the compound-interest formula to solve problems involving interest, amount and principal.

8. Compare the straight-line and diminishing-value methods of calculating depreciation.

9. Investigate the effect of inflation on the value of money, income and goods.

10. Compute present values for superannuation and life insurance lump sum payouts.

11. Investigate the accuracy of the formula \( n = \frac{70}{r} \) or \( n = \frac{72}{r} \), where \( n \) is the number of years taken to double the principal if invested at a compound interest rate of \( r\% \).

12. Investigate the use of credit cards to, for example:
   - compare the effects of various conditions quoted on credit cards from different financial institutions
   - reconcile a personal financial account; for example, a credit card account or a cheque account
   - investigate the efficient use of credit cards.

13. Calculate the percentage return from, for example:
   - real estate transactions, taking into account commission, legal costs and stamp duty
   - an investment with a financial institution, taking into account establishment costs, commission and interest rates
   - a stock market transaction, taking into account brokerage fees, dividend and yield.

14. Gain an awareness of the effects of taxes connected with investment in the stock market, real estate and financial institutions.

15. Investigate the benefits of making repayments weekly instead of monthly.

16. Convert the daily interest rate to a yearly one and compare with the quoted annual rate.

17. Use technology to simulate investment in the stock market over a period of time.

18. Use technology to produce a repayments table and demonstrate the effect of changing interest rates.

19. Use technology to investigate the growth of an investment over time.

Exploring and understanding data (notional time 30 hours)

Focus

Students should be encouraged to develop a working knowledge of some elementary concepts in exploring and interpreting data, and encouraged to develop skills in recognising different types of data situations. In developing this knowledge, students will become aware of some fundamental concepts used in models for data, including the roles of probability and estimating probabilities. Calculators (or computers) should be used routinely for calculations and graphical displays. The emphasis is on exploration and inference, and should also aim to help students develop confidence through a range of life-related scenarios. Students’ learning will be enhanced by the use and/or formation of models as required and the use of electronic technology.
**Subject matter**

- use of summary statistics to draw and analyse conclusions, represent data and make inferences (SLEs 1–5)
- interpretation and use of sample statistics (including sample means and medians) as estimates of parameters to predict underlying population values or of values in a model (SLEs 1–5)
- interpret relationships between variables and make predictions by identifying and using trend lines (both linear and non-linear) (SLEs 6, 12, 13)
- interpretation and use of relative frequencies to estimate probabilities of individual values for discrete variables (including categories) and of intervals for continuous variables (SLEs 7, 9–11)
- interpretation and use of probability as a measure of chance in a range of practical and theoretical situations (SLEs 7, 9–11)
- interpretation in context of row and column percentages for a contingency table (two-way table of frequencies) (SLEs 8, 9)
- misuse of probabilities, including misinterpretation of row and column percentages in contingency tables (SLEs 6–9)

**Suggested learning experiences**

The following suggested learning experiences may be developed as individual student work, or may be part of small-group or whole-class activities.

1. Compare two sets of data using a variety of statistics, including the range, minimum value, maximum value, mean, median, standard deviation and interquartile distance.
2. Examine the use of summary statistics in, for example, newspapers, articles, TV programs such as weather reports, stock exchange and government reports.
3. Examine reports (e.g. house prices in different areas) and explain the choice of measure of central tendency.
4. Calculate outliers and compare their effects on a variety of summary statistics.
5. Discuss different sampling situations and possible difficulties and sources of bias, caused by, for example, poor questionnaire design or a lack of random sampling; or by practical difficulties such as survey interviewer influence.
6. Discuss why it is easier to estimate parameters such as the proportion of women who work full time rather than the proportion of full-time workers who are women.
7. Estimate probabilities using relative frequency in simple life-related situations.
8. Consider responses to pairs of questions on a survey, with numbers of types of responses summarised in a two-way table (a contingency table); for example, the responses to a question on approving daylight saving organised according to gender or longitude; interpret row and column percentages.
9. Discuss the importance of identifying the reference for percentages (using a two-way table).
10. Identify discrete variables and estimate probabilities of their values from data; e.g. the number of girls in families of two or three children; the number of pets in a family.
11. Identify continuous variables and estimate probabilities of intervals of values from data; e.g. maximum temperatures, travelling times, pulse rates.
12. Discuss the suitability of using straight-line relationships between variables such as weight and height, running times and distance, income and education level.
13. Consider how humidity varies with temperature over the seasons.

5.3 The elective topics

Maps and compasses

Either Navigation or Land measurement may be studied. The focus, subject matter and SLEs for both are described here.

Maps and compasses — Navigation (notional time 30 hours)

Focus

Students should be encouraged to develop a working knowledge of techniques used in navigation, and procedures for interpreting various maps which are used to represent portions of the earth’s surface. The emphasis should be on the use of genuine artefacts (e.g. maps) and technology (e.g. GPS) in real-world contexts (e.g. orienteering, air or coastal navigation).

Subject matter

- compass bearings and reverse bearings (SLEs 1–3, 8, 9, 11, 15)
- magnetic variation (SLEs 1–3, 9, 11, 15)
- nautical miles and knots (SLE 3, 15)
- use of maps and charts, compasses, dividers and parallel rulers or their equivalent (SLEs 1, 3–5, 7–13, 15)
- methods of fixing position which may include bearing fix, dead reckoning, running fix, GPS (SLEs 3, 4, 6–8, 10–15)
- plot and determine compass bearings and reverse bearings (SLEs 1–3, 8, 9, 11, 15)
- use magnetic variation to explain the link between true bearings and magnetic bearings (SLEs 1–3, 9, 11, 15)
- calculate speed and distances: (SLEs 3, 15)
  - with reference to latitude
  - using nautical miles and knots
- plot courses and determine location by: (SLEs 1, 3–15)
  - using maps, charts, compasses, dividers and parallel rulers or their equivalent
  - a variety of methods of fixing position which may include bearing fix, dead reckoning, running fix, GPS.

Suggested learning experiences

The following suggested learning experiences may be developed as individual student work, or may be part of small-group or whole-class activities.

1. Explore the relationships between true north, magnetic north and grid north on several adjacent maps (suggest 1:50000 scale).
2. Explore the effects on bearings of magnetic variation; calculate true bearing given compass bearing and magnetic variation; calculate compass bearing given true bearing and magnetic variation.
3. Use coastal navigational techniques on charts to fix a position and to plot a given course.
4. Use tables or the rule of twelfths to estimate tide height.
5. Identify, by reference to atlases and other sources, examples of projections which preserve area and examples which preserve angles correctly; understand why both of these cannot be preserved simultaneously on a spherical surface.

6. Research inertial, radio or satellite navigational systems.

7. Research navigational methods used by voyagers such as Kay Cottee, Sir Francis Chichester, Amelia Earhart, Sir Charles Kingsford-Smith, Captain Cook, Indigenous groups.

8. Use coastal navigational techniques on charts including transit fix, cross-bearings, double the angle at the bow.

9. Investigate the effects on bearings, of the change of magnetic variation over a century.

10. Follow, on the ground or on a map, an orienteering path where each station provides the directions to the next.

11. Consider the different problems that arise according to whether one is navigating on land, in the air, or at sea (within sight of land or with no land visibility).

12. Hire a vessel and chart the course taken.

13. Research various navigational techniques (for example, dead reckoning, use of sextant and chronometer, horizontal sextant, doubling the angle on the bow, and satellite navigation systems).

14. Research how a computerised navigational system is used by visiting the bridge of a ship.

15. Undertake a boat licence course.

Maps and compasses — Land measurement (notional time 30 hours)

Focus

Students should be encouraged to develop a working knowledge of techniques used in land measurement and procedures for interpreting various maps and plans which are used to represent portions of the earth’s surface. The emphasis should be on the use of genuine artefacts (e.g. maps and plans) and technology (e.g. GPS and theodolite) in real-world contexts (e.g. orienteering and surveying).

Subject matter

- compass bearings and reverse bearings (SLE 3, 12, 13, 17, 18)
- drawing and interpreting site plans (SLEs 1, 2, 4, 5, 12, 14–16, 19)
- position-fixing using directions, and vertical and horizontal measurements in relation to data (SLEs 3, 12, 13)
- calculation of grades (gradient of the land) (SLEs 4, 5, 12)
- interpretation of maps which may include contour, topographical, detail, cadastral and land-use maps (SLEs 1, 2, 8–10, 14–16)
- calculation of perimeters and areas (SLEs 6, 7, 18, 19).

Suggested learning experiences

The following suggested learning experiences may be developed as individual student work, or may be part of small-group or whole-class activities.

1. From a point on top of a hill, sketch a map of the local area.
2. Check the validity of a sketch map by comparing it with a published one.
3. Design an orienteering path where each station provides the directions to the next.
4. Determine the steepest hill in the district.
5. View and analyse a flood-risk map of your local area.
6. Determine the perimeter and area of a polygonal piece of land by applying various techniques such as triangulation, traverse or radial surveys.
7. Determine the cost of fencing a given piece of land by first finding the dimensions of the land using suitable instruments.
8. Research the history of the use of different units for land measurements, including those used by Indigenous peoples of Australia.
9. Compare survey maps for your area over the past 200 years.
10. Research the use of aerial photography or satellite imagery in land surveying.
11. Use a local authority or cadastral map to locate a piece of land.
12. Collect data using a theodolite and write the field notes.
13. By measurement and calculation, find the difference in height between two distinctive local landmarks.
14. Obtain the site plans for the school from the local authority and locate objects marked on the plans; compare the plan with actual positions of objects (accuracy).
15. Obtain a satellite map of the local area and identify the features on the map.
16. Obtain the drainage plan for the school or a domestic site and locate features marked on the plan.
17. Research the tasks carried out by a surveyor.
18. Have a surveyor demonstrate the use of a range of surveying instruments.
19. Draw a plan from surveying field notes.

**Operations research**

*Either* Linear programming *or* Networks and queuing may be studied. The focus, subject matter and SLEs for both are described here.

**Operations research — linear programming (notional time 30 hours)**

**Focus**

Students should be encouraged to develop a working knowledge of the methodology of linear programming, and to see how it is used to solve life-related situations. Problems with non-integer solutions are not appropriate for this section. The emphasis should be on real-world problems and the use of technology for routine computational aspects.

**Subject matter**

- graphing two-dimensional linear inequalities (SLEs 1, 4)
- recognition of the problem to be optimised (maximised or minimised) (SLEs 1, 2)
- identification of variables, parameters and constraints (SLEs 1, 3, 5–9)
- construction of the linear objective function and constraints with associated parameters (SLEs 1, 3, 5, 6, 8, 9)
• graphing linear functions associated with the constraints, and identification of the regions defined by the constraints (SLEs 1, 3, 4)
• recognition that the area bounded by the constraints gives the feasible (possible) solutions (SLEs 1, 3, 6)
• recognition that different values of the objective function can be represented by a series of parallel lines (SLE 5)
• use of a series of parallel lines to find the optimal value of the objective function (parallel or rolling ruler, graphical method) (SLE 5)
• observation that the feasible region is always a convex polygon and thus the optimal solutions occur at an edge or a corner point of the feasible region (SLEs 3, 6, 7, 8).

**Suggested learning experiences**

The following suggested learning experiences may be developed as individual student work, or may be part of small-group or whole-class activities.

1. Take a real problem, formulate it into a linear programming problem, solve by the graphical method and provide the answer or conclusion in the context of the original problem given.
2. Explore how linear programming is used to assist management decisions in areas such as manufacturing, transport, primary industries and environmental management.
3. Consider optimal solutions of simple problems such as balancing diets.
4. Use a computer software package to graph linear functions.
5. Use parallel rulers to identify optimal solutions.
6. Change parameters or constraints in a given problem and investigate the effect on optimal solutions.
7. Consider the allocation of two crops to the areas available on a farm in order to optimise profit when there are constraints on the labour and finances available.
8. Consider the design of an optimal-sized solar powered home which is to be competitive in the marketplace; constraints will apply through the size of solar cells, living area and total cost of construction.
9. Research the history of linear programming.

**Operations research — Networks and queuing (notional time 30 hours)**

**Focus**

Students should be encouraged to develop a working knowledge of some fundamental concepts involved in the analysis of networks and queues. The emphasis is on the applications of techniques to model and investigate problems occurring in a variety of life-related situations.

**Subject matter**

• identify and use network terminology including node, branch, path and tree (SLE 1–6)
• shortest path through a network (SLEs 1–3, 6)
• minimum spanning tree for a network (SLEs 1–3)
• choose and use shortest path or minimum spanning tree as applicable to the context (SLEs 1–3, 5, 6)
• identify and reflect upon the effect of critical steps in project networks (SLEs 1, 4, 6)
identify and reflect upon the impact of slack time in a project network (SLEs 1, 4, 6)
investigate single- and multiple-server queue situations with constant arrival and service times using a variety of representations (SLEs 7–9)
investigate the effects on a queuing system of random arrival and service times (SLEs 7–9).

**Suggested learning experiences**

The following suggested learning experiences may be developed as individual student work, or may be part of small-group or whole-class activities.

1. Consider a life-related problem expressed in everyday language, formulate it into a network problem, and solve and interpret the solutions in terms of the original problem.
2. Consider a road map showing two places connected by a network of roads and find the shortest path between them.
3. A complicated rail system connecting a number of towns is to be rationalised; investigate which lines should be removed so that a minimum amount of line will be left to service all the towns.
4. Consider the times taken for different activities involved in the following problems; determine the critical steps and consider the effects of changing the time taken for certain activities on the critical path, such as:
   - constructing a house
   - using a recipe
   - planning a 21st-birthday party.
5. Determine the shortest path(s) the sales representative can take from home base to each of the stores.
6. Examine the way critical path analysis could be used by surveyors, architects, engineers, chefs and physiotherapists.
7. Using tabular and graphical methods, investigate the percentage server idle time and average waiting time for a supermarket queue with a single server and constant arrival and service times; investigate the first time the queue becomes empty.
8. Using the tabular method, investigate the percentage server idle time and average waiting time in, for example a:
   - ticket outlet with a single server, and random arrival and service times simulated using a random number table
   - bank queue with two servers and constant arrival and service times.
9. Research methods which are used to facilitate traffic flow through intersections.

**Introduction to models for data (notional time 30 hours)**

**Focus**

Students are encouraged to develop a working knowledge of some elementary concepts in statistical modelling and the interaction of models and data, and use these in life-related applications. In considering real-world implications of statistical models and the notions of probability, students will become aware of fundamental issues involved in data collection, data modelling and interpretation of models in context. Calculators (or computers) should be used routinely for calculations and graphical displays.
Subject matter

- calculate, tabulate and graph probability distributions for discrete variables (SLEs 1–3)
- use areas in histograms to estimate probabilities (SLEs 2, 4)
- calculate expected values for discrete variables using probability distributions (SLEs 1, 2)
- identify situations in which a discrete variable is uniformly distributed, for example random numbers (SLEs 3, 4)
- identify binomial situations, calculate expected values and probabilities for these situations using tables or calculators (SLEs 5, 8)
- compare relative frequencies with theoretical probabilities for a range of variables (SLEs 2, 3, 8)
- standardise variables which are normally distributed (SLE 6)
- calculate probabilities using the standard normal distribution, with tables or calculators (SLEs 6, 7, 9)
- use the normal distribution model to solve problems involving variables which can be assumed to be normally distributed (SLEs 6–10)
- compare relative frequencies with normal probabilities (SLE 9)
- use the sample average and the sample standard deviation as estimates of the mean and standard deviation in the normal distribution model (SLEs 6–10)
- use percentage points of normal distribution model in practical applications (SLEs 11, 12)
- apply basic probability rules of complements and unions to a range of life-related situations (SLEs 13, 14)
- determine odds as an application of probabilities (SLEs 13, 14)

Suggested learning experiences

The following suggested learning experiences may be developed as individual student work, or may be part of small-group or whole-class activities.

1. Identify situations with events that could be assumed to be equally likely, such as birthdays, month of birth, male/female births.
2. Identify discrete variables and estimate probabilities of their values from data and/or model probabilities from assumptions, e.g. the number of girls in families of two or three children, by listing probabilities.
3. Use the tabled information given in the newspaper about previous Gold Lotto draws to determine whether the numbers are drawn at random; i.e. whether the numbers follow a uniform probability distribution model.
4. Ask a group of people to try to generate random numbers between, say, 0 and 50, and use graphical displays to investigate how successful they were, e.g. use a histogram to check rectangular shape, and plot numbers in order of generation to check on trends or patterns.
5. Examine a number of situations for which the binomial is appropriate and use tables of binomial probabilities; for an example with \( n = 3 \) or \( 4 \), write down, from the binomial tables, the probability of each value of the variable, calculate the expected value and relate it to the example.
6. Consider a number of life-related situations where a normal distribution may be assumed; standardise variables and use standard normal tables or calculators to calculate probabilities.
7. Use a statistical model with known mean, standard deviation and a normal distribution, to simulate a sample of data.

8. Use a computer package to simulate a number of samples of data from the same distribution and look at the variation in the summary statistics that are estimating population parameters.

9. Compare probabilities obtained from normal distribution tables with those estimated from data that look nearly normal.

10. Use a normal model to obtain probabilities of, for example, the maximum temperature in Toowoomba exceeding 35°C.

11. Use a normal distribution model for lifetimes of, for example, tennis racquets or car batteries, to obtain guarantee times that limit the proportion of replacements under guarantee.

12. Use a normal distribution model for water level in a creek or river that will be exceeded with a given probability.

13. Investigate strategies used by bookmakers to avoid large losses.

14. Investigate the use of odds and probabilities in forensic science and court cases.

**School elective (notional time 30 hours)**

Schools may develop a single elective topic of their own choice, but it must:

- be consistent with the rationale and global aims of the course
- contain subject matter ensuring a level of challenge comparable to that provided by the other elective topics
- not consist of a combination of subject matter from other topics within this syllabus.

In addition to specifying the subject matter, work programs will need to indicate a focus and state the range of likely learning experiences.
6. Assessment

The purposes of assessment are to provide feedback to students and parents about learning that has occurred, to provide feedback to teachers about the teaching and learning processes, and to provide information on which to base judgments about how well students meet the general objectives of the course. In designing an assessment program, it is important that the assessment tasks, conditions and criteria are compatible with the general objectives and the learning experiences. Assessment then is an integral aspect of a course of study. It can be formative or summative. The distinction between formative and summative assessment lies in the purpose for which that assessment is used.

Formative assessment is used to provide feedback to students, parents, and teachers about achievement over the course of study. This enables students and teachers to identify the students’ strengths and weaknesses so students may improve their achievement and better manage their own learning. The formative techniques used should be similar to summative assessment techniques, which students will meet later in the course. This provides students with experience in responding to particular types of tasks, under appropriate conditions. Feedback on any early assessment tasks may be used in a formative sense to assist students’ preparation for later assessment tasks.

Summative assessment, while also providing feedback to students, parents and teachers, provides cumulative information on which levels of achievement are determined at exit from the course of study. It follows, therefore, that it is necessary to plan the range of assessment techniques and instruments/tasks to be used, when they will be administered, and how they contribute to the determination of exit levels of achievement. Students’ achievements are matched to the standards of exit criteria, which are derived from the general objectives of the course. Thus, summative assessment provides the information for certification at the end of the course.

6.1 Underlying principles of exit assessment

The policy on exit assessment requires consideration to be given to the following principles when devising an assessment program for the two-year course of study.

- Information is gathered through a process of continuous assessment.
- Balance of assessments is a balance over the course of study and not necessarily a balance over a semester or between semesters.
- Exit achievement levels are devised from student achievement in all areas identified in the syllabus as being mandatory.
- Assessment of a student’s achievement is in the significant aspects of the course of study identified in the syllabus and the school’s work program.
- Selective updating of a student’s profile of achievement is undertaken over the course of study.
- Exit assessment is devised to provide the fullest and latest information on a student’s achievement in the course of study.

These principles are to be considered together and not individually in the development of an assessment program. Exit assessment must satisfy concurrently the six principles associated with it.
Continuous assessment

The major operating principle is “continuous assessment”. The process of continuous assessment provides the framework in which all the other five principles of balance, mandatory aspects of the syllabus, significant aspects of the course, selective updating, and fullest and latest information exist and operate.

This is the means by which assessment instruments are administered at suitable intervals and by which information on student achievement is collected. It involves a continuous gathering of information and the making of judgments in terms of the stated criteria and standards throughout a two-year course of study.

Decisions about levels of achievement are based on information gathered, through the process of continuous assessment, at points in the course of study appropriate to the organisation of the learning experiences. Levels of achievement must not be based on students’ responses to a single assessment task at the end of a course, or instruments set at arbitrary intervals that are unrelated to the developmental course of study.

Balance

Balance of assessments is a balance over the course of study and not necessarily a balance within a semester or between semesters.

Within the two-year course for Mathematics A it is necessary to establish a suitable balance in the general objectives, assessment techniques and instruments/tasks, conditions and across the criteria. The exit criteria are to have equal emphasis across the range of summative assessment. The exit assessment program must ensure an appropriate balance over the course of study as a whole.

Mandatory aspects of the syllabus

Judgment of student achievement at exit from a two-year course of study must be derived from information gathered about student achievement in those aspects stated in the syllabus as being mandatory, namely:

- the general objectives of Knowledge and procedures, Modelling and problem solving and Communication and justification, and
- the six core topics, Managing money 1, Elements of applied geometry, Linking two and three dimensions, Data collection and presentation, Managing money 2 and Exploring and understanding data.

The exit criteria and standards stated in Sections 6.6 and 6.9 respectively must be used to make the judgment of student achievement at exit from a two-year course of study.

Significant aspects of the course of study

Significant aspects refer to those areas in the school’s course of study selected from the choices permitted by the syllabus. Significant aspects can complement mandatory aspects or be in addition to them. They will be determined by the context of the school and the needs of students at that school to provide choice of learning experiences appropriate to the location of the school, the local environment and the resources available.

The significant aspects must be consistent with the general objectives of the syllabus and complement the developmental nature of learning in the course over two years.
Selective updating

In conjunction with the principle of fullest and latest information, information on student achievement should be selectively updated throughout the course.

Selective updating is related to the developmental nature of the course of study and operates within the context of continuous assessment. As subject matter is treated at increasing levels of complexity, assessment information gathered at earlier stages of the course may no longer be representative of student achievement. The information therefore should be selectively and continually updated (not averaged) to accurately reflect student achievement.

The following conceptions of the principle of selective updating apply:

- a systemic whole subject-group approach in which considerations about the whole group of students are made according to the developmental nature of the course and, in turn, the assessment program. In this conception, developmental aspects of the course are revisited so that later summative assessment replaces earlier formative information.

- an act of decision-making about individual students — deciding from a set of assessment results the subset which meets syllabus requirements and typically represents a student’s achievements, thus forming the basis for a decision about a level of achievement. In the application of decisions about individual students, the set of assessment results does not have to be the same for all students. However, the subset which represents the typical achievement of a student must conform to the parameters outlined in the school’s work program.

Selective updating must not involve students reworking and resubmitting previously graded assessment tasks. Opportunities may be provided for students to complete and submit additional tasks. Such tasks may provide information for making judgments where achievement on an earlier task was unrepresentative or atypical, or there was insufficient information upon which to base a judgment.

Fullest and latest information

Judgments about student achievement made at exit from a school course of study must be based on the fullest and latest information available. This information is recorded on a student profile.

“Fullest” refers to information about student achievement gathered across the range of general objectives. “Latest” refers to information about student achievement gathered from the most recent period in which the general objectives are assessed. As the assessment program in Mathematics A is developmental, fullest and latest information will most likely come from Year 12.

Information recorded on a student profile will consist of the latest assessment data on mandatory and significant aspects of the course, which includes the data gathered in the summative assessment program that is not superseded.

6.2 Planning an assessment program

At the end of Year 12, judgments are made about how students have achieved in relation to the standards stated in the syllabus for each of the criteria. These summative judgments are based on achievement in each of the general objectives.

When planning an assessment program, schools must consider:

- general objectives (see Section 3)
- principles of a balanced course (see Section 3.3)
- the learning experiences (see Section 5)
- the underlying principles of assessment (see Section 6.1)
• a variety of assessment techniques and instruments over the two-year course (see Section 6.4)
• conditions under which the assessment is implemented
• the exit criteria and standards (see Sections 6.6 and 6.9)
• verification folio requirements, especially the number and the nature of student responses to
  assessment tasks to be included (see Section 6.8)
• minimum assessment necessary to reach a valid judgment of the student’s standard of
  achievement.

Students should be conversant with the assessment techniques and have knowledge of the criteria
to be used in assessment instruments.

6.3 Implementing assessment

Assessment instruments are developed by the school to provide:
• information on which teachers may make judgments about student achievement of the general
  objectives
• a level of challenge suitable for the whole range of students.

An assessment instrument is accompanied by:
• a statement of the conditions of assessment that apply (Section 6.3.1)
• a detailed description of the instrument (Section 6.3.2)
• a detailed criteria sheet (Section 6.3.3)
• details of procedures for authentication of student responses (Section 6.3.4).

6.3.1 Conditions of assessment

Across the whole assessment program, teachers should establish a range of conditions. This can
be done by systematically varying the factors that are most significant in establishing the
conditions for an instrument, namely:
• the time allowed to prepare and complete the response
• access to resources, both material and human, during the preparation for and completion of the
  instrument.

Every instrument description must include clear statements of the assessment conditions that
apply. These may include:
• time available for the preparation and completion of the response
• resources accessible and available (both material and human) during the preparation for and
  completion of the response
• location for the preparation and completion of the response, e.g. in class, at home
• whether the response is to be an individual or group production
• the strategy used to ensure student authorship, e.g. the degree of teacher supervision and
  teacher monitoring that will apply.
6.3.2 **Instrument descriptions**

Instrument descriptions are to:

- state all requirements, including the length and the conditions
- be congruent with the general objectives of the syllabus, the standards associated with exit criteria and the school work program; this congruence ensures the essential relationship between learning, teaching and assessment practices.

6.3.3 **Criteria sheets**

Where criteria sheets specific to each instrument are developed, they should be provided to students before undertaking assessment.

An instrument-specific criteria sheet:

- should be derived from the exit criteria
- must describe/state standards consistent with those associated with exit criteria (see section 6.9)
- should provide a clear expectation of how each of the five standards (A–E) will be demonstrated
- should inform teaching and learning practice.

Once the student has completed an assessment instrument, the criteria sheet must:

- be annotated to indicate student achievement
- provide the basis for teacher judgment about student achievement
- provide students with the opportunity to develop self-evaluative expertise.

The extent to which the exit standards are reflected in the criteria sheet will vary according to the general objectives associated with the instrument and according to the stage in the course at which the instrument is undertaken.

6.3.4 **Authentication of student work**

It is essential that judgments of student achievement be made on genuine student assessment responses. Teachers must take reasonable steps to ensure that each student’s work is their own, particularly where students have access to electronic resources or when they are preparing responses to collaborative tasks.

The QSA’s A–Z of Senior Moderation contains a strategy for authenticating student work [www.qsa.qld.edu.au/10773.html](http://www.qsa.qld.edu.au/10773.html). This provides information about various methods teachers can use to monitor that students’ work is their own. Particular methods outlined include:

- teachers seeing plans and drafts of student work
- student production and maintenance of evidence for the development of responses
- student acknowledgment of resources used.

Teachers must ensure students use consistent, accepted conventions of in-text citation and referencing, where appropriate.
6.4 Assessment techniques

Assessment techniques in this syllabus are grouped under categories. The following categories of assessment techniques may be considered:

- extended modelling and problem-solving tasks
- reports
- supervised tests.

Assessment of student achievement should not be seen as a separate activity, but as an integral part of the developmental learning process which reflects the learning experiences of students. There should be variety and balance in the types of assessment instruments used, thereby enabling students with different learning styles to demonstrate their understanding.

An extended modelling and problem-solving task or a report or similar must be included at least twice each year. These should contribute significantly to the decision-making process in each of the three exit criteria.

6.4.1 Category: Extended modelling and problem-solving tasks

What is an extended modelling and problem-solving task?

An extended modelling and problem-solving task is an assessment instrument developed in response to a mathematical task. It may require a response that involves mathematical language, appropriate calculations, tables of data, graphs and diagrams, and could involve standard Australian English.

Students may provide a response to a specific task or issue that could be set in a context that highlights a real-life application of Mathematics.

Aspects of each of the three criteria should be evident in the task.

What might a student do to complete an extended modelling and problem-solving task?

- Analyse information and data from a variety of sources.
- Process information to identify assumptions and parameters.
- Interpret and synthesise data.
- Explain relationships to develop and support mathematical arguments.
- Reflect on and evaluate data collected, propositions, results and conclusions.
- Communicate ideas.

What do teachers do when planning and implementing an extended modelling and problem-solving task?

- The teacher should provide the mathematical task.
- Teachers must implement strategies to ensure authentication of student work. Some strategies are annotated notes in response to issues that emerged during the extended modelling and problem solving task; teacher observation sheets; research checklists and referencing and reference lists.
- Teachers may consult, negotiate and provide feedback prior to and during students’ preparation of the report to provide ethical guidance and to monitor student work. Feedback and assistance should be provided judiciously.
- When students undertake extended modelling and problem-solving tasks for the first time scaffolding may be provided to help students complete the assessment. However, if the task is intended to demonstrate high initiative then the scaffolding provided should not specify the procedures, nor lead the student through a series of steps to reach a solution.
- Scaffolding should be reduced from Year 11 to Year 12 to allow the student to better demonstrate the principle of initiative in the problem-solving process.
### 6.4.2 Category: Reports

#### What is a report?

A report is typically an extended response to a practical or investigative task such as:
- an experiment in which data are collected, analysed and modelled
- a mathematical investigation
- a field activity
- a project.

A mathematical report could comprise forms such as a:
- scientific report
- proposal to a company or organization
- feasibility study.

The report and the activities leading to a report could be done individually and/or in groups and the report could be prepared in class time and/or in the students’ own time. A report will typically be in written form, or a combination of written and oral multimedia forms.

The report will generally include an introduction, analysis of results and data, conclusions drawn, justification, and, when necessary, appendixes and a bibliography and/or reference list.

Aspects of each of the three criteria should be evident in the task.

#### What might a student do to complete a report?

- Gather and sort information and data from a variety of sources.
- Process information to identify assumptions and parameters.
- Interpret, analyse and synthesise data.
- Explain relationships to develop and support mathematical arguments.
- Reflect on and evaluate data collected, propositions, results and conclusions.
- Communicate ideas.

#### What do teachers do when planning and implementing a report?

- The teacher suggests topics and provides some stimulus to trigger student interest.
- Teachers can provide the research question or it may be instigated by the student. In those instances teachers should negotiate with students to ensure the possibility of success. It is more likely that students will be able to generate their own research questions the further they progress in the course of study.
- Teachers may allow some class time for students to be able to effectively undertake each component of the report. Teachers may allow elements of the report to be conducted in small groups or pairs.
- Teachers must implement strategies to ensure authentication of student work. Some strategies are annotated notes in response to issues that emerged during the report; teacher observation sheets; checklists and referencing and reference lists.
- Teachers may consult, negotiate and feedback before and during the report to provide ethical guidance and to monitor student work. Feedback and assistance should be provided judiciously.
- When students undertake reports for the first time scaffolding may be provided to help students complete the assessment. However, if the task is intended to demonstrate high initiative then the scaffolding provided should not specify the procedures, nor lead the student through a series of steps to reach a solution.
- Scaffolding should be reduced from Year 11 to Year 12 to allow the student to better demonstrate the principle of initiative in the problem-solving process.
6.4.3 Category: Supervised tests

### What is a supervised test?

A supervised test is an assessment instrument that is conducted under supervised conditions. Supervised tests commonly include tasks requiring quantitative and/or qualitative responses. The supervised test could be done individually and/or in groups.

The supervised test must provide adequate opportunities for students to demonstrate their level of expertise in Mathematics across the full range of standards in the syllabus.

The supervised test may be constructed from the following four types of techniques:

1. **Short items**
   - requiring multiple-choice, single word, sentence or short paragraph (up to 50 words) responses, written in mathematical language, symbols and/or standard Australian English.

2. **Practical exercises**
   - using graphs, tables, diagrams, data or the application of algorithms

3. **Paragraph responses**
   - these are used when explanation of a greater complexity is required, written in mathematical language, symbols and/or standard Australian English. Responses should be 50–150 words.

4. **Responses to seen or unseen stimulus materials**
   - this may take the form of a series of short items, practical exercises and paragraph responses (see above)
   - the question or statement is not be provided before the assessment (unseen) and should focus on asking the students to evaluate and justify
   - stimulus materials should be succinct enough to allow students to engage with them in the time provided for the supervised test. Perusal times may be required or, if the stimulus materials are lengthy, they may need to be shared with students before the administration of the supervised test.

### What do teachers do when planning a supervised test?

The teacher should:

- construct questions that are unambiguous
- format the paper to allow for ease of reading and responding
- consider the individual needs of the students
- ensure the questions allow students to demonstrate the full range of standards
- ensure that formula sheets, if used, are supplied by the school and are common and constant across the cohort
- consider whether students will have access to information previously stored in their calculators.

### 6.5 Special consideration

Guidance about the nature and appropriateness of special consideration and special arrangements for particular students may be found in the Authority’s Policy on Special Consideration in School-based Assessments in Senior Certification (2006), available from <www.qsa.qld.edu.au> under Assessment > Senior assessment > Special consideration. This statement also provides guidance on responsibilities, principles and strategies that schools may need to consider in their school settings.

To enable special consideration to be effective for students so identified, it is important that schools plan and implement strategies in the early stages of an assessment program and not at the point of deciding levels of achievement. The special consideration might involve alternative teaching approaches, assessment plans and learning experiences.
6.6 Exit criteria

The following exit criteria must be used in making judgments about a student’s level of achievement at exit from this course. They reflect the three assessable categories of general objectives of the syllabus as defined in Section 3.

Knowledge and procedures

This criterion refers to the student’s ability to access, select and apply mathematical definitions, rules and procedures, and to demonstrate application of sequences of mathematical procedures, with and without the use of mathematical technology.

Modelling and problem solving

This criterion refers to the student’s ability to model situations using mathematical constructs, select and apply appropriate strategies, investigate situations mathematically, provide solutions and make informed decisions using mathematical reasoning.

Communication and justification

This criterion refers to the student’s ability to interpret, translate, communicate, present and justify mathematical arguments and propositions, using mathematical and everyday language and symbols to develop logical supported arguments.

6.7 Determining exit levels of achievement

On completion of the course of study, the school is required to award each student an exit level of achievement from one of the five categories:

Very High Achievement
High Achievement
Sound Achievement
Limited Achievement
Very Limited Achievement.

The school must award an exit standard for each of the criteria Knowledge and procedures, Modelling and problem solving, and Communication and justification based on the principles of assessment described in Section 6.1. The criteria are derived from the general objectives and are described in Section 3. The typical standards associated with the three exit criteria are described in the matrix in Section 6.9. When teachers are determining a standard for each criterion, it is not always necessary for the student to have met each descriptor for a particular standard; the standard awarded should be informed by how the qualities of the work match the descriptors overall.

For Year 11, particular standards descriptors may be selected from the matrix and/or adapted to suit the task. These standards are used to inform the teaching and learning process. For Year 12 tasks, students should be provided with opportunities to understand and become familiar with the expectations for exit. The typical standards are applied to the summative body of work selected for exit.
The seven key competencies* referred to in the Rationale are embedded in the descriptors in the standards matrix. The descriptors refer mainly to aspects of Knowledge and procedures, Modelling and problem solving, and Communication and justification.

When standards have been determined in each of the criteria of Knowledge and procedures, Modelling and problem solving, and Communication and justification, the following table is used to award exit levels of achievement, where A represents the highest standard and E the lowest. The table indicates the minimum combination of standards across the criteria for each level.

**Awarding exit levels of achievement**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VHA</td>
<td>Standard A in any two criteria and no less than a B in the remaining criterion</td>
</tr>
<tr>
<td>HA</td>
<td>Standard B in any two criteria and no less than a C in the remaining criterion</td>
</tr>
<tr>
<td>SA</td>
<td>Standard C in any two criteria, one of which must be the Knowledge and procedures criterion, and no less than a D in the remaining criterion</td>
</tr>
<tr>
<td>LA</td>
<td>At least Standard D in any two criteria, one of which must be the Knowledge and procedures criterion</td>
</tr>
<tr>
<td>VLA</td>
<td>Standard E in the three criteria</td>
</tr>
</tbody>
</table>

### 6.8 Requirements for verification folio

A verification folio is a collection of a student’s responses to assessment instruments on which the level of achievement is based. Each folio should contain a variety of assessment techniques demonstrating achievement in the criteria Knowledge and procedures, Modelling and problem solving, and Communication and justification, over a range of topics. The variety of assessment techniques is necessary to provide a range of opportunities from which students may demonstrate achievement.

For information about preparing monitoring and verification submissions schools should refer to Moderation Processes for Senior Certification available at <www.qsa.qld.edu.au> under Assessment > Senior Assessment > Forms and procedures.

Students’ verification folios for Mathematics A must contain:

- a minimum of four assessment instruments from Year 12 with at least one of these being an extended modelling and problem-solving task or report or similar
- student responses to a minimum of four and a maximum of ten summative assessment instruments
- where used, a criteria sheet for each assessment instrument which provides evidence of how students meet standards associated with the assessment criterion involved in that instrument
- formula sheets or other allowable materials used where appropriate
- a student profile completed to date.

#### 6.8.1 Post-verification assessment

In addition to the contents of the verification folio, there must be subsequent summative assessment in the exit folio. In Mathematics A, at least one instrument must be completed after verification. It is desirable for the assessment instrument to include all criteria.

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* KC1: collecting, analysing and organising information; KC2: communicating ideas and information; KC3: planning and organising activities; KC4: working with others and in teams; KC5: using mathematical ideas and techniques; KC6: solving problems; KC7: using technology
### 6.9 Standards associated with exit criteria

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Knowledge and procedures</td>
<td>The student’s work has the following characteristics: • accurate use of rules and formulas in simple through to complex situations</td>
<td>The student’s work has the following characteristics: • accurate use of rules and formulas in simple situations or use of rules and formulas in complex situations</td>
<td>The student’s work has the following characteristics: • use of rules and formulas in simple routine situations</td>
<td>The student’s work has the following characteristics: • use of given rules and formulas in simple rehearsed situations</td>
<td>The student’s work has the following characteristics: • attempted use of given rules and formulas in simple rehearsed situations</td>
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<tr>
<td></td>
<td>• application of simple through to complex sequences of mathematical procedures in routine and non-routine situations</td>
<td>• application of simple sequences of mathematical procedures in non-routine situations or complex sequences in routine situations</td>
<td>• application of simple sequences of mathematical procedures in routine situations</td>
<td>• application of simple mathematical procedures in simple rehearsed situations</td>
<td>• attempted use of simple mathematical procedures in simple rehearsed situations</td>
</tr>
<tr>
<td></td>
<td>• appropriate selection and accurate use of technology</td>
<td>• appropriate selection and accurate use of technology</td>
<td>• selection and use of technology</td>
<td>• use of technology</td>
<td>• attempted use of technology</td>
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<tr>
<td>Modelling and problem solving</td>
<td>The student’s work has the following characteristics: • use of strategies to model and solve problems in complex routine through to simple non-routine situations</td>
<td>The student’s work has the following characteristics: • use of strategies to model and solve problems in routine through to simple non-routine situations</td>
<td>The student’s work has the following characteristics: • use of familiar strategies for problem solving in simple routine situations</td>
<td>The student’s work has the following characteristics: • use of given strategies for problem solving in simple rehearsed situations</td>
<td>The student’s work has the following characteristics: • attempted use of given strategies for problem solving in well-rehearsed situations</td>
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<tr>
<td></td>
<td>• investigation of alternative solutions and/or procedures to complex routine through to simple non-routine problems</td>
<td>• investigation of alternative solutions and/or procedures to routine problems</td>
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<td></td>
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<tr>
<td></td>
<td>• informed decisions based on mathematical reasoning in complex routine through to simple non-routine situations</td>
<td>• informed decisions based on mathematical reasoning in routine situations</td>
<td>• informed decisions based on mathematical reasoning in simple routine situations</td>
<td></td>
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<tr>
<td></td>
<td>• reflection on the effectiveness of mathematical models including recognition of the strengths and limitations of the model</td>
<td>• recognition of the strengths and limitations of the model in simple situations</td>
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<tr>
<td>Communication and justification</td>
<td>The student's work has the following characteristics:</td>
<td>The student's work has the following characteristics:</td>
<td>The student's work has the following characteristics:</td>
<td>The student's work has the following characteristics:</td>
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<td></td>
<td>• accurate and appropriate use of mathematical terminology and conventions in simple non-routine through to complex routine situations</td>
<td>• accurate and appropriate use of mathematical terminology and conventions in simple non-routine and/or complex routine situations</td>
<td>• appropriate use of mathematical terminology and conventions in simple routine situations</td>
<td>• use of mathematical terminology and conventions in simple rehearsed situations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• organisation and presentation of information in a variety of representations in simple non-routine through to complex routine situations</td>
<td>• organisation and presentation of information in a variety of representations in simple non-routine and/or complex routine situations</td>
<td>• organisation and presentation of information in a variety of representations in simple routine situations</td>
<td>• presentation of information in simple rehearsed situations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• analysis and translation of information displayed from one representation to another in complex routine situations</td>
<td>• analysis and translation of information displayed from one representation to another in simple routine situations</td>
<td>• translation of information displayed from one representation to another in simple routine situations</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• use of mathematical reasoning to develop logical sequences in simple non-routine through to complex routine situations using everyday and/or mathematical language</td>
<td>• use of mathematical reasoning to develop logical sequences in simple non-routine and/or complex routine situations using everyday and/or mathematical language</td>
<td>• development of logical sequences in simple routine situations using everyday and/or mathematical language</td>
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<tr>
<td></td>
<td>• justification of the reasonableness of results obtained through technology or other means</td>
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</table>
7. Language education

Teachers of Senior English have a special responsibility for language education. However, it is the responsibility of all teachers to develop and monitor students’ abilities to use the forms of language appropriate to their own subject areas. Their responsibility entails developing the following skills:

- ability in the selection and sequencing of information required in the various forms (such as reports, essays, interviews and seminar presentations)
- the use of technical terms and their definitions
- the use of correct grammar, spelling, punctuation and layout.

Assessment in all subjects needs to take into consideration appropriate use of language.

Mathematics A requires students to use language in a variety of representations — oral, written, graphical, symbolic and pictorial. The responsibility for developing and monitoring students’ abilities to use effectively the forms of language demanded by this course rests with the teachers of mathematics. This responsibility includes developing students’ abilities to:

- select and sequence information
- manage the conventions related to the forms of communication used in Mathematics A (such as short responses, reports, multimedia presentations, seminars)
- use the specialised vocabulary and terminology related to Mathematics A
- use language conventions related to grammar, spelling, punctuation and layout
- communicate effectively and efficiently.

Thus, when writing, reading, questioning, listening and talking about mathematics, teachers and students should use the specialised vocabulary related to the subject. Students should be involved in learning experiences that require them to comprehend and transform data in a variety of forms and, in so doing, use the appropriate language conventions.

Assessment in Mathematics A needs to take into consideration appropriate use of language. Assessment instruments should use format and language that are familiar to students. Attention to language education within Mathematics A should assist students to meet the language components of the exit criteria, especially the criterion Communication and justification.
8. Quantitative concepts and skills

Success in dealing with issues and situations in life and work depends on the development and integration of a range of abilities, such as being able to:

• comprehend basic concepts and terms underpinning the areas of number, space, probability and statistics, measurement and algebra
• extract, convert or translate information given in numerical or algebraic forms, diagrams, maps, graphs or tables
• calculate, apply algebraic procedures, implement algorithms
• make use of calculators and computer packages
• use skills or apply concepts from one problem or one subject domain to another.

In all subjects students are to be encouraged to develop their understanding and to learn through the incorporation — to varying degrees — of mathematical strategies and approaches to tasks. Similarly, students should be presented with experiences that stimulate their mathematical interest and hone those quantitative skills that contribute to operating successfully within each of their subject domains.

Mathematics A focuses on the development and application of numerical and other mathematical concepts and skills. It provides a basis for the general development of such quantitative skills to prepare students to cope with the quantitative demands of their personal lives or to participate in a specific workplace environment.

The distinctive nature of Mathematics A will require that new mathematical concepts be introduced and new skills be developed. Within appropriate learning contexts and experiences in the subject, opportunities are to be provided for revising, maintaining, and extending such skills and understandings.

The following quantitative knowledge and procedures will be required throughout the Mathematics A course and must be learned or maintained as required:

• metric measurement, including measurement of mass, length, area and volume in practical contexts
• calculation and estimation with and without instruments
• rates, percentages, ratio and proportion
• simple interest
• basic algebraic manipulations
• gradient of a straight line
• equation of a straight line
• plotting points using Cartesian coordinates
• tree diagrams as a tool for defining sample spaces and estimating probabilities.
Equity means fair treatment of all. In developing work programs from this syllabus, schools should incorporate the following concepts of equity.

All young people in Queensland have a right to gain an education that meets their needs, and prepares them for active participation in creating a socially just, equitable and democratic global society. Schools need to provide opportunities for all students to demonstrate what they know and can do. All students, therefore, should have equitable access to educational programs and human and physical resources. Teachers should ensure that particular needs of the following groups of students are met: female students; male students; Aboriginal students; Torres Strait Islander students; students from non–English-speaking backgrounds; students with disabilities; students with gifts and talents; geographically isolated students; and students from low socioeconomic backgrounds.

Subject matter chosen should include, whenever possible, the contributions and experiences of all groups of people. Learning contexts and community needs and aspirations should also be considered. In choosing appropriate learning experiences teachers can introduce and reinforce non-racist, non-sexist, culturally sensitive and unprejudiced attitudes and behaviour. Learning experiences should encourage the participation of students with disabilities and accommodate different learning styles.

Resource materials used should recognise and value the contributions of both females and males to society and include social experiences of both genders. Resource materials should also reflect cultural diversity within the community and draw from the experiences of the range of cultural groups in the community.

To allow students to demonstrate achievement, barriers to equal opportunity need to be identified, investigated and removed. This may involve being proactive in finding the best ways to meet the diverse range of learning and assessment needs of students. The variety of assessment techniques in the work program should allow students of all backgrounds to demonstrate their knowledge and skills related to the criteria and standards stated in this syllabus. The syllabus criteria and standards should be applied in the same way to all students.

Teachers should consider equity policies of individual schools and schooling authorities, and may find the following resources useful for devising an inclusive work program:

QSA 2006, Policy on Special Consideration in School-based Assessments in Senior Certification, available from <www.qsa.qld.edu.au>
QSCC 2001, Equity Considerations for the development of curriculum and test material, available from <www.qsa.qld.edu.au>
10. Resources

Text and reference books
A wide variety of textbooks and resource materials that could be used as sources of information about Mathematics A are available. Book suppliers provide information regarding current publications.

World Wide Web
Many interactive and static websites can be used to enhance a course in Mathematics A and often include useful resources. Some particularly useful sites include:

- Mathematics problems, games, and articles, University of Cambridge: <http://nrich.maths.org>
- National Council of Teachers of Mathematics: <http://www.nctm.org>
- The Australian Association of Teachers of Mathematics: <http://www.aamt.edu.au>
- The Institute of Mathematics and its Applications: <http://www.ima.org.uk/>
- The Queensland Association of Mathematics Teachers: <http://qamt.org>

Newspaper reports
Newspapers can be a source of useful data. The compilation of news files on particular topics can broaden students’ knowledge and provide a valuable source of material for developing assessment instruments.

Periodicals
Journals and periodicals provide current, relevant information. Journals and periodicals relevant to Mathematics A may include:

- *Australian Senior Mathematics Journal* — journal of the Australian Association of Mathematics Teachers, Inc.
- *Mathematics Teacher* — journal of the National Council of Teachers of Mathematics
- *Teaching Mathematics* — journal of the Queensland Association of Mathematics Teachers
- *The Australian Mathematics Teacher* — journal of the Australian Association of Mathematics Teachers, Inc.

School librarians should be able to help identify and locate other useful periodicals.
Electronic media and learning technology

A wide range of videos, DVDs and television recordings are available on a variety of topics related to Mathematics A. Various computer software programs and CD-ROMs may be useful for a course in Mathematics A, as learning tools, to gain access to information presented in a variety of forms, and help students gain ICT skills. Educational program distributors can supply updated resource lists.

Organisations and community resources

A variety of government and community organisations provide personnel, advice, resources and information to assist in constructing and implementing a course in Mathematics A. Links with community groups and organisations not only provide relevant and up-to-date resources for students but also help to improve the credibility of the course in the eyes of the community.

There may be protocols that must be observed when working with Aboriginal and Torres Strait Islander organisations and community groups, for example meeting with the elders before an activity is conducted. Further information may be found at <www.qsa.qld.edu.au> under P-12 syllabuses and support > Indigenous Perspectives, particularly in the Aboriginal and Torres Strait Islander Studies Senior Syllabus and on the Support materials page.
Glossary

**Algorithm**
Process or set of rules to be used; list of well-defined instructions for completing a task; step-by-step approach.

**Analyse**
To break up a whole into its parts, to examine in detail to determine the nature of, to look more deeply into and to detect the relationships between parts.

**Annuity (pl. annuities)**
The accumulation of fixed payments at fixed intervals over a period of time.

**Assessment instruments**
Particular methods developed and used by a school to gather information about student achievement.

**Assessment techniques**
The methods (categories) identified in the syllabus to gather evidence about student achievement. Senior syllabuses describe suitable techniques and prescribe the mix of assessment techniques for verification folios.

**Communicate**
Convey information about; make known; impart; reveal clearly; manifest.

**Concept**
A concept is an abstract idea or a mental symbol, typically associated with a corresponding representation in language or symbology, that denotes all of the objects in a given category or class of entities, interactions, phenomena, or relationships between them. Concepts are abstract in that they omit the differences of the things in their extension, treating them as if they were identical. They are universal in that they apply equally to every thing in their extension. Concepts are also the basic elements of propositions. Concepts are discursive and result from reason. Concepts help to integrate apparently unrelated observations and phenomena into viable hypothesis and theories.

**Conclusion**
Final result or summing up; inference deduced from previous information; reasoned judgment.

**Context**
A context is a framework for linking concepts and learning experiences that enables students to identify and understand the application of mathematics to their world. A context is a group of related situations, phenomena, technical applications and social issues likely to be encountered by students. A context provides a meaningful application of concepts in real-world situations.
Contingency tables (or two-way tables)
Contingency tables are used to record and analyse the relationship between two or more variables, most usually categorical variables. For example, for two variables, sex (male or female) and handedness (right handed or left handed) in a random sample of 100 people, the contingency table could be used to express the relationship between these two variables, as follows:

<table>
<thead>
<tr>
<th></th>
<th>Right handed</th>
<th>Left handed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>43</td>
<td>9</td>
<td>52</td>
</tr>
<tr>
<td>Female</td>
<td>44</td>
<td>4</td>
<td>48</td>
</tr>
<tr>
<td>Total</td>
<td>87</td>
<td>13</td>
<td>100</td>
</tr>
</tbody>
</table>

Continuous data
Data that have an infinite number of possible values within a given range.

Criterion (pl. criteria)
A property, dimension or characteristic by which something is judged or appraised. In senior syllabuses, the criteria are the significant dimensions of the subject, described in the Rationale and used to categorise the general objectives and exit criteria.

Criteria sheets
Criteria sheets are developed from the standards associated with exit criteria to describe the attributes of student work anticipated at each level of achievement for the particular assessment instrument.

Data
In the context of the Mathematics A syllabus, data are thought of as documented information or evidence of any kind that lends itself to mathematical interpretation. Data may be quantitative or qualitative. (See Primary data, Secondary data, Qualitative data, Quantitative data.)

Decision
The process of coming to a conclusion or determination about something; resolve, form conclusions, provide judgment for an answer; choice formed after considering various alternatives.

Deduce
Infer; reach a conclusion which is necessarily true provided a set of assumptions is true.

Depth
The development of knowledge and understandings from simple through to complex.

Describe
To give an account of in speech or writing; to convey an idea or impression of; characterise; to represent pictorially; depict; to trace the form or outline of.

Determine
To come to a resolution or decide.

Discrete data
Data that have only a finite or limited number of possible values; describing quantities that can be measured by a counting process.

Discuss
Consider a particular topic in speaking or writing; talk or write about a topic to reach a decision.

Double the angle of the bow
A method of obtaining a running fix by measuring the distance a vessel travels on a steady course while the relative bearing (right or left) of a fixed object doubles. The distance from the object at the time of the second bearing is equal to the run between bearings, neglecting drift.
Estimate
Calculate an approximate amount or quantity.

Evaluate
Establishes the value, quality, importance, merit, relevance or appropriateness of information, data or arguments based in logic as opposed to subjective preference.

Exemplify
To show or illustrate using examples.

Exit level of achievement
The standard reached by students at exit judged by matching standards in student work with the exit criteria and standards stated in a syllabus.

Explain
Make clear or understandable, know in detail.

Formative assessment
Formative assessment is used to provide feedback to students, parents, and teachers about achievement over the course of study. This enables students and teachers to identify the students’ strengths and weaknesses so students may improve their achievement and better manage their own learning.

Frequency plot
A diagrammatic presentation of the frequency distribution of the observations; for example, bar chart, pie chart, histogram, frequency polygon or an ogive.

General objectives
General objectives are those which the school is intended to pursue directly and student achievement of these is assessed by the school.

Inference
The act or process of deriving a conclusion based solely on what one already knows.

Interpret
To give meaning to information presented in various forms — words, symbols, pictures, graphs etc.

Justify
Provide sound reasons based on logic or theory to support response; prove or show statements are just or reasonable; convince. Specifically the justification may include:
- providing evidence (words, diagrams, symbols etc.) to support processes used
- stating a generic formula before using specifically
- providing reasoned, well-formed, logical sequence within a response.

Key competencies
The key competencies define skills essential for effective participation in adult life, including further education and employment.

Mathematical model
Any depiction of a situation expressing a relationship between ideas in mathematical terms.

Mathematical modelling
The act of creating a mathematical model, which may involve the following steps:
- identify assumptions, parameters and variables
- interpret, clarify and analyse the problem
- develop strategies or identify procedures required to develop the model and solve the problem
- investigate the validity of the mathematical model.
Median boxplot (box-and-whisker plot)
A graphical presentation of some main features of a dataset. The simplest version of a box plot is formed by drawing a box extending from the lower to the upper quartiles, marking the median within that box, and drawing lines (called whiskers) from the box to the smallest and largest data points. There are slight variations in the possible ways of identifying the median and quartiles of data: these variations make very little difference except with small or sparse datasets.

Moderation
Moderation is the name given to the quality assurance process for senior secondary studies used by the QSA to ensure that:
- Authority subjects taught in schools are of the highest possible standards
- student results in the same subject match the requirements of the syllabus and are comparable across the state
- the process used is transparent and publicly accountable.

Parameter
The values that allow a model to define a particular situation i.e. $m$ and $c$ in the equation $y = mx + c$

Primary (or raw) data
Data that have been collected first hand, but not yet processed.

Procedure
A list of sequential instructions that is to be used to solve a problem or perform a task.

Qualitative data
Concerned with quality; verbal analysis.

Quantitative data
Concerned with measurement; mathematical analysis.

Outlier
An extreme value in the observations, for example, an observation which lies beyond the box-and-whisker plot, or a point which is well away from the line of best fit.

Reliability
Able to be trusted to be accurate or correct or to provide a correct result.

Representation
Refers both to process and to product i.e:
- the act of capturing a mathematical concept or relationship in some form and
- the form itself.

Representation applies to processes and products that are observable externally as well as to those that occur “internally” in the minds of people doing mathematics. Some forms of representation include diagrams, graphical displays and symbolic expressions. Representations are essential elements in supporting understanding of mathematical concepts and relationships; in communicating mathematical approaches, arguments, and understandings.
**Rule of twelfths**
The rule of twelfths is a rule of thumb for estimating the height of the tide at any time, given only the time and height of high and low water. This is important when navigating a boat or a ship in shallow water and when launching and retrieving boats on slipways on a tidal shore. The rule assumes that the rate of flow of a tide increases smoothly to a maximum halfway between high and low tide before smoothly decreasing to zero again and that the interval between low and high tides is approximately six hours. The rule states that in the first hour after low tide the water level will rise by one twelfth of the range, in the second hour two twelfths, and so on according to the sequence 1:2:3:3:2:1.

**Scaffolding**
The scaffolding analogy comes from the building industry, and refers to the process of supporting a student’s learning to solve a problem or perform a task that could not be accomplished by that student alone. The aim is to support the student as much as necessary while they build their understanding and ability to use the new learning; then gradually reduce the support until the student can use the new learning independently.

**Secondary data**
Data that have been collected by someone else or data that have been processed.

**Solution**
Answers to problems, investigations, research or questions.

**Standard**
A standard is a fixed reference point for use in assessing or describing the quality of something. In senior syllabuses, standards are usually described at five points within each exit criterion.

**Stem-and-leaf plot (stemplot)**
An exploratory technique that simultaneously ranks the data and gives an idea of the distribution. Example: The following 16 average daily temperatures have been recorded to the nearest degree Celsius:

| 31 | 21 | 35 | 30 | 22 | 23 | 9  | 24 |
| 13 | 41 | 30 | 21 | 29 | 24 | 18 | 28 |

Example 2 | 1 represents 21

<table>
<thead>
<tr>
<th>Preliminary stem-and-leaf plot of the temperatures:</th>
<th>Completed stem-and-leaf plot of the temperatures:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 9</td>
<td>0 9</td>
</tr>
<tr>
<td>1 3 8</td>
<td>1 3 8</td>
</tr>
<tr>
<td>2 1 2 3 4 1 9 4 8</td>
<td>2 1 1 2 3 4 4 8 9</td>
</tr>
<tr>
<td>3 0 0 1 5</td>
<td>3 0 0 1 5</td>
</tr>
<tr>
<td>4 1</td>
<td>4 1</td>
</tr>
</tbody>
</table>

**Student profile of achievement**
This records information about student performance on assessment instruments undertaken periodically throughout the course of study. Techniques are chosen to sample the significant aspects of a course across relevant exit criteria to ensure balance in assessment. In particular, it is important that the profile of achievement illustrates how assessment of significant aspects is selectively updated and eventually leads to summative assessment within each exit criterion.
Summary statistics
In descriptive statistics, summary statistics are used to summarise a set of observations, in order to communicate as much as possible as simply as possible. Statisticians commonly try to describe the observations in:

- a measure of location, or central tendency, such as the arithmetic mean, median, mode, or interquartile mean
- a measure of statistical dispersion like the standard deviation, variance, range, or interquartile range, or absolute deviation.
- a measure of the shape of the distribution like skewness or kurtosis.

Summative assessment
Summative assessment provides cumulative information on which levels of achievement are determined at exit from the course of study. It follows, therefore, that it is necessary to plan the range of assessment instruments to be used, when they will be administered, and how they will contribute to the determination of exit levels of achievement.

Synthesise
Assembling constituent parts into a coherent entity. The term “entity” includes a system, theory, plan or set of operations.

Theory
A set of facts, propositions or principles analysed in their relation to one another and used, especially in science, to explain phenomena.

Valid
Sound, reasonable, relevant, defensible, well grounded, able to be supported with logic or theory. May include the strengths and limitations of models and the analysis of the effect on assumptions.

Variation
The way in which the observations differ (vary) from each other, often measured by the standard deviation or range.

Verification
Towards the end of Year 12, school submissions, one for each Authority subject, are sent to the relevant (usually district) review panels who review the material to confirm that the standards assigned to students’ work are in line with the descriptors in the syllabus. These submissions comprise folios of the work of sample students about to exit from the course of study, together with the school’s judgment.

Verification folio
This is the collection of documents (tests, reports, assignments, checklists and other assessment instruments) used to make the decision about a student’s level of achievement. At October verification, it will contain a minimum of four pieces of work that conform to the underlying principles of assessment as outlined in Section 6.1.

Work program
The school’s program of study in Authority and Authority-registered subjects for which the students’ results may be recorded on QSA certificates (requirements are listed on the QSA website <www.qsa.qld.edu.au>).
