

Numeracy

A short course senior syllabus 2010

Numeracy: A short course senior syllabus

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1. Rationale

Numeracy involves using some mathematics to achieve some purpose in a particular context... To be numerate is to use mathematics effectively to meet the general demands of life at home, in paid work, and for participation in community and civic life.¹

Numeracy is considered integral to a person's ability to function effectively in society. To be numerate requires more than being able to operate with numbers: it requires mathematical knowledge and understanding, mathematical problem-solving skills, literacy skills and positive beliefs and attitudes.

When students become numerate, they are able to manage situations or solve problems in real contexts such as everyday life, work or further learning. Students are able to identify or locate, act upon, interpret and communicate mathematical ideas and information. They learn to represent these ideas and information in a number of ways. This learning should take place in contexts that are relevant, cooperative, supportive, enjoyable and non-competitive.

Numeracy is embedded across the school curriculum and is developed through all phases of learning. This numeracy short course senior syllabus allows teachers to design courses of study that cater for the prior learning and specific numeracy needs of their students.

This short course senior syllabus focuses on aspects of numeracy and does not replace the study of the subject Mathematics. It is informed by the Australian Core Skills Framework (ACSF).² The requirements for a standard C Level of Achievement in this short course mirror the numeracy requirements for ACSF Level 3. For more information about how ACSF has influenced the shape of this syllabus refer to the companion document, *Background to the Literacy and Numeracy Short Course Senior Syllabuses* available on the QSA website <www.qsa.qld.edu.au>.

In this course of study students will:

- learn a variety of strategies to develop and monitor their own learning
- identify and communicate mathematical information that is embedded in a range of texts and contexts from everyday life and work
- use mathematical processes and strategies to solve problems in a range of situations
- reflect on outcomes and the appropriateness of mathematical processes used.

This subject is suited for students in Years 10–12 who are performing at least at Level 2 of the ACSF and who may:

- be at risk of not attaining the numeracy requirement for the QCE
- disengaged with school.

¹ Australian Association of Mathematics Teachers and Education Department of Western Australia 1997, *Numeracy = Everyone's Business*, report of the Numeracy Education Strategy Development Conference, Adelaide, AAMT.

² Department of Education, Employment and Welfare 2008, *Australian Core Skills Framework*, Commonwealth of Australia, Canberra, <www.deewr.gov.au/Skills/Programs/WorkplaceEnglishLanguageandLiteracy/Documents/AustralianCoreSkillsFramework.pdf>.

1.1 Attitudes and values

Students should appreciate that understanding and being able to use familiar mathematics in the world around them allows them to organise and control many facets of their lives. They should value becoming numerate citizens who can make informed decisions about issues involving mathematics, and should develop confidence in using mathematics in everyday life.

1.2 Aboriginal and Torres Strait Islander perspectives³

The Queensland Studies Authority (QSA) recognises Aboriginal and Torres Strait Islander peoples, their traditions, histories and experiences from before colonisation through to the present time. To strengthen students' appreciation and understanding of the first peoples of the land, relevant sections of the syllabus identify content and skills that can be drawn upon to encourage engagement with:

- Indigenous frameworks of knowledge and ways of learning
- Indigenous contexts in which Aboriginal and Torres Strait Islander peoples live
- Indigenous contributions to Australian society and cultures.

³ The Queensland Government has a vision that Aboriginal and Torres Strait Islander Queenslanders have their cultures affirmed, heritage sustained and the same prospects for health, prosperity and quality of life as other Queenslanders. The Queensland Studies Authority (QSA) is committed to helping achieve this vision and supports teachers to include Aboriginal and Torres Strait Islander perspectives in the curriculum.

2. Dimensions and objectives

The objectives are those that the school is required to teach and that students have the opportunity to learn. Schools must assess how well students have achieved the objectives.

The objectives, as well as the standards, are grouped by dimensions, which describe the salient properties or characteristics of the learning.

There are three interrelated, assessable dimensions linked to the achievement standards (see Section 5.7). These are:

- *identifying and communicating mathematical information*
- *problem-solving and mathematical processes*
- *learning.*

Progress in all dimensions should occur concurrently, as progress in one dimension may depend on the skills developed in another. The objectives for each dimension are detailed below.

2.1 Identifying and communicating mathematical information

Identifying mathematical information involves recognising and selecting the relevant mathematical knowledge, processes and solutions that are embedded formally and informally in contexts from everyday life and work.

Communicating involves presenting outcomes of the use of selected mathematics in contexts from everyday life and work.

By the conclusion of the course, students should:

- select and use mathematical information that is embedded in texts and stimuli, including data located in tables, graphs and charts
- use whole numbers (including very large numbers) and fractions, decimal fractions and percentages embedded in a range of contexts
- communicate mathematical information and problem-solving processes and results through oral and written informal and formal language, including mathematical conventions, symbolism, abbreviations and diagrammatic representations.

2.2 Problem-solving and mathematical processes

Problem-solving and mathematical processes are the strategies that students use to demonstrate their numeracy abilities. This dimension involves investigating situations using various mathematical methods to find solutions; reflecting on processes used; and evaluating outcomes.

By the conclusion of the course, students should:

- solve a range of problems by selecting and applying mathematical processes and methods, including the use of “in-the-head” methods, pen and paper and calculator/technological processes; hands-on and in-context materials; personal experience; and mathematical and other prior knowledge
- reflect on outcomes of mathematical activities and the appropriateness of mathematical processes, including the use of estimation and other assessment skills.

2.3 Learning

Learning strategies are part of the metacognitive processes that students need to plan, monitor, evaluate and regulate their thinking and learning.⁴ Students' individual orientation towards learning and the range of strategies they can draw on to assist their learning are crucial to helping them adapt to rapidly evolving environments.⁵

By the conclusion of the course, students should:

- acquire, plan for and apply practical strategies that facilitate learning
- evaluate and adapt learning strategies as required.

⁴ Marzano, J 2004, *Designing a New Taxonomy of Educational Objectives*, Corwin Press, CA, p. 48.

⁵ Department of Education, Employment and Welfare 2008, *Australian Core Skills Framework*, Commonwealth of Australia, Canberra, p. 16
<www.deewr.gov.au/Skills/Programs/WorkplaceEnglishLanguageandLiteracy/Documents/AustralianCoreSkillsFramework.pdf>.

3. Course organisation

The number of hours of timetabled school time, including assessment, for a course of study developed from this syllabus is a minimum of 55 hours.

3.1 Course requirements

The requirements for a course are:

- the objectives within the dimensions of *identifying and communicating mathematical information, problem-solving and mathematical processes and learning* (see Section 2)
- the subject matter: number and calculations, shape and space, data and statistics, measurement, location and direction, and formulas and algebra (see Section 3.3)
- the six aspects of communication (see Section 4).

3.2 Planning a course of study

A course of study should:

- base learning and assessment activities on real-life or lifelike contexts
- align the numeracy curriculum to students' education and career pathways, identified in their Senior Education and Training (SET) Plan
- choose topics or issues that are of interest to students
- provide choices in learning contexts and assessment, where possible, to help cater for students' individual differences
- ensure that students experience all aspects of communication at least once
- ensure learning and assessment opportunities are provided for all objectives at least twice.

Supporting students

Some students who undertake this course will be able to embark on independent learning; all will require help and guidance. Scaffolding for tasks should encompass learning experiences that focus on identifying and applying a variety of mathematics in everyday and work-related situations (see Section 3.3 for subject matter elaborations). It is the responsibility of teachers to model and provide strategies for:

- learning
- identifying and communicating mathematical information
- approaching and solving mathematical problems.

3.3 Subject matter elaborations

The following tables give examples of possible subject matter. The elaborations have been adapted from the ACSF Numeracy Core Skill. These examples are not meant to be prescriptive or exhaustive.

3.3.1 Number and calculations

Students will learn to identify number properties and use a range of strategies and calculations to solve problems involving real numbers, rates, percentages and fractions.

This may involve students:

- identifying and using whole numbers including numbers up to 1000s, money and simple, everyday fractions, decimals and percentages, e.g. $\frac{1}{4}$, $\frac{1}{10}$, 50%, 25%, 0.25
- calculating with whole numbers, fractions, decimal fractions and percentages, linking and using equivalent forms appropriate to a range of contexts
- performing a range of calculations with the 4 operations (+, −, ×, ÷) with division being related to simple and familiar tasks such as equal sharing, e.g. dividing a food bill equally between 5 people
- using and applying ratio, rates and proportion in a range of situations, e.g. km/hr, \$/kg, \$/m, scales on maps and drawings, magnification factors, mixing chemicals.

3.3.2 Shape and space

Students will learn to describe, represent, construct and manipulate a range of shapes, objects, maps and plans using geometric conventions.

This may involve students:

- identifying, drawing and describing 2D shapes and 3D shapes in a range of situations
- applying knowledge of properties of 2D and 3D shapes to describe and draw everyday objects, including constructing common 3D shapes
- using knowledge about space and shape including angle properties, symmetry and similarity to describe, draw or construct relevant common 2D and 3D shapes.

3.3.3 Data and statistics

Students will learn to gather, organise and interpret data in a range of everyday life and work contexts.

This may involve students:

- collecting and organising data manually or with spreadsheets
- using data to construct charts and tables based on scales and axes in a range of situations
- representing, summarising and interpreting data in a variety of ways, e.g. tables, spreadsheets, graphs, plots, averages (such as mean, median, mode) and simple measures of spread.

3.3.4 Measurement

Students will learn to use instruments and strategies to measure, estimate and calculate quantities.

This may involve students:

- measuring length, mass, capacity, time and temperature; using instruments graduated in familiar units, e.g. cm, m, mL, °C, hours, minutes and seconds
- converting between metric units by applying understanding of prefixes, e.g. centi, milli, kilo, and as appropriate, micro, mega.

3.3.5 Location and direction

Students will learn to use conventions representing location, distance, speed and orientation in maps and plans.

This may involve students:

- using knowledge of location and direction, distance, coordinates, scales, labels, symbols and keys to read and use maps (both printed and web-based), street directories and plans
- calculating and interpreting information based on maps including scales, bearings, travel distances, speeds and times and time zones.

3.3.6 Formulas and algebra

Students will learn to use simple formulas and algebraic representations in contexts from everyday life and work.

This may involve students:

- describing relationships between variables in relevant contexts e.g. sport, repair charges, mixing chemicals, area and volume, specific workplace formulas
- using simple formulas to find the unknown value in personally significant financial situations such as those involving interest rates, savings, pay, taxation and investment.

3.4 Composite classes

This syllabus enables teachers to develop a course that caters for a variety of circumstances, such as combined Year 10, 11 and 12 classes, combined campuses, or modes of delivery involving periods of student-managed study.

The flexibility of the syllabus can support teaching and learning for composite classes by enabling teachers to:

- provide opportunities for multilevel group work, peer teaching and for independent work on appropriate occasions
- structure learning experiences and assessment that allows students to access the key concepts and ideas suited to meet their needs in each year level.

3.5 Study plan requirements

A study plan is the school's outline 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 study plan must meet all syllabus requirements and must demonstrate that there will be sufficient scope and depth of student learning to meet the objectives and the exit standards. The requirements for study plan approval are available on the QSA's website, <www.qsa.qld.edu.au>. Please see the latest updates before completing a study plan.

4. Teaching and learning

The suggested learning experiences on the following pages are taken from the Level 3 sample activities outlined in the ACSF. The ACSF groups sample activities according to six *aspects of communication* to illustrate how communication varies according to purpose, audience and context.⁶ These are:

- personal (expressing identity)
- cooperative (interacting in groups)
- procedural (performing tasks)
- technical (using technology)
- systems (interacting in organisations)
- public (interacting with the wider community).

The six aspects of communication should be considered together when planning a course of study. They are not distinct and exclusive categories. It would be difficult, for example, to talk technically without talking procedurally; to communicate cooperatively requires communicating interpersonally. Students should be provided with learning experiences and assessment opportunities that allow them to demonstrate these aspects of communication.

The ACSF includes additional sample activities. For more information about how ACSF has influenced the shape of this syllabus refer to the companion document, *Background to the Literacy and Numeracy Short Course Senior Syllabuses* available on the QSA website <www.qsa.qld.edu.au>.

⁶ Department of Education, Employment and Welfare 2008, *Australian Core Skills Framework*, Commonwealth of Australia, Canberra, p. 9
<www.deewr.gov.au/Skills/Programs/WorkplaceEnglishLanguageandLiteracy/Documents/AustralianCoreSkillsFramework.pdf>.

4.1 Suggested learning experiences

Numeracy: Sample activities — ACSF Level 3

Aspect of communication	Suggested learning experiences
Personal (expressing identity)	<ul style="list-style-type: none"> • Compares the costs of purchasing everyday items in different sized containers to work out the best way to purchase, e.g. compares the cost of buying drinks in 3 different sized containers (500 ml, 1.25 litre or 2 litre), taking into account rate of usage and wastage. • Gives instructions including a sketch map and estimated distance and travel time for an everyday route, e.g. for a friend to drive to their house from where they work.
Cooperative (interacting in groups)	<ul style="list-style-type: none"> • Works in a group to undertake a simple survey and documents the results including at least 1 everyday or routine graph, e.g. a workplace survey of worker's OHS knowledge, accident rates. • Works in team to organise and cater for a meal/party (e.g. a breakfast at the start of term, an afternoon tea for someone's farewell) and decide on the cost per person.
Procedural (performing tasks)	<ul style="list-style-type: none"> • Selects, totals and orders items from a catalogue within budgetary constraints, e.g. workplace stationery order, food for a special event. • Correctly adjusts quantities and follows recipe/operating instructions including measuring quantities in order to make a product of a smaller or larger size than specified, e.g. adjusts and follows a recipe specified for 6 people for a group of 12 people.
Technical (using tools and technology)	<ul style="list-style-type: none"> • Correctly enters data onto an electronic cash register and undertakes end-of-day summaries and balancing of till. • Uses appropriate technological devices to measure and record data and report and act on results, e.g. blood pressure machine, micrometer, temperature gauge. • Uses a calculator to compare costs for the purchase of a particular item from different outlets, e.g. sale/discount from catalogues/shops/internet, decides on the best buy and explains the reasons behind the choice.
Systems (interacting in organisations)	<ul style="list-style-type: none"> • Compares and contrasts costs of different types of travel, e.g. travel options for three people using plane, bus, train, taxi and hire car for a journey between 2 large cities. • Reads and explains costs, data and graphical information on a bill or invoice from a utility/organisation, e.g. a phone/gas/electricity/water bill.
Public (interacting with the wider community)	<ul style="list-style-type: none"> • Identifies and explains uses and application of shapes in different contexts, e.g. use of 2D and 3D shapes in house or building construction, construction of domestic or industrial packaging. • Collects data and information about a community or social issue from newspapers or the internet and writes a report presenting the information using everyday tables and graphs, e.g. impact of a drought on a community, road accident statistics for a dangerous local intersection, sporting team results.

Learning: Sample activities — ACSF Level 3

Aspect of communication	Suggested learning experiences
Personal (expressing identity)	<ul style="list-style-type: none"> • Reviews own skills in relation to job selection criteria to clarify future study or training plan. • Volunteers to learn a new skill in an area with limited prior knowledge. • Approaches trusted, more experienced colleague to act as a sounding board and mentor. • Attends an information session and follows enrolment process for chosen course.
Cooperative (interacting in groups)	<ul style="list-style-type: none"> • Works with a partner on a short research project. • Participates in quality improvement processes in the workplace, considering the priorities and commitments of self and other members.
Procedural (performing tasks)	<ul style="list-style-type: none"> • Uses subheadings to organise key information for a presentation. • Develops and uses personal organisation systems such as files, notebooks, folders and checklists. • Lists references to be used for independent study.
Technical (using tools and technology)	<ul style="list-style-type: none"> • Demonstrates navigational pathway used to access information via the internet. • Learns how to use new software, e.g. spreadsheet package. • Interprets visual representations of information such as diagrams and illustrations and comments on the usefulness of these to own learning.
Systems (interacting in organisations)	<ul style="list-style-type: none"> • Negotiates professional development plan aligned with personal and workplace needs, and takes responsibility for organising the formal training component. • Understands that domains (.com, .gov, .net etc.) are relevant to the way information is communicated on the internet. • Approaches information professionals for assistance with information searches.
Public (interacting with the wider community)	<ul style="list-style-type: none"> • Identifies and evaluates several options for addressing a local community issue. • Seeks advice on how to make an insurance claim. • Participates in local community group, helping to identify goals, constraints and consequences, e.g. considers alternative action plans to address a local issue.

4.2 Developing Aboriginal and Torres Strait Islander perspectives

To strengthen students' appreciation and understanding of Aboriginal and Torres Strait Islander perspectives, teachers planning a course of study should identify content and skills that can be drawn upon to encourage awareness and understanding of Aboriginal and Torres Strait Islander:

- frameworks of knowledge and ways of learning
- contributions to Australian society and cultures
- ways of life and social contexts.

The Indigenous perspectives section of the QSA website has a collection of resources to help teachers engage with Indigenous histories and peoples (<www.qsa.qld.edu.au> P-12 approach > Indigenous perspectives).

The *Aboriginal and Torres Strait Islander Studies Handbook* has valuable information on key success factors such as:

- removing barriers to student success and engagement
- establishing a supportive school and classroom environment
- consulting and collaborating with local Indigenous communities
- dealing with sensitive issues
- selecting appropriate resources and texts.

In the study of numeracy, the key success factors listed above should be the basis for planning a course of study. The role of the community, in partnership with the school and other government and community groups, is particularly important.

The Deadly pathways section of the Queensland Studies Authority (QSA) Career Information Service website <www.cis.qsa.qld.edu.au> has much information specifically for Aboriginal students and Torres Strait Islander students about networks, resources and opportunities for careers and educational pathways.

5. Assessment

Assessment is an integral part of the teaching and learning process. It is the purposeful, systematic and ongoing collection of information about student learning outlined in the senior syllabuses.

In Queensland, assessment is standards-based. The standards for each subject are described in dimensions, which identify the valued features of the subject about which evidence of student learning is collected and assessed. The standards describe the characteristics of student work.

The major purposes of assessment are to:

- promote, assist and improve learning
- inform programs of teaching and learning
- advise students about their own progress to help them achieve as well as they are able
- give information to parents and teachers about the progress and achievements of individual students to help them achieve as well as they are able
- provide comparable levels of achievement for subjects to be recorded in students' learning accounts that may also contribute to the award of a Queensland Certificate of Education
- provide information about how well groups of students are achieving for school authorities and the State Education and Training Minister.

5.1 Assessment principles for this course

All the principles of exit assessment must be used when planning an assessment program and must be applied when making decisions about exit levels of achievement.

A standards-based assessment program for this short course requires application of the following interdependent principles:

- Information is gathered through a process of continuous assessment.
- Balance of assessment is a balance over the course of study.
- 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 study plan.

Continuous assessment

Judgments about student achievement made at exit from a course of study must be based on an assessment program of continuous assessment.

Continuous assessment involves gathering information on student achievement using assessment instruments administered at suitable intervals over the course of study.

Balance

Judgments about student achievement made at exit from a course of study must be based on a balance of assessments over the course of study.

Balance of assessment means judgments about students' achievements of all the assessable objectives are made a *number of times* using a *variety of assessment techniques* and a *range of assessment conditions* over the course.

See also Section 5.6 Requirements for student folio at exit.

Mandatory aspects of the syllabus

Judgments about student achievement made at exit from a course of study must be based on mandatory aspects of the syllabus.

The mandatory aspects are:

- the objectives within the dimensions of *identifying and communicating mathematical information, problem-solving and mathematical processes, and learning*, as evidenced in at least two assessment instruments.

To ensure that the judgment of student achievement at exit from this course of study is based on the mandatory aspects, *the exit standards for the dimensions stated in the standards matrix* (refer to Section 5.8.1) *must be used*.

Significant aspects of the course of study

Judgments about student achievement made at exit from a course of study must be based on significant aspects of the course of study.

Significant aspects are those areas described in the school's study plan that have been selected from the choices permitted by the syllabus to meet local needs.

The significant aspects must be consistent with the objectives of the syllabus.

5.2 Planning an assessment program

To achieve the purposes of assessment listed at the beginning of this section, schools must consider the following when planning a standards-based assessment program:

- dimensions and objectives (see Section 2)
- teaching and learning strategies (see Section 4)
- assessment principles for this course (see Section 5.1)
- variety in assessment techniques (see Section 5.5)
- conditions in which assessment instruments are undertaken (see Section 5.5)
- requirements for the student folio at exit, that is, the range and mix of assessment instruments necessary to reach valid judgments of students' standards of achievement (see Section 5.6)
- exit standards (see Section 5.7).

In keeping with the principle of continuous assessment, students should have opportunities to become familiar with the assessment techniques that will be used to make summative judgments.

Further information can be found at <www.qsa.qld.edu.au> <Years 10-12> <Years 11-12 subjects>.

5.3 Special provisions

Guidance about the nature and appropriateness of special provisions for particular students may be found in the QSA's *Policy on Special Provisions for School-based Assessments in Authority and Authority-registered Subjects* (2009), available from <www.qsa.qld.edu.au> by searching for "Special provisions".

This statement provides guidance on responsibilities, principles and strategies that schools may need to consider in their school settings.

To enable special provisions to be effective for students, 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 provisions might involve alternative teaching approaches, assessment plans and learning experiences.

5.4 Authentication of student work

It is essential that judgments of student achievement are made on accurate and genuine student assessment responses. Teachers should ensure that students' work is their own, particularly where students have access to electronic resources or when they are preparing collaborative tasks.

The QSA information statement *Strategies for Authenticating Student Work for Learning and Assessment* is available from <www.qsa.qld.edu.au> (search on "authenticating"). This statement provides information about various methods teachers can use to monitor that students' work is their own. Particular methods outlined include:

- students planning their production of drafts and final responses
- teachers seeing plans and drafts of student work
- teachers and students maintaining documentation of the development of responses
- students acknowledging resources used.

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

5.5 Assessment techniques

The techniques and associated conditions of assessment most suited to the judgment of student achievement in this subject are described in the following tables. They are grouped in categories representing the assessment types required for exit folios; the list of techniques is not exhaustive. The dimensions that best suit each assessment type are also indicated.

For each dimension, standards are described. These standards descriptors are used to determine the properties or characteristics to be assessed by individual assessment instruments. The properties or characteristics for each instrument determined by a school are termed criteria. Therefore, the criteria for an assessment instrument are drawn from the syllabus standards descriptors for relevant dimensions (see Section 5.8.1 Standards matrix).

Schools decide the instruments to be used for assessment. For each assessment instrument, schools develop a criteria sheet: a tool for making judgments about the quality of students' responses to an assessment instrument. It lists the properties or characteristics used to assess students' achievements. Students must be given a criteria sheet for each assessment instrument.

When students undertake assessment in a group or team, instruments must be designed so that teachers can validly assess the work of individual students and not apply a judgment of the group product and processes to all individuals.

5.5.1 Supervised assessment

Supervised assessment (SA)

Purpose

This technique is used to assess specific knowledge and understandings and the student's ability to solve problems. Student responses are produced independently, under supervision and in a set timeframe. The conditions of this technique should establish the authenticity of the student work.

Description

- A supervised assessment may include one or more items. These could be in response to stimulus materials, which may be seen or unseen, or questions, which should be unseen. If, however, a seen question is used, then teachers must ensure the purpose of this technique is not compromised. These conditions must be explained on the assessment instrument.
- Unseen materials or questions should not be copied from information or texts that students have previously been exposed to or have directly used in class.
- When stimulus materials are used they should be succinct enough to allow students sufficient time to engage with them. If the stimulus materials are lengthy, complex or numerous, they may need to be shared with students before the assessment.

Dimensions to be assessed

Objectives from each of the dimensions *identifying and communicating mathematical information* and *problem-solving and mathematical processes* should be evident in the task.

Types of items that could be included

- Short-response items
- Multiple choice / matching / true or false / classification
- Cloze passages and sentence completion
- Practical exercises
- Responses to seen or unseen stimulus materials

Conditions

- Supervised conditions
- Individual
- Perusal times may be required
- Recommended time: 1–1.5 hours

Teacher role

- Construct questions that are unambiguous.
- Format the instrument so it is easy to read and respond.
- Consider the language needs of the students.
- Ensure questions allow the full range of standards to be demonstrated.
- Consider the instrument conditions in relation to the requirements of the unseen question.
- Outline any permitted material in the instrument conditions (e.g. one page of handwritten notes).
- Determine appropriate use of stimulus materials and student notes. Ensure stimulus materials are succinct enough to allow students to engage with them in the time provided; if they are lengthy, consider sharing them with students before the assessment.
- Design questions that are linked with learning experiences.
- Provide students with prior learning experiences that involve responding to unseen tasks and using appropriate communication strategies.

5.5.2 Extended response assessment

Extended response assessment (ER)

Purpose

- Developed in response to a question, circumstance or issue that the student is required to research using a variety of resources. Research and secondary data will often be the focus.
- Management of the extended response instrument should be mostly the responsibility of the student. Supervision by the teacher may be necessary at times.
- Duration of the instrument ranges from two weeks to the entire length of the unit of work.

Description

- Developed in response to a question, circumstance or issue that requires students to analyse, synthesise and evaluate data and information to develop a response. Research is not the focus of this technique.
- May involve solving a problem; explaining and evaluating; or applying concepts or theories to a circumstance.
- Management of the extended response instrument should be mostly the responsibility of the student. Supervision by the teacher may be necessary at times.
- Duration ranges from two weeks to the entire length of the unit of work; often involves work in students' own time.

Dimensions to be assessed

- Objectives from each of the three dimensions, *identifying and communicating mathematical information, problem-solving and mathematical processes* and *learning* should be evident in the task.

Types of items that could be included

The student response can take the form of a research assignment, written report, journal/portfolio or multimodal presentation.

Research assignment

- Students provide a response to a specific question/issue; may include appropriate tables of data, diagrams and flowcharts.
- Recommended length: 600–1000 words.

Report

- Students make decisions about the question/issue under investigation and support their decisions with logical arguments.
- The report may be in response to observations and conclusions drawn from case studies.
- Recommended length: 600–1000 words (data analysis, discussion, recommendations and conclusions).

Journal/portfolio

- This "purposeful" collection of work helps define the student's efforts and achievements in a specified area.
- Can be used to document information, ideas and working processes.
- Should contain decisions and justifications; evidence of learning strategies; and research, including the collection and sorting of data.
- Recommended length: 500–700 words.

Multimodal presentation

- Presentations should include significant contributions from at least two modes (e.g. visual, electronic, physical, audio or spoken). Examples include a spoken presentation that interfaces with a PowerPoint presentation; documentary, PowerPoint webpage, video or computer simulation.

Extended response assessment (ER)

- Evidence of student responses may be folios, electronic (disc/file), video and commentary, visual evidence of the performance etc. as appropriate.
- Student responses must be supported by explanatory notes, references, data and diagrams. Aspects of each of the three dimensions would be assessed.
- Recommended length: 3–5 minutes.

(Note: Multimodal presentations do not need to be conducted in front of the class or the teacher, e.g. the presentation might be pre-recorded and presented to the teacher on disc or sent as a file. A student response for a task in this category will depend on the instrument expectations and conditions, which may be negotiated with the teacher, and which may differ from student to student.

Student role

- Gather and sort information and data from a variety of sources, demonstrating appropriate referencing.
- Process relevant information and data that is based on the course subject matter, demonstrating an understanding of the meaning of ideas and information.
- Interpret, analyse and synthesise information and data.
- Explain relationships between information, data, concepts, principles and theories.
- Evaluate information and data, and justify ideas.
- Communicate ideas.

Teacher role

- Provide the research question or work with the student to develop a hypothesis.
- Allow sufficient class time for students to effectively undertake each component of the extended response. However, independent student time will be required to complete the instrument.
- Implement strategies to authenticate student work. Some strategies are annotated notes in response to issues that emerged during the extended response (e.g. journals, experimental logs), teacher observation sheets, research checklists and referencing, and reference lists.
- Consult, negotiate and provide feedback before and while students are working on the extended response to provide ethical guidance and to monitor student work. Provide feedback and assistance judiciously, gradually reducing support as students gain experience and confidence.
- Provide scaffolding. When an extended response task is undertaken for the first time, the scaffolding should help students complete the assessment by modelling the extended response task process. However, the scaffolding provided should not specify or lead the student through a series of steps dictating a solution.
- Provide learning experiences in the use of appropriate communication strategies.

5.6 Requirements for a student folio at exit

A folio of student work is required to support decisions and provide feedback to both parents and students. The folio will contain:

- evidence from two to three assessment instruments that demonstrate the standards, of which:
 - one is completed under supervised conditions so that student authorship has been authenticated
 - one is an extended response in which a student conducts research.

The exit folio may also contain additional evidence to support teacher judgments including:

- no more than two instruments completed outside the short course and for which student authorship has been authenticated
- no more than two informal instruments that demonstrate any of the dimensions.

These instruments will include documentation of student work and teacher judgments, including an instrument description, instrument-specific standards and annotated teacher comments reflecting the decisions made.

Assessment evidence of all of the objectives from each dimension must be provided in the student folio

5.6.2 Student profile

The purpose of the student profile is to record student achievement over the course of study. Key elements on the profile include:

- units/themes/topics
- assessment instruments
- standard achieved in each dimension for each instrument.

5.7 Exit standards

The purpose of standards is to make judgments about students' levels of achievement at exit from a course of study. The standards are described in the same dimensions as the assessable objectives of the syllabus. The standards describe how well students have achieved the objectives and are stated in the standards matrix.

The following dimensions must be used:

- Dimension 1: identifying and communicating mathematical information
- Dimension 2: problem-solving and mathematical processes
- Dimension 3: learning.

Each dimension should contribute equally to the determination of exit levels of achievement.

5.8 Determining exit levels of achievement

When students exit the course of study, the school is required to award each student an exit level of achievement from one of the five levels:

- Very High Achievement (VHA)
- High Achievement (HA)
- Sound Achievement (SA)
- Limited Achievement (LA)
- Very Limited Achievement (VLA).

Exit levels of achievement are summative judgments made when students exit the course of study. Judgments are based on exit folios providing evidence of achievement in relation to all objectives of the syllabus and the standards.

Determining a standard

The standard awarded is an *on-balance judgment* about how the qualities of the student's work match the standards descriptors overall in each dimension. This means that it is not necessary for the student to have met every descriptor for a particular standard in each dimension.

When standards have been determined in each of the dimensions for this subject, 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 dimensions for each level.

Awarding exit levels of achievement

VHA	Standard A in any two dimensions and no less than a B in the remaining dimension
HA	Standard B in any two dimensions and no less than a C in the remaining dimension
SA	Standard C in any two dimensions and no less than a D in the remaining dimension
LA	At least Standard D in any two dimensions
VLA	Standard E in the three dimensions

5.8.1 Standards matrix

Dimension	A	B	C	D	E
Identifying and communicating mathematical information	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> selection and effective use of mathematical information that is embedded in a broad range of texts and stimuli, including some that are unfamiliar and complex 	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> selection and use of mathematical information that is embedded in a range of familiar and some unfamiliar texts and stimuli 	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> selection and use of mathematical information that is embedded in some familiar and less familiar texts and stimuli 	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> narrow selection and use of mathematical information that is embedded in familiar texts and stimuli 	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> directed selection and use of mathematical information that is embedded in simple and familiar texts and stimuli
	<ul style="list-style-type: none"> accurate interpretation and use of whole numbers and fractions, decimal fractions and percentages embedded in a broad range of contexts, including some that are unfamiliar and complex 	<ul style="list-style-type: none"> interpretation and use of whole numbers and fractions, decimal fractions and percentages, embedded in a range of familiar and some unfamiliar contexts 	<ul style="list-style-type: none"> interpretation and use of whole numbers and familiar or routine fractions, decimal fractions and percentages, embedded in familiar or routine contexts 	<ul style="list-style-type: none"> identification and use of familiar whole numbers and simple, everyday fractions and percentages, embedded in familiar contexts 	<ul style="list-style-type: none"> identification of familiar whole numbers embedded in simple and familiar contexts
	<ul style="list-style-type: none"> effective use of oral and written informal and formal language, mathematical conventions, symbolism, abbreviations and diagrammatic representations to clearly communicate mathematical information and problem-solving process and results, in a broad range of contexts, including some that are unfamiliar and complex. 	<ul style="list-style-type: none"> use of oral and written informal and formal language, mathematical conventions, symbolism, abbreviations and diagrammatic representations to communicate mathematical information and problem-solving processes and results, in a range of familiar and some unfamiliar contexts 	<ul style="list-style-type: none"> use of oral and written informal and formal language, mathematical conventions, symbolism, abbreviations and diagrammatic representations to communicate mathematical information and problem-solving process and results, in familiar or routine contexts. 	<ul style="list-style-type: none"> variable use of oral and written informal and formal language, mathematical conventions, symbolism, abbreviations and diagrammatic representations to communicate simple mathematical information and problem-solving process and results, in familiar contexts. 	<ul style="list-style-type: none"> unclear use of oral and written informal and formal language, mathematical conventions, symbolism, abbreviations and diagrammatic representations, in simple and familiar contexts.

Dimension	A	B	C	D	E
Problem-solving and mathematical processes	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> • selection and application of a range of mathematical processes and methods of solution to solve complex familiar and some unfamiliar problems • critical reflection on outcomes and the appropriateness of mathematical processes to tasks to validate decisions. 	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> • selection and application of a range of mathematical processes and methods of solution to solve familiar and some unfamiliar problems • informed reflection on outcomes and the appropriateness of mathematical processes to tasks using estimation and other assessment skills. 	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> • selection and application of simple mathematical processes and methods of solution to solve familiar problems • reflection on outcomes and the appropriateness of mathematical processes to tasks using estimation and other assessment skills. 	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> • some selection and application of simple mathematical processes and methods of solution to solve some familiar problems • some reflection on outcomes and the appropriateness of mathematical processes to tasks using estimation. 	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> • directed selection and application of simple mathematical processes and methods of solution • cursory and unclear statements about outcomes and the appropriateness of mathematical processes to tasks.
Learning	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> • independent planning and application of practical strategies that facilitate learning in familiar and some unfamiliar contexts • independent evaluation and adaptation of learning strategies in a range of familiar and some unfamiliar contexts. 	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> • planning and application of practical strategies that facilitate learning in familiar and some unfamiliar contexts • evaluation and adaptation of learning strategies in a range of familiar and some unfamiliar contexts. 	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> • planning and application of practical strategies that facilitate learning in familiar contexts • evaluation and adaptation of learning strategies in a range of familiar contexts. 	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> • planning and application of practical strategies that facilitate learning in simple, familiar and predictable contexts • evaluation of learning strategies in simple, familiar and predictable contexts. 	<p>The student work has the following characteristics:</p> <ul style="list-style-type: none"> • simple planning and guided application of practical strategies that facilitate learning in simple, familiar and predictable contexts • directed evaluation of learning strategies in simple, familiar and predictable contexts.

6. Educational equity

Equity means fair treatment of all. In developing study plans 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 dimensions and standards stated in this syllabus. Syllabus dimensions 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 study plan:

ACACA 1995, Guidelines for Assessment Quality and Equity, available from <www.acaca.org.au>.

ANTA 2004, A Guide to Equity and the AQTF, available from Australian Training Products Ltd <www.atpl.net.au>.

QSA 2005, Policy on Special Consideration in School-based Assessments in Senior Certification; and 2005, Policy Statement: Equity, available from <www.qsa.qld.edu.au>.

EQ 2005, Inclusive Education Statement; and 2005, Education Policy and Procedures Register: Inclusive education, available from <<http://education.qld.gov.au/strategic/eppr>>.

QSCC 2001, Equity Considerations for the Development of Curriculum and Test Material, available from <www.qsa.qld.edu.au>.

QCEC 2001, Inclusive Practices in Queensland Catholic Schools, available from <www.qcec.qld.catholic.edu.au>.

7. Resources

Department of Education, Employment and Welfare 2008, *Australian Core Skills Framework*, Commonwealth of Australia, Canberra, available from:

<www.deewr.gov.au/Skills/Programs/WorkplaceEnglishLanguageandLiteracy/Documents/AustralianCoreSkillsFramework.pdf>

See the QSA website <www.qsa.qld.edu.au> for other resources.

8. Glossary

The following terms are used in the standards descriptors. They are degree words and refer to a valued element of assessment (e.g. significant (degree) information (element)) on which we make judgments about student work. The definitions are intended to help clarify the standards; teachers should refer to dictionary definitions for more detailed meanings.

In reading the standards, teachers should note that a higher standard subsumes a lower one.

Appropriate	Fitting
Complex	Relationships or interactions that have a number of elements or components
Critical	Rationally appraising for logical consistency and merit
Cursory	Hasty and superficial
Directed	Following the instructions of the facilitator
Effective	Meeting the assigned purpose
Familiar	Materials (including texts) or circumstances that have been the focus of classroom learning experiences
Guided	Work produced primarily in response to the facilitator's direction
Independent	Not relying on another (does not preclude advice and modelling)
Informed	Having relevant knowledge
Narrow	Limited in scope
Predictable	Familiar relationships or interactions that always yield the same result
Range	More than two, but applicable to the context under study
Relevant	Applicable and important
Simple	Not complex
Unfamiliar	Materials (including texts) or circumstances that have not been the focus of classroom learning experiences

Appendix 1: Sample course of study

Example 1: Self-directed student investigation

The teacher and the student identify an area of student interest, then create a learning and assessing plan with timelines and deadlines, including dates for monitoring progress. (Note: 5E Instructional Model from: Rodger W. Bybee et al. 2006, *The BSCS 5E Instructional Model: Origins, effectiveness, and applications—Executive summary*, BSCS, <www.bscs.org/pdf/bscs5eexecsummary.pdf>).

5E Instructional Model phase and summary	Possible learning experiences	Assessment opportunity/ mode	Facet of communication	Formal/ informal	Objective assessed
<p>Engagement — “The teacher or a curriculum task accesses the learners’ prior knowledge and helps them become engaged in a new concept through the use of short activities that promote curiosity and elicit prior knowledge. The activity should make connections between past and present learning experiences, expose prior conceptions, and organize students’ thinking toward the learning outcomes of current activities.”</p>	<p>The student, in consultation with the teacher:</p> <ul style="list-style-type: none"> • devises an issue of interest • raises questions and existing beliefs • negotiates assessment opportunities • creates a timeline for completion. 	<ul style="list-style-type: none"> • Observation and monitoring of student plan • Observation and interview 	<ul style="list-style-type: none"> • Personal • Cooperative • Procedural 	Informal	1
<p>Exploration — “Exploration experiences provide students with a common base of activities within which current concepts (i.e. misconceptions), processes, and skills are identified and conceptual change is facilitated. Learners may complete activities that help them use prior knowledge to generate new ideas, explore questions and possibilities, and design and conduct a preliminary investigation.”</p>	<p>The student researches issue/ topic by:</p> <ul style="list-style-type: none"> • examining relevant information from online or printed sources • categorising and collating relevant information • constructing a concept map • devising and implementing a survey for data collection • developing a budget. 	<ul style="list-style-type: none"> • Collation and presentation of information • Folio 	<ul style="list-style-type: none"> • Personal • Cooperative • Technical • Public 	Informal	3, 4, 5

5E Instructional Model phase and summary	Possible learning experiences	Assessment opportunity/ mode	Facet of communication	Formal/ informal	Objective assessed
<p>Explanation — “The explanation phase focuses students’ attention on a particular aspect of their engagement and exploration experiences and provides opportunities to demonstrate their conceptual understanding, process skills, or behaviours. This phase also provides opportunities for teachers to directly introduce a concept, process, or skill. Learners explain their understanding of the concept. An explanation from the teacher or the curriculum may guide them toward a deeper understanding, which is a critical part of this phase.”</p>	<p>The student describes and interprets the results of the exploration phase by:</p> <ul style="list-style-type: none"> • providing a brief summary of the materials • explaining their view and/or results to the teacher • presenting information using tables, graphs and short summary • constructing hypothesis/stance. 	<ul style="list-style-type: none"> • Written • Multimodal 	<ul style="list-style-type: none"> • Procedural • Technical • Systems 	Formal	4, 5, 6, 7
<p>Elaboration — “Teachers challenge and extend students’ conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills. Students apply their understanding of the concept by conducting additional activities.”</p>	<p>The student, in collaboration with the teacher, establishes a final assessment opportunity by:</p> <ul style="list-style-type: none"> • choosing a new context or aspect to extend their learning • deciding on a mode of assessment. 	<ul style="list-style-type: none"> • Written • Multimodal 	<ul style="list-style-type: none"> • Personal • Cooperative 	Formal	2, 3, 4, 5, 6, 7
<p>Evaluation — “The evaluation phase encourages students to assess their understanding and abilities and provides opportunities for teachers to evaluate student progress toward achieving the educational objectives.”</p>	<p>The student and teacher assess the student’s learning by:</p> <ul style="list-style-type: none"> • reflecting on the student’s project • comparing their learning at the beginning of the project with their learning at the end • multimodal presentation and handout. 	<ul style="list-style-type: none"> • Observation and interview 	<ul style="list-style-type: none"> • Personal • Cooperative 	Formal	1, 2

Appendix 2: Year 9 Numeracy Indicators

Year 9 Numeracy Indicators

Number

- Order and position positive and negative numbers, fractions, percentages, and numbers represented in whole powers, scientific/index notation, roots and ratios
- Read and make connections among different representations of numerals and words, whole powers, positive and negative numbers, percentages, scientific notation, roots and ratios
- Interpret fractions, decimals, ratios and percentages, including their equivalent values, to assist with calculations or estimations
- Identify personally preferred methods and combinations of strategies to solve problems, and estimate and explain a possible range of solutions
- Combine strategies and procedures to calculate solution/s to everyday problems, justify the method and record it in numbers
- Solve problems involving combinations of calculations using positive and negative numbers and decimals, including ratio, rate and percentage
- Check the reasonableness of solutions and review assumptions and methods of working
- Create word problems involving combinations of calculations, including ratio, rate and percentage, with positive and negative numbers and decimals, using materials, visuals and words to represent a given number sentence
- Evaluate personally significant financial situations involving interest rates and savings, purchasing and investing
- Convert rates and ratios to fractions (common, decimal) or percentages to assist with calculations, e.g. population growth, goods and services tax (GST)

Algebra

- Find unknown values, describes generalisations, and interpret relationships between different units, e.g. if 5 L is used in 200 km, 7 L will be used in ? km

Measurement

- Use known measures of attributes and relevant formulas to derive unknown measurements that cannot be directly measured
- Describe the effect of compounding errors in calculations involving measurements
- Compare, calculate and order durations of events involving hundredths of a minute

Year 9 Numeracy Indicators

Space

- Apply properties of angles and geometric features, including similarity, to draw and construct models involving 2D and 3D compound, truncated, and embedded shapes
- Interpret plans, maps and navigation displays, including electronic displays, to identify locations and describe movements

Chance and data

- Recognise and represent the probability of compound events, e.g. tossing two or more coins
- Evaluate and analyse data (census, sample) using measures of location and range, and by reviewing sample sizes and the reliability of the data

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