**Vocational specialisation:
Numeracy**

Draft study design
for consultation

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Important information

Accreditation period

Units 1–2: 1 January 20XX – 31 December 20XX
Units 3–4: 1 January 20XX – 31 December 20XX

Implementation of this study commences in 20XX.

Other sources of information

The [*VCAA Bulletin*](https://www.vcaa.vic.edu.au/news-and-events/bulletins-and-updates/bulletin/Pages/index.aspx) is the only official source of changes to regulations and accredited studies. The *Bulletin* regularly includes advice on VCE studies. It will also include advice on studies within the Vocational specialisation stream and the Foundation pathways certificate. It is the responsibility of each teacher to refer to each issue of the *Bulletin*. The *Bulletin* is available as an e-newsletter via free subscription on the VCAA’s website at: [www.vcaa.vic.edu.au](https://www.vcaa.vic.edu.au/Pages/HomePage.aspx).

An *Advice for Teachers* resource will be published to support the implementation of each study design. It will provide curriculum development and assessment advice for Units 1 to 4, including examples of teaching and learning activities and resources for each unit.

The *Advice for Teachers* will also provide advice to schools on opportunities to integrate units across the Vocational specialisation and Foundation pathways programs.

Assessment information will be provided for school-based assessment in Units 3 and 4 with advice for teachers on how to construct assessment tasks using suggested performance descriptors and rubrics.

The [VCE and VCAL Administrative Handbook](https://www.vcaa.vic.edu.au/administration/vce-vcal-handbook/Pages/index.aspx) will contain essential information on assessment processes and other procedures.

Senior secondary providers

Throughout this study design the term ‘school’ is intended to include both schools and non-school providers.

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Introduction

Scope of study

Numeracy focuses on enabling students to develop and enhance their numeracy practices to make sense of their personal, public and vocational lives. Students develop mathematical skills with consideration of their local, national and global environments and contexts and an awareness and use of appropriate technologies.

This study allows students to explore the underpinning mathematical skills and knowledge of number and quantity, measurement, shape, dimensions and directions, data and chance, the understanding and use of systems and processes, and mathematical relationships and thinking. This mathematical knowledge is then applied to tasks which are part of the students’ daily routines and practices, but also extends to applications outside the immediate personal environment, such as the workplace and the community.

The structure of this study aligns with other VCE Mathematics studies, ensuring a familiar format. There is a strong correlation between this numeracy study and Units 1 and 2 of Foundation Mathematics, where there is a strong emphasis on the use of mathematics in practical contexts encountered in everyday life in the community, at work and at study. The applied learning approach of numeracy ensures that the context leads the teaching of knowledge and skills, engaging students through real life experiences.

The contexts are the starting point and the focus and are framed in terms of personal, financial, civic, health, recreational and vocational classifications. These six numeracies are developed using a problem-solving cycle with four components:

* formulating
* acting on and using mathematics
* evaluating and reflecting
* communicating and reporting.

Rationale

Numeracy in the curriculum is viewed as using mathematics to make sense of the world and applying mathematics in a context for a social purpose. Numeracy gives meaning to mathematics and mathematics is the tool (the knowledge and skills) to be used efficiently and critically. Numeracy is concerned with dealing with situations that involve the use and application of a range of mathematical skills and knowledge which arise in a range of different contexts and situations.

Numeracy enables students to develop logical thinking and reasoning strategies in their everyday activities. It develops students’ problem-solving skills, allows them to make sense of numbers, time, patterns and shapes for everyday activities like cooking, gardening, sport and travel. Through numeracy, students will understand the mathematical requirements for personal organisation matters involving money, time and travel. They will be able to apply these skills to their everyday lives to recognise monetary value, understand scheduling and timetabling, direction, planning, monetary risk and reward.

Digital technology is integrated in the learning of mathematics processes throughout this study which is essential and vital for students’ preparation for vocational pathways. Technology is an integral part of everyday and working life in Australia. Handheld devices (e.g. tablets) are commonly used for multiple purposes: connectivity, communication, information, and as a tool for carrying out a myriad of functions. Software applications are available on a range of devices. Furthermore, there is an expectation that our students are ready with these skills when they transition to independent living, further study and employment.

Underpinned by applied learning

This numeracy curriculum is framed around an applied learning approach to teaching mathematics. Applied learning incorporates the teaching of skills and knowledge in the context of ‘real life’ experiences. Learners apply what they have learnt by doing, experiencing and relating acquired skills to the real-world. Applied learning emphasises the relevance of what is learnt in the classroom to the ‘real-world’ outside the classroom and makes that connection as immediate and transparent as possible.

Applied learning is about nurturing and working with a student in a holistic manner, taking into account their personal strengths, interests, goals and previous experiences. Applied learning values skills and knowledge that may not normally be the focus of more traditional school curricula. It also recognises differences in ways of learning. Real-life application will often require a shift from a traditional focus on discrete curriculum to a more integrated and contextualised approach to learning, as students learn and apply the skills and knowledge required to solve a problem, implement a project or participate in the workforce.

This numeracy curriculum acknowledges that part of the transition from school to further education and employment is the ability to participate and function in society as an adult. Moving students out of the classroom to learn also allows them to make the shift to become more independent and responsible for their own learning. Best practice applied learning programs are flexible and student-centred, where learning goals and outcomes are designed and negotiated with students.

Applied learning may also involve students and their teachers working in partnership with external organisations and individuals to access VET and work integrated learning placements. These partnerships provide the necessary contexts for students to demonstrate the relevance of the skills and knowledge they have acquired in their study and training.

Teaching and assessment approaches

The teaching, learning and assessment strategies should be based around applied learning principles. The cohort of students studying for the Numeracy curriculum have, in most cases, attended schools for at least ten years, and as such have already encountered much of the mathematics content that is covered in Units 1 and 2. However, it is likely to include students who have not successfully engaged with the mathematics content or curriculum and may well still be struggling with learning the foundations of mathematics and numeracy. This challenge needs to be acknowledged and addressed. An applied learning approach is appropriate in this regard, starting where the student is at in their knowledge and competency, and use relevant contexts and materials to enhance learning outcomes. Students should be assisted to make the connections between the mathematics world and their real-world application as well as making connections between different areas within mathematics.

A range of practices can be adopted including:

* using practical and ‘hands-on’ materials and resources – including out-of-class as well as classroom-based demonstrations, activities, investigations, and problem-solving
* using authentic materials rather than manufactured materials and word problems
* valuing students’ own approaches to solving problems including effective use of supporting technologies
* teaching concepts in contexts relevant to the students, utilising their backgrounds, interests and experiences – this should include putting mathematics into its historical and cultural context
* ensuring holistic teaching by integrating other skill areas into numeracy, such as adding oral communication skills and reading and writing skills into the numeracy curriculum
* raising awareness about social and community issues and practices that influence and impact on students’ lives
* ensuring that all students experience success in order to develop increased confidence
* using everyday language to convey mathematical ideas, concepts, and terminology that can be understood by students and applied by them in talking, reading, writing and listening, using authentic examples as much as possible
* encouraging and supporting students to learn through interaction and cooperation – via discussion, asking questions, giving explanations and presentations, and working cooperatively in pairs or small groups.

Aims

This study enables students to:

* develop and enhance their numeracy practices to help them make sense of their personal, public and vocational lives
* develop mathematical skills with consideration of their local, national and global environments and contexts, and an awareness and use of appropriate technologies
* meet the minimum standards to be tested by the GAT, a level of achievement equivalent to Level 3 of the Australian Core Skills Framework (ACSF). Students with a strong grasp of numeracy in Units 1 and 2 will be able to demonstrate the standard. Students with a strong grasp of numeracy in Units 3 and 4 will be able to demonstrate above the standard.

Structure

This study is made of four units. Each unit deals with specific content contained in areas of study and is designed to enable students to achieve the set of outcomes for that unit.

A glossary defining numerical and mathematical terms and notations used in this study design will be included in a companion *Advice for teachers* document.

The structure of this study aligns with other VCE Mathematics studies, ensuring a familiar format.

This Numeracy study design is designed around four complementary and essential components:

1. **Outcome 1** is framed around six different numeracies:
2. Personal numeracy
3. Civic numeracy
4. Financial numeracy
5. Health numeracy
6. Vocational numeracy
7. Recreational numeracy.
8. **Outcome 2** elaboratesand describes a four-stage problem-solving cycle that underpins the capabilities required to solve a mathematical problem embedded in the real-world.
9. **Outcome 3** expects students to develop a technical mathematical toolkit to use as they undertake their numeracy activities and tasks. Students should be able to confidently use multiple mathematical tools, both analogue and digital/technological.
10. **Eight areas of study** name and describe a range of different mathematical knowledge and skills that are expected to be used and applied across the three outcomes.

Schools and teachers must follow these guidelines when delivering the units:

* Each unit must include three of the six numeracies.
* All six numeracies must be covered over Units 1 and 2, and Units 3 and 4.
* All eight areas of study must be covered across Units 1 and 2, and Units 3 and 4.
* Either one or two areas of study are required per numeracy.
* A minimum of four and a maximum of six areas of study per unit are required.

The following table provides an overview of this:

|  |
| --- |
| Outcome 1 |
|  | **Unit 1 or 3** | **Unit 2 or 4** |
| **Numeracy** | **Numeracy** | **Numeracy** | **Numeracy** | **Numeracy** | **Numeracy** |
| **Areas of study** | Number |  |  |  |  |  |  |
| Data  |  |  |  |  |  |  |
| Dimension and direction |  |  |  |  |  |  |
| Shape |  |  |  |  |  |  |
| Quantity and measures |  |  |  |  |  |  |
| Change  |  |  |  |  |  |  |
| Uncertainty  |  |  |  |  |  |  |
| Systems  |  |  |  |  |  |  |

Flexible delivery

Numeracy has been designed so Units 1 and 2 can be undertaken as stand-alone units or concurrently. Units 3 and 4 must be undertaken as a sequence.

Numeracy units have been designed to complement the full suite of Vocational specialisation studies to ensure it is possible to deliver the units in an integrated approach. Flexible delivery of the Vocational specialisation units allows for integration of complementary outcomes across the studies.

Teaching programs can be structured so students can undertake programs and projects that combine acquisition and application of knowledge and skills across several of the Vocational specialisation units. Integration of teaching and learning materials and activities can increase understanding and application of general concepts, develop multiple perspectives and points of view, increase the ability of the student to make decisions, to think critically and creatively and build skills in problem solving. It may also enhance a learner’s ability to transfer knowledge learned in one study to other aspects of their life. Through integration of units more opportunities for collaboration and team projects will be possible.

In an integrated program approach students will still need to meet the individual outcomes, including key knowledge and key skills, for each of the units of study. Teachers should keep clear documentation of the student’s achievement of the individual outcomes within an integrated teaching and learning program.

Entry

There are no prerequisites for entry into Units 1, 2 and 3. Students must undertake Unit 3 and Unit 4 as a sequence.

Duration

Each unit involves at least 50 hours of scheduled classroom instruction over the duration of a semester.

Changes to the study design

During its period of accreditation minor changes to the study will be announced via the [*VCAA Bulletin*](https://www.vcaa.vic.edu.au/news-and-events/bulletins-and-updates/bulletin/Pages/index.aspx). The *Bulletin* is the only source of changes to regulations and accredited studies. It is the responsibility of each teacher to monitor changes or advice about studies published in the *Bulletin*.

Monitoring for quality

The VCAA will conduct monitoring and quality assurance processes on an annual basis.

Safety and wellbeing

It is the responsibility of the school to ensure that duty of care is exercised in relation to the health and safety of all students undertaking the study.

Employability skills

This study offers a number of opportunities for students to develop employability skills. The *Advice for Teachers* companion document will provide specific examples of how students can develop employability skills during learning activities and assessment tasks.

Legislative compliance

When collecting and using information, the provisions of privacy and copyright legislation, such as the Victorian *Privacy and Data Protection Act 2014* and *Health Records Act 2001*, and the federal *Privacy Act 1988* and *Copyright Act 1968*, must be met.

Assessment and reporting

Satisfactory completion

The award of satisfactory completion for a unit is based on the teacher’s decision that the student has demonstrated achievement of the set of outcomes specified for the unit. Demonstration of achievement of outcomes and satisfactory completion of a unit are determined by evidence gained through the assessment of a range of learning activities and tasks.

Teachers must develop courses that provide appropriate opportunities for students to demonstrate satisfactory achievement of outcomes.

The decision about satisfactory completion of a unit is distinct from the assessment of levels of achievement. Schools will report a student’s result for each unit to the VCAA as S (Satisfactory) or N (Not Satisfactory).

Evidence for assessment

The evidence for assessment provides examples of evidence that a student may use to demonstrate achievement of the set of outcomes specified for the unit. Suggested assessment tasks are also included that may be used to facilitate a student’s demonstration of achievement.

Levels of achievement

Units 1 and 2

Procedures for the assessment of levels of achievement in Units 1 and 2 are a matter for school decision. Assessment of levels of achievement for these units will not be reported to the VCAA. Schools may choose not to have levels of achievement, or may choose to report levels of achievement using grades, descriptive statements or other indicators.

Units 3 and 4

Procedures for the optional assessment of levels of achievement in Units 3 and 4 are being considered and more information will be available in due course.

It is expected that the student’s level of achievement in Units 3 and 4 will be based on evidence from coursework.

Authentication

Work related to the outcomes of each unit will be accepted only if the teacher can attest that, to the best of their knowledge, all unacknowledged work is the student’s own. Teachers need to refer to the [*VCE and VCAL Administrative Handbook*](https://www.vcaa.vic.edu.au/administration/vce-vcal-handbook/Pages/index.aspx) for authentication procedures.

Units 1 and 2

In Units 1 and 2 students develop and enhance their numeracy practices to make sense of their personal, public and vocational lives. Students develop mathematical skills with consideration of their local, community, national and global environments and contexts and an awareness and use of appropriate technologies.

These units provide students with the fundamental mathematical knowledge, skills, understandings and dispositions to solve problems in real contexts for a range of workplace, personal, further learning and community settings relevant to contemporary society.

Outcomes

For Units 1 and 2 the student is required to demonstrate achievement of three outcomes. As a set these outcomes encompass all of the areas of study for the unit.

At the end of Units 1 and 2, students should be able to select the appropriate method or approach required, attempt a series of operations or tasks, and communicate their ideas in multiple formats, including verbal and written form. Students should also be at ease with straightforward calculations manually and/or using technology.

Outcome 1

On the completion of this outcome the student should be able to apply their numeracy capabilities developed from the areas of study.

The purpose of Outcome 1 is to focus the teaching and learning on supporting and enabling students to develop a range of different numeracy skills and capabilities in order to make sense of their daily personal, public and vocational lives.

Outcome 1 describes the range of contexts that are the starting points, and hence the focus, for developing the student’s numeracy and mathematical skills. These six numeracies cover personal, financial, civic, health, recreational and vocational contexts where a range of mathematical skills are situated and embedded.

Structure of Outcome 1

Outcome 1 is framed around six different numeracies:

1. **Personal numeracy** relates to the mathematical requirements for personal organisational matters involving money, time and travel.

Personal numeracy relates to understanding, using, and interpreting numerical and mathematical information presented and embedded in different formats and media, in order to undertake personally relevant activities in familiar situations.

The understanding, use and interpretation of personal numeracy can be drawn from the following examples, but is not limited to:

* numerical information embedded in print and digital media, including monetary values
* time and dates, including digital and analogue time, and elapsed time
* timetabling and shift work such as retail or hospitality
* direction and locational materials (such as printed and online maps, building location diagrams and GPS displays) and planning, describing and following oral and written directions such as tours, holidays and excursions
* personal and home/family day-to-day tasks such as cooking, gardening, sport, travel
* risk and reward with money such as investing.
1. **Civic numeracy** relates to participating in civic life through knowing how to stay informed, and understanding governmental and societal data, information and processes.

Civic numeracy includes understanding, interpreting and critically evaluating statistical and quantitative information often presented in news and media reports, and other data-related arguments to meet the demands and challenges of life at local, state, national and global levels. It can incorporate the understanding, use and interpretation of quantitative and statistical information and related arguments.

The understanding, use and interpretation of civic numeracy can be drawn from the following examples, but is not limited to:

* opinion polls in the media
* government and political related information and arguments, including advertising, elections and voting
* social and environmental issues such as climate change, human rights, animal rights
* managing personal social responsibilities and obligations
* local, national and global environmental issues
* statistical monitoring of people’s lives, their use of devices and any actions made based on such data
* basic economic data including unemployment rates, underemployment, participation rates, inflation and official interest rates.
1. **Financial numeracy** relates to understanding and undertaking financial transactions and making informed judgements and decisions regarding the use and management of money.

Financial numeracy involvesmanaging relevant personal, social or work-related financial costs, charges, income and expenditure.

The understanding, use and interpretation of financial numeracy can be drawn from the following examples, but is not limited to:

* personal banking such as savings, debit, credit and setting up savings plans
* occupational income and expenses, including work related budgets, penalty rates
* government financial systems such as taxation, GST, student loans and superannuation
* utility and other relevant personal or family bills and charges, and comparing providers
* personal loans such as car loan, buy now pay later apps and store credit, use of online interest calculators
* pitfalls of credit, interest on credit, minimum payments versus paying off credit, money safety, online safety and scams
* costs and purchases such as new versus second-hand, mark-ups and markdowns, and comparative prices including overseas versus local.
1. **Health numeracy** relates to accessing, understanding and using mathematical information to make decisions, and to take action about health, healthcare and well-being.

Health numeracyinvolves being able to use mathematics to manage one’s own health, safety and well-being, alongside being aware of such issues from a community or a work-related perspective.

The understanding, use and interpretation of health numeracy can be drawn from the following examples, but is not limited to:

* nutrition or fitness, including setting goals, tracking data and understanding the issues
* social health issues such as drinking, safe driving, obesity, drugs
* health and safety at work such as accident types, rates and causes, audits of workplace chemicals and comparison with home-based chemicals
* medical data within a hospital/doctor setting such as typical blood pressure, heart rate, respiration rate, temperature
* publicly available medical and health information, data and advice, for example, in relation to maintaining a healthy lifestyle including healthy eating/diet, exercise, or diseases and pandemics
* self medical care, such as the use and dosages of medications, including scheduling
* health and safety matters related to potential accidents and use of chemicals.
1. **Vocational numeracy** relates to effectively participating in work life and managing the demands of work and/or vocational training.

Vocational or work-related numeracy relates to undertaking the required tasks and activities in a work-related context, such as using different workplace tools, applications and processes/systems, following and giving directions, participating in quality assurance processes and data collection, and reading workplace documents and information.

The understanding, use and interpretation of vocational numeracy can be drawn from the following examples, but is not limited to:

* workforce comparisons from past practices (pre-digital) to current (digital) such as time to complete tasks and effort involved
* reading or creating tables and charts to give or follow workplace directions such as numbers, ratios to mix chemicals or for handling hazardous chemicals or substances
* occupational health and safety or quality assurance data requirements
* workplace specific plans, diagrams, formulae, ratios
* different technological, digital or analogue measuring and processing devices, tools and applications
* tolerances and levels of accuracy and the implications of incorrect applications or mixing of chemicals
* recording information and data or following and giving directions.
1. **Recreational numeracy** relates to the many mathematical aspects of recreational activities including but not limited to sport and social media.

Recreational numeracyencompasses not only physical exercise and sport, but also aspects of personal time spent on non-work activities such as indoor and outdoor pursuits, arts, social media, and interests. It also covers community, cultural or religious activities.

The understanding, use and interpretation of recreational numeracy can be drawn from the following examples, but is not limited to:

* the planning of an activity or event including costings, steps and processes
* comparison of planning and costs of different party venues such as a birthday party
* dimensions and specifications of playing areas such as the size of a netball court, chess board, a multipurpose court
* dimensions and specifications of art and craft products being planned or created such as photo sizes, dresses/costumes, furniture
* rules and game scoring systems and formulae, penalties, fines, timing
* statistical and data collection measures around recreational activities and events
* use and overuse of recreational activities and associated dangers.

**Note:** each of the numeracies can also apply to the world of work and vocational education and training.

Selecting numeracies for Units 1 and 2

Across Units 1 and 2 all of the six numeracies must be covered. The order in which this is done and how this is combined with the underpinning mathematical knowledge and skills, as described in the areas of study, is decided by the school and the teachers. This flexibility is an essential part of an applied learning approach.

These combinations can therefore be selected based on the needs and interests of the student cohort and its community, and related vocational and work options.

Schools and teachers must make their selection of numeracies based on the following guidelines:

* Each unit must include three of the six numeracies.
* All six numeracies must be covered over Units 1 and 2.
* All eight areas of study must be covered over Units 1 and 2.

This table provides an overview for schools and teachers in selecting numeracies for Units 1 and 2:

|  |  |
| --- | --- |
| Numeracies | Areas of study |
| **Unit 1, Outcome 1** |
| Select three of the following six numeracies for Unit 1:1. Personal numeracy
2. Civic numeracy
3. Financial numeracy
4. Health numeracy
5. Vocational numeracy
6. Recreational numeracy
 | * Select one or two areas of study to support the chosen numeracy.
* Select a minimum of four and a maximum of six areas of study for Unit 1:
* Area of study 1: Number
* Area of study 2: Data
* Area of study 3: Dimension and direction
* Area of study 4: Shape
* Area of study 5: Quantity and measures
* Area of study 6: Change
* Area of study 7: Uncertainty
* Area of study 8: Systems
 |
| **Unit 2, Outcome 1** |
| Select the three remaining numeracies for Unit 2:1. Personal numeracy
2. Civic numeracy
3. Financial numeracy
4. Health numeracy
5. Vocational numeracy
6. Recreational numeracy
 | * Select one or two areas of study to support the chosen numeracy.
* Select a minimum of four and a maximum of six areas of study for Unit 2:
* Area of study 1: Number
* Area of study 2: Data
* Area of study 3: Dimension and direction
* Area of study 4: Shape
* Area of study 5: Quantity and measures
* Area of study 6: Change
* Area of study 7: Uncertainty
* Area of study 8: Systems

*Ensure all areas of study have been covered over the two units.* |

Connecting the numeracies with the mathematical content in the areas of study

The following table provides an example of a learning program that covers the eight areas of study.

|  |
| --- |
| Outcome 1 |
|  | **Unit 1** | **Unit 2** |
| Personal | Civic | Financial | Health | Vocational | Recreational |
| **Areas of study** | Number |  |  | ✓ |  |  |  |
| Data  | ✓ | ✓ |  | ✓ |  |  |
| Dimension and direction |  |  |  |  | ✓ |  |
| Shape |  |  |  |  |  | ✓ |
| Quantity and measures |  | ✓ |  |  | ✓ |  |
| Change  |  |  | ✓ |  |  |  |
| Uncertainty  |  |  |  | ✓ |  |  |
| Systems  | ✓ |  |  |  |  |  |

Outcome 2

On completion of this outcome the student should be able to use the problem-solving cycle (formulate, act on and use mathematics, evaluate and reflect, and communicate and report) in an applied learning context, relevant to the key skills and knowledge reflected in the areas of study and the numeracies in Outcome 1.

The purpose of Outcome 2 is to enable students to develop their everyday numeracy skills and practices to make sense of their daily personal, civic and vocational lives. Students need to develop the skills and capabilities to be able to problem-solve, and to use their skills to investigate and solve a problem where the mathematics is embedded in a real-world context. Outcome 2 describes and outlines a problem-solving cycle that supports students to become more capable problem solvers, and to use their mathematical skills successfully to become numerate individuals within the community and in their selected vocations.

Given that the contexts will be the starting point, students need to be taken through a structured problem-solving cycle, in order to know how to move from the real-world context to the mathematical world and apply their mathematical knowledge to solve the mathematical problem at hand. Part of solving any such embedded problem is to be able to reflect and evaluate the outcomes, and to then communicate and report on what was done and the results.

The problem-solving cycle underpinning the curriculum has four distinct components of formulating, acting on and using mathematics, evaluating and reflecting, followed by communicating and reporting on the results.

These four components are represented in the figure below.



*Structure of Outcome 2*

The elements and their performance criteria are organised under four classifications to match the problem-solving cycle:

1. **Formulate**: identify, select and interpret mathematical information embedded in a real-world context and decide what mathematics to use.
2. **Act on and use mathematics**: perform mathematical actions and processes in order to complete tasks. This includes the use and application of a range of technologies.
3. **Evaluate and reflect**: check and reflect on the mathematical problem-solving processes and the results in relation to the real-world context.
4. **Communicate and report**: use a combination of informal and formal mathematical representation to document and report outcomes and results.
5. Formulate

When mathematical problems are embedded within real-world contexts, students need to identify the essential features to be accommodated when transforming the real-world situation into a mathematical problem. This requires students to identify and name the mathematics embedded in the context or scenario and to make decisions about how the task can be best approached and solved mathematically. Students need to develop a plan of the actions they need to undertake, including providing an overview of the scenario and any related background information, and specify the related mathematical questions of interest, conjectures, or hypotheses.

1. Act on and use mathematics

This stage of the problem-solving cycle involves undertaking the mathematical aspects of the task identified in the previous stage. It requires the utilisation of mathematical processes and problem-solving techniques, facts, and procedures in order to solve the problem, and selection and use of appropriate tools, representations and technologies. For example, students may need to undertake measurements; perform calculations; select and solve equations; make logical deductions from mathematical assumptions; perform symbolic manipulations; create and extract information from mathematical tables and graphs; represent and manipulate geometrical objects in 2D and 3D; or analyse data.

1. Evaluate and reflect

Responses to real-world numeracy tasks, including any mathematical solutions and results, judgements, decisions, or conclusions, require critical review, reflection and evaluation. Any results should be checked and evaluated against the original situation in terms of its reasonableness and relevance as to its final solution; with comparisons made to the initial estimates before decisions are made to accept the solution and/or make revisions and adjustments before presenting the final solutions. In cases where decisions or judgements are being made about the solution, other factors might also be considered, such as social or economic consequences. These processes are often referred to as contextual judgements.

1. Communicate and report

The results of any numeracy task require a summary of the work to be compiled and developed, including the presentation and interpretation of the findings from the mathematical activities and related applications. This stage requires students to prepare a range of representations to communicate the mathematical results. This will involve both oral and written language, and the use of formal and informal mathematical visualisations and representations including the use of a range of different formats, media, or technologies.

Outcome 3

On completion of this outcome the student should be able to apply the appropriate mathematical tool to undertake the numeracy tasks required in Outcomes 1 and 2. The toolkit should be applied and should underpin all learning and teaching activities in both Outcomes 1 and 2.

The purpose of Outcome 3 is for students to develop a mathematical toolkit to use where necessary as they undertake their numeracy practices, activities and tasks. At the end of Units 1 and 2, students should be productive and informed users of both analogue and digital technologies with the ability to select and effectively use a wide range of appropriate mathematical tools (analogue and digital/technological) to solve and communicate mathematical problems embedded in practical contexts.

A student’s toolkit should include: existing, traditional tools such as measuring equipment (e.g. tape measures, rulers, kitchen scales); software applications such as spreadsheets; and a range of new and emerging devices and applications from across different technologies (e.g. measurement, angle and level apps available through technological devices). Students should be ready to adapt to emerging technologies into the future, for example, the use of drones and mobile technologies to measure and quote for jobs; or the use of internet applications (such as measuring and photography apps) for costing and ordering of materials for an onsite job.

In undertaking their numeracy tasks and activities as part of Outcomes 1 and 2, students should demonstrate understanding and knowledge of the following:

* contemporary technological and online and digital media, including software and applications based on computers, tablets, calculators and hand-held devices and the accuracy, relevance, appropriateness and validity of their use and application
* keeping abreast of emerging technologies and their use and representations
* a range of analogue and digital tools which may include tools such as manipulatives, clocks, tape measures, tools of trade and industry
* a range of digital tools which may include mobile technology, software (including spreadsheets) and applications
* the conventions and use of such analogue and digital tools appropriate to the individual, community and workplace, and comparisons between technologies
* the conventions and language for the representations of mathematical and statistical information, objects and processes, using different technologies and digital media
* the numerical, graphical, symbolic, geometric and statistical functionalities of this range of technologies for working mathematically
* the conditions and settings including accuracy for a given purpose, and for effective and appropriate application of a given technology and its functionality
* awareness of online safety when using technologies.

Students should demonstrate competence in the following skills:

* use a range of both analogue and digital/technological tools and devices to carry out tasks and derive results
* use technology to carry out computations and analysis
* use technology to visualise and represent information, such as to produce diagrams, tables, charts, infographics, and graphs which model situations and solve practical problems
* use technology to help interpret and communicate the results of a numeracy task
* understand accuracy and error with different technologies and its implications for results
* make decisions regarding inputs into technology and then evaluate and discuss the outputs of technology
* reflect on and evaluate use of tools and technology used in relation to comparing estimates to results
* reflect on and evaluate any tools and technologies used and the outcomes obtained relative to personal, contextual, and real-world implications, appropriateness, and reasonableness.

**Note:** Outcome 3 should be applied and underpin all learning and teaching activities in both Outcomes 1 and 2.

Areas of study

The areas of study name and describe a range of different mathematical knowledge and skills that are expected to be used and applied across the three outcomes. There are eight areas of study:

* Area of study 1: Number
* Area of study 2: Data
* Area of study 3: Dimension and direction
* Area of study 4: Shape
* Area of study 5: Quantity and measures
* Area of study 6: Relationships
* Area of study 7: Uncertainty
* Area of study 8: Systematics

Selecting the areas of study

Students will cover the eight areas of study at least once across Units 1 and 2.

Areas of study are to be selected to support the teaching and learning for each of the six numeracies, as appropriate to the situations and contextual problems being solved. The order in which the areas of study are taught, and how they are combined with other areas of study, is decided by the school and the teachers. This flexibility is an essential aspect of an applied learning approach.

These combinations can therefore be based on the needs and interests of the student cohort and related vocational and work requirements.

Schools and teachers must make their selection of the areas of study based on the following guidelines:

* Each unit must include three numeracies.
* All six numeracies must be covered across Units 1 and 2.
* Select either one or two areas of study to support each selected numeracy.
* Select a minimum of four and a maximum of six areas of study per unit.

Area of study 1: Number

This area of study seeks to develop students’ number sense through meaningful application of numeracy practices to a range of contexts where whole numbers, fractions, decimals and percentages are used. Students should select the appropriate method or approach required and communicate their ideas. They should be at ease with performing straightforward calculations both mentally, manually and using software tools and devices.

Key knowledge

* whole numbers and decimals up to two places
* place value and reading numbers expressed in digits or words
* multiplication facts and knowledge of factors and multiples
* rounding whole numbers and decimals up to two places
* order of operations
* common fractions and percentages, and their equivalence such as ¼ = 0.25 = 25%; 1/10 = 0.1 = 10%.

Key skills

* demonstrate an understanding of reading numbers, place value and decimal place value, including rounding to two decimal places
* use the order of operations to solve a range of practical calculations with whole numbers and common decimals and fractions
* solve problems involving common fractions and decimals; for example: half, quarter, third, fifth and equivalent decimals
* calculate common percentages of numbers, and increase and decrease numbers by common percentages.

Area of study 2: Data

Data can be found in everyday life, workplaces and society. Students are to be able to collect, represent and undertake common analyses of data to look for patterns in data and derive meaning from data sets located within familiar and routine contexts. Data should be examined for comparison and analysis. Students should draw conclusions from the data and be confident to describe general patterns and trends.

Key knowledge

* simple data collection tools and processes
* display of data with commonly used tables and graphs, including use of axes and simple scales
* simple measures of spread, such as range
* interpretation and description of familiar and simple data sets and their displays.

Key skills

* collect, collate and organise familiar and simple data sets, and display these choosing and using the most appropriate format, including axes and simple scales
* choose and find simple common measures of spread for contextual data sets; for example, range of data
* identify key facts from tables and graphs
* read and interpret results from familiar and simple data presented in both graph and table form, including describing general patterns and trends.

Area of study 3: Dimension and direction

The study of dimension includes understanding of space, direction and location in relation to common landmarks and key compass directions. Students should be able to give and follow directions to locations based on digital and printed maps and diagrams. The study of dimension also includes common and routine angles with degrees and an awareness of the one-, two- and three-dimensions of space.

Key knowledge

* location and direction in relation to everyday, familiar objects and landmarks
* location and direction in relation to everyday, familiar maps and technologies
* everyday, familiar oral and written instructions for moving to specified locations
* everyday angles such as 45, 90, 180 and 360 degrees.

Key skills

* find and locate places of interest on maps and describe location in relation to other objects and landmarks using appropriate maps or technology
* determine and give or follow everyday straightforward instructions to move between familiar locations
* identify everyday compass directions such as N, S, W, E, NE, SE
* identify and demonstrate an understanding of everyday angles such as 45, 90, 180 and 360 degrees
* understand where an object is in space using one-, two- and three-dimensions and everyday, familiar language such as up, down, left, right, in front, behind to describe position and location in space.

Area of study 4: Shape

This area of study includes the recognition, description and naming of common two- and three-dimensional shapes. Students should be able to classify, manipulate, represent and construct common and familiar shapes in diagrammatical and concrete forms. This area also includes common characteristics and properties used in classifying shapes.

Key knowledge

* properties and names of two-dimensional shapes and everyday, familiar three-dimensional objects such as regular prisms; for example, boxes, cylinders
* simple reflection, rotation and symmetry in relation to everyday, familiar shapes
* patterns in, and between, everyday and familiar shapes
* appropriate technologies that create and manipulate simple two-dimensional shapes
* simple scaling in relation to having a sense of enlargement and reduction such as in plans, diagrams, photographs.

Key skills

* describe and classify common and familiar two- and three-dimensional shapes, including the use of appropriate technology
* demonstrate an understanding of reflection, rotation and symmetry of simple familiar shapes
* create common and familiar two- and three-dimensional shapes and describe the relationship between these, including through the use of technology
* determine and name patterns of common and familiar shapes such as in engineering, architecture and design; for example, bridges, buildings, sculptures.

Area of study 5: Quantity and measures

This area of study includes an understanding of routine and familiar metric quantities and their units of measurement applied to single- and multi-step measurement tasks. Students will conduct estimations of measurements, undertake routine measurements, perform measurement calculations, and convert units within the metric system with the embedded use of different technologies.

Key knowledge

* common and familiar measures of distance, perimeter, area, volume and capacity (for simple rectangular based shapes only)
* common and familiar metric units of measurement and conversion between metric units
* common units of time and temperature
* common measurement estimation strategies
* common measurement tools
* understanding of appropriate accuracy in measurements.

Key skills

* estimate and measure familiar objects and distances by using measurement tools
* undertake common calculations to determine measurements of distance, perimeter, area, volume and capacity, related to common two- and three-dimensional objects
* convert with one step calculations between common units of metric measurement such as, millimetres, centimetres, metres, kilometres, grams, kilograms, millilitres, litres, and degrees Celsius
* read and interpret units of analogue and digital time and temperature
* perform simple calculations using units of time, including calendar months, weeks, days, hours, minutes, and seconds.

Area of study 6: Relationships

This area of study encompasses the recognition, understanding and representation of simple patterns of relationship and change in mathematical terms where it exists in common and familiar contexts and applications. Students should be able to recognise when change is occurring, be able to identify common and simple mathematical relationships and variables, and apply the most appropriate process or processes to determine the results of change.

Key knowledge

* common and familiar relationships such as rates of change, $/m, km/hr
* simple, common and familiar algebraic formulae, relationships and algebraic expressions such as for the area and perimeter of a rectangle, and cost per hour
* standard conventions used in the development, use and writing of simple, everyday algebraic relationships
* representation and visualisation of change such as tables, simple charts or graphs.

Key skills

* recognise and represent relationships with simple mathematical expressions, or simple pictorial or graphical representations
* demonstrate simple algebraic substitution with simple formulae to find solutions to everyday problems
* use and apply rates in familiar situations such as $/m, km/hr
* apply simple formulae to find solutions to everyday problems such as area, amounts or costings.

Area of study 7: Uncertainty

This area of study includes the basic concepts and everyday language of chance. Students should be able to make mathematical predictions about the likelihood of common and familiar events occurring or not occurring. They should be able to consider conclusions from familiar known events or data, and make very simple inferences.

Key knowledge

* likelihood of common and familiar events or occurrences happening
* common and familiar language of chance and its relationship to common numerical values associated with chance, such as “even chance” = 0.5 or 50%
* simple and familiar unconditional probability events with randomness and chance
* simple inferencing from likelihood estimates to inform decision making in relation to common and familiar events such as rolling dice, or spinners.

Key skills

* estimate and identify likelihood of common and familiar events occurring using simple fractions, decimals or percentages such as $\frac{1}{2},$ $\frac{1}{3}$, $\frac{1}{5}$, 0.5, 50%
* identify sample spaces or options for common and familiar events or occurrences
* recognise that the likelihoods of events occurring can differ and have a basic understanding of how to reduce or increase the likelihood of an event occurring.

Area of study 8: Systematics

This area of study encompasses the understanding of inputs and outputs of technology that can be used in everyday lives for the purposes of planning, collecting, sorting, or categorising common and familiar quantitative or mathematical data and information. Students should be able to choose a number of inputs of familiar data, compare the outputs and results, and understand the representations and any summary information derived from the technology.

Key knowledge

* common and familiar information and data inputs and outputs
* common and familiar computational data collection tools and applications
* collating, organising, categorising, planning, scheduling and table creation of common and familiar information and data using technology.

Key skills

This area of study will include the use of technology (such as spreadsheets, software, mobile technologies, and apps) to:

* create tables to collate, organise and input or record common and familiar data and information
* arrange and sort simple and familiar data and information
* use systems to plan and schedule common and familiar actions
* read inputs and interpret outputs such as from interactive maps, PTV, online calculators/applications/planners
* adjust variables of inputs to optimise outputs and solutions for common and familiar situations and contexts.

Assessment

The award of satisfactory completion for a unit is based on whether the student has demonstrated the set of outcomes specified for the unit. Teachers should use a variety of learning activities and assessment tasks that provide a range of opportunities for students to demonstrate the key knowledge and skills in the outcomes.

The areas of study, including the key knowledge and key skills listed for the outcomes, should be used for course design and the development of learning activities and assessment tasks. Assessment must be a part of the regular teaching and learning program and should be completed mainly in class and within a limited timeframe.

All assessments in Units 1 and 2 are school-based.

Demonstration of achievement of all outcomes should be based on the students’ performance on a selection of evidence from across the three outcomes:

* each of the six numeracies
* the problem-solving cycle
* the use of technologies.

Assessment should be an ongoing process which integrates key knowledge and skills with practical applications over a period of time. It will require a combination of evidence collected through teacher observations along with the collection of records of students’ work.

Assessment could consist of a combination of the following, but is not limited to:

* Investigations and projects; for example a diary on a “week in the life of me”, outlining budgets (pay rates and tax), travel (how do I get places), shopping (best deals).
* Multimedia presentation or oral report; for example an outline of food requirements for an athlete preparing for their sport including nutrition, recipes, calories required and exerted, energy requirements, and measurements including distances.
* Interview or role play; for example students may prepare job interview questions and responses to include details on scheduling a diary and planning, what resources are needed using data and tables, and understanding cost calculations.

Where teachers allow students to choose between tasks, they must ensure that the tasks they set are of comparable scope and demand.

Evidence for assessment

It is expected that all of the performance criteria in the table below be covered at least once across the different numeracy tasks for each unit. However it is not expected that all of the performance criteria are covered in each investigation or School-assessed coursework task.

|  |  |
| --- | --- |
| **Element** | **Performance Criteria** |
| Elements describe the essential outcomes. | Performance criteria describe the performance needed to demonstrate achievement of the element. |
| 1. *Formulate:* identify, select, and interpret mathematical information embedded in a numeracy context and decide what mathematical knowledge and skills to use to solve the problem.
 | 1.1 Decide on the purpose of the task and the questions to be posed and answered.1.2 Identify and interpret the relevant mathematical information embedded in the selected numeracy context and materials. 1.3 Describe and define the mathematical operation(s), processes and tools needed to solve the problem.1.4 Plan activities to be undertaken to perform the mathematical actions. |
| 1. *Act on and use mathematics:* perform relevant mathematical actions and processes in order to complete the numeracy task
 | 2.1 Select and implement appropriate mathematical problem-solving processes for completing the numeracy task. 2.2 Undertake estimations required prior to completing the numeracy task.2.3 Select and use appropriate technology, tools and applications to complete numeracy task.2.4 Undertake relevant mathematical actions, processes and calculations to complete the numeracy task. |
| 1. *Evaluate and reflect:* check and reflect on mathematical results
 | 3.1 Check and reflect on estimations, actions and any calculation outcomes to see if results are as expected.3.2 Review and reflect on appropriateness and reasonableness of results from the numeracy task and adjust if necessary. |
| 1. *Communicate and report*: use informal and formal mathematical representation to document and report outcomes and results
 | 4.1 Use informal and formal written mathematical representation to document and report on the mathematical processes used and the results of the numeracy task.4.2 Use informal and formal oral mathematical language to present and discuss the mathematical processes used and the results of the numeracy task.4.3 Use of a range of different formats, devices or technologies to represent and document the numeracy task. |

Range of performance statements for Outcome 2: Units 1 and 2

The table below specifies the range of actions, the complexity of the numeracy tasks and the levels of performance that are expected for students studying Units 1 and 2 for each of the above elements and performance criteria. It also indicates the levels of support that teachers can provide.

|  |  |
| --- | --- |
| **Element** | **Range of performance statements to be met in Units 1 and 2** |
| 1. *Formulate:* identify, select, and interpret mathematical information embedded in a numeracy context and decide what mathematical knowledge and skills to use to solve the problem.
 | * Identifies, interprets, and comprehends a range of everyday mathematical information that is embedded in familiar and routine materials, texts, and tasks where the mathematics content is fairly explicit or visual with relatively few distractors.
* Draws on a combination of hands-on, contextually appropriate materials, personal experience, mathematical and prior knowledge to select appropriate solution strategies selected from the range of mathematical processes described in the areas of study.
* Develops a mathematical plan that is concise and clear, using a combination of both informal and formal written mathematical language and symbols.
 |
| 1. *Act on and use mathematics:* perform relevant mathematical actions and processes in order to complete numeracy task
 | * Require the use and application of only one or two steps or processes, or more if they are related or similar processes.
* Selects and uses appropriate tools, hand-held devices, computers and technological processes, such as to measure the dimensions of a window in mm with a tape measure, or to create a personal weekly budget in a spreadsheet.
* Uses a blend of personal 'in-the-head' methods, formal pen and paper methods and digital/technological calculators, software, apps and tools to undertake the required calculations or problem-solving process.
 |
| 1. *Evaluate and reflect:* check and reflect on mathematical results
 | * Applies estimation and personal experience, mathematical and other prior knowledge, to check and reflect on the results and their reasonableness and appropriateness to the context and task, and can explain why a problem could not be solved if this is the outcome.
* Some level of prompting and support can be provided in relation to critical reflections on the outcome and results.
 |
| 1. *Communicate and report:* use informal and formal mathematical representation to document and report outcomes and results
 | * Uses a combination of both informal and formal written mathematical language and symbols and general language to document and report on the mathematical and problem-solving process and results.
* Uses a combination of both informal and formal oral mathematical and general language to present and discuss the mathematical and problem-solving process and results.
* Uses a combination of both formal and informal symbolism, diagrams, graphs and conventions relevant to the mathematical knowledge of the level; for example:
* 1/100, 12.5%
* km/hr, $/kg
* 1.25 m = 1250 mm
 |

Learner support

In Units 1 and 2, students are expected to work independently but with some level of teacher support and scaffolding when required. They should use their own familiar support resources, but may have a moderate level of scaffolding with regards to the problem-solving process and tasks for the students to follow. The level of support can consist of actions such as, but not limited to:

* the provision of flexible and open-ended questions that can be used to prompt students to address the different problem-solving cycle steps
* working alongside the student when learning or undertaking a task, for example, responding to any questions posed by the student or directing them to where they can get the required knowledge or information requested
* encouraging students to document and report on their work and investigations in a way they feel most comfortable with and providing advice or support about the most appropriate approach for their particular project/investigation – orally, in writing, using an audio or video recording, an image or a graphic. It should not be expected that all students will do this in the same way.

Units 3 and 4

In Units 3 and 4 students further develop and enhance their numeracy practices to make sense of their personal, public, and vocational lives. Students extend their mathematical skills with consideration of local, community, national and global contexts and an awareness and use of appropriate technologies.

Units 3 and 4 provide students with a broad range of mathematical knowledge, skills, understanding and dispositions to solve problems in real contexts for a range of workplace, personal, further learning, and community settings relevant to contemporary society.

The progression of learning is evident in Units 3 and 4 with the development of more complex numeracy and mathematical skills and knowledge, drawing on the knowledge gained from Units 1 and 2.

Outcomes

For Units 3 and 4 the student is required to demonstrate achievement of three outcomes. As a set these outcomes encompass all of the areas of study for the unit.

At the end of Units 3 and 4 students should be able to select the appropriate method or approach required, be able to attempt a series of operations or tasks, and communicate their ideas in multiple formats, including verbally and in written form. They should be at ease with a range of calculations and mathematical processes both manually and/or using technology. Students should be able to evaluate and critically reflect on the outcomes and results of their numeracy tasks and investigations and be aware of any real-world implications and consequences.

Outcome 1

On completion of this outcome the student should be able to apply their numeracy capabilities developed from the areas of study.

The purpose of Outcome 1 is to focus the teaching and learning on supporting and enabling students to develop a range of different numeracy skills and capabilities in order to make sense of their daily personal, public and vocational lives.

This outcome describes the range of contexts that are the starting points, and hence the focus, for developing the students’ numeracy and mathematical skills. These six numeracies cover personal, financial, civic, health, recreational and vocational contexts where a range of mathematical skills are situated and embedded.

Structure of Outcome 1

Outcome 1 is framed around six different numeracies:

1. **Personal numeracy** relates to the mathematical requirements for personal organisational matters involving money, time and travel.

Personal numeracy relates to understanding, using, and interpreting numerical and mathematical information presented and embedded in different formats and media, in order to undertake personally relevant activities in familiar situations.

The understanding, use and interpretation of personal numeracy can be drawn from the following examples, but is not limited to:

* numerical information embedded in printed and digital media, including monetary values
* time and dates, including digital and analogue time, and elapsed time
* timetabling and shift working such as retail or hospitality shifts
* direction and locational materials (such as printed maps, location diagrams for buildings, and GPS displays) and planning, describing and following oral and written directions; for example, tours, holidays, excursions
* personal and home/family day-to-day tasks such as cooking, gardening, sport, travel.
1. **Civic numeracy** relates to participating in civic life through knowing how to stay informed, and understanding governmental and societal data, information and processes.

Civic numeracy includes understanding, interpreting and critically evaluating statistical and quantitative information often presented in news and media reports, and other data-related arguments to meet the demands and challenges of life at local, state, national and global levels. It can incorporate the understanding, use and interpretation of quantitative and statistical information and related arguments.

The understanding, use and interpretation of civic numeracy can be drawn from the following examples, but is not limited to:

* opinion polls in the media including national and global polls
* government and political information and arguments, including advertising, elections and voting
* social and environmental issues such as climate change, human rights, animal rights
* managing personal social responsibilities and obligations
* local, national and global environmental issues
* statistical monitoring of peoples’ lives (such as online check-in data) and their use of devices, and actions made based on such data.
1. **Financial numeracy** relates to understanding and undertaking financial transactions and making informed judgments and decisions regarding the use and management of money.

Financial numeracy involvesmanaging relevant personal, social or work-related financial costs, charges, income and expenditure.

The understanding, use and interpretation of financial numeracy can be drawn from the following examples, but is not limited to:

* personal banking such as savings, debit, credit and setting up savings plans
* online financial services such as cryptocurrencies and share trading
* occupational income and expenses, including work related budgets, penalty rates
* government financial systems such as taxation, GST, student loans, trade/apprenticeship loans and superannuation
* utility and other relevant personal or family bills and charges, and comparing providers
* personal loans such as car loan, buy now pay later apps and store credit, use of online interest calculators
* pitfalls of credit, minimum payments versus paying off credit, money safety, online safety and scams
* comparing costs and purchases, such as new versus second-hand versus selling your own goods, mark-ups and markdowns, and comparative prices including overseas versus local.
1. **Health numeracy** relates to accessing, understanding, and using mathematical information to make decisions, and to take action about health, healthcare and well-being.

Health numeracyinvolves being able to use mathematics to manage one’s own health, safety and well-being, alongside being aware of such issues from a community or a work-related perspective.

The understanding, use and interpretation of health numeracy can be drawn from the following examples, but is not limited to:

* nutrition or fitness, including setting goals, tracking data and understanding the issues
* social health issues such as drinking, safe driving, obesity, drugs
* health and safety at work such as accident types, rates and causes, audits of workplace chemicals and comparison with home-based chemicals
* medical data within a hospital/doctor setting such as typical blood pressure, heart rate, respiration rate, temperature
* publicly available medical and health information, data and advice; for example, in relation to maintaining a healthy lifestyle including healthy eating/diet, exercise, or diseases and pandemics
* self medical care, such as the use and dosages of medications, including scheduling
* health and safety matters related to potential accidents and use of chemicals
* funding health care such as Medicare and/or health insurance
* costs of raising a family.
1. **Vocational numeracy** relates to effectively participating in work life and managing the demands of work and/or vocational training.

Vocational or work-related numeracy relates to undertaking the required tasks and activities in a work-related context, such as using different workplace tools, applications and processes/systems following and giving directions, participating in quality assurance processes and data collection, and reading workplace documents and information.

The understanding, use and interpretation of vocational numeracy can be drawn from the following examples, but is not limited to:

* workforce comparisons from past practices (pre-digital) to current (digital) such as time to complete tasks and effort involved
* reading or creating tables and charts to give or follow workplace directions such as numbers, ratios to mix chemicals or for handling hazardous chemicals or substances
* occupational health and safety or quality assurance data requirements
* workplace specific plans/diagrams/formulae/ratios
* different technological, digital or analogue measuring and processing devices, tools and applications
* tolerances and levels of accuracy and the implications of incorrect applications or mixing of chemicals
* work life balance calculations
* recording information and data or following and giving directions.
1. **Recreational numeracy** relates to the many mathematical aspects of recreational activities including, but not limited to, sport and social media.

Recreational numeracyencompasses not only physical exercise and sport, but also aspects of personal time spent on non-work activities such as indoor and outdoor pursuits, arts, social media and interests. It also covers community, cultural or religious activities.

The understanding, use and interpretation of recreational numeracy can be drawn from the following examples, but is not limited to:

* the planning of an activity or event including costings, steps and processes
* comparison of planning and costs of different party venues; for example, a birthday party
* dimensions and specifications of playing areas; for example, size of a netball court, chess board, a multipurpose court
* dimensions and specifications of art and craft products being planned or created; for example, photo sizes, dresses/costumes, furniture
* rules and game scoring systems and formulae, penalties, fines, timing
* statistical and data collection measures around recreational activities and events
* use and overuse of recreational activities and associated dangers.

**Note:** each of the numeracies can also apply to the world of work and vocational education and training.

Selecting numeracies for Units 3 and 4

Across Units 3 and 4 all of the six numeracies must be covered. The order in which this is done and how this is combined with the underpinning mathematical knowledge and skills, as described in the areas of study, is decided by the school and the teachers. This flexibility is an essential part of an applied learning approach.

These combinations can therefore be based on the needs and interests of the student cohort and its community, and related vocational and work options.

Schools and teachers must make their selection of numeracies based on the following guidelines:

* Each unit must include three of the six numeracies
* All six numeracies must be covered over Units 3 and 4
* All eight areas of study must be covered over Units 3 and 4.

This table provides overview for schools and teachers in selecting numeracy for Units 3 and 4:

|  |  |
| --- | --- |
| Numeracies | Areas of study |
| **Unit 3, Outcome 1** |
| Select three of the following six numeracies for Unit 3:1. Personal numeracy
2. Civic numeracy
3. Financial numeracy
4. Health numeracy
5. Vocational numeracy
6. Recreational numeracy
 | * Select one or two areas of study to support the chosen numeracy.
* Select a minimum of four and a maximum of six areas of study for Unit 3:
* Area of study 1: Number
* Area of study 2: Data
* Area of study 3: Dimension and direction
* Area of study 4: Shape
* Area of study 5: Quantity and measures
* Area of study 6: Change
* Area of study 7: Uncertainty
* Area of study 8: Systems
 |
| **Unit 4, Outcome 1** |
| Select the three remaining numeracies for Unit 4:1. Personal numeracy
2. Civic numeracy
3. Financial numeracy
4. Health numeracy
5. Vocational numeracy
6. Recreational numeracy
 | * Select one or two areas of study to support the chosen numeracy.
* Select a minimum of four and a maximum of six areas of study for Unit 4:
* Area of study 1: Number
* Area of study 2: Data
* Area of study 3: Dimension and direction
* Area of study 4: Shape
* Area of study 5: Quantity and measures
* Area of study 6: Change
* Area of study 7: Uncertainty
* Area of study 8: Systems

*Ensure all areas of study have been covered over the two units.* |

Connecting the numeracies with the mathematical content in the areas of study

The following table provides an example of a learning program that covers the eight areas of study.

|  |
| --- |
| Outcome 1 |
|  | **Unit 3** | **Unit 4** |
| Personal | Civic | Financial | Health | Vocational | Recreational |
| **Areas of study** | Number | ✓ |  | ✓ |  |  |  |
| Data  |  | ✓ |  | ✓ |  |  |
| Dimension and direction |  |  |  |  |  | ✓ |
| Shape |  |  |  |  | ✓ |  |
| Quantity and measures |  |  |  |  | ✓ | ✓ |
| Change  |  |  |  | ✓ |  |  |
| Uncertainty  |  | ✓ |  |  |  |  |
| Systems  | ✓ |  |  |  |  |  |

Outcome 2

On the completion of this outcome the student should be able to use the problem-solving cycle in an applied learning context, relevant to the key skills and knowledge reflected in the areas of study and the numeracies in Outcome 1.

The purpose of Outcome 2 is to enable students to develop their everyday numeracy skills and practices to make sense of their daily personal, civic and vocational lives. Students need to develop the skills and capabilities to be able to problem-solve, and to use their skills to investigate and solve a problem where the mathematics is embedded with a real-world context. Outcome 2 describes and outlines a problem-solving cycle that supports students to become more capable, critical and reflective problem solvers, and to use their mathematical skills successfully and confidently to become numerate individuals within the community and in their selected vocations.

Given that the contexts will be the starting point, students need to be taken through a structured problem-solving cycle, inorder to know how to move from the real-world contexts to the mathematical world and apply their mathematical knowledge to solve the mathematical problem at hand. Part of solving any such embedded problem is to be able to reflect and evaluate the outcomes, and to then communicate and report on what was done and the results.

The problem-solving cycle underpinning the curriculum has four distinct components of formulating, acting on and using mathematics, evaluating and reflecting, followed by communicating and reporting on the results.

These four components are represented in the figure below.



*Structure of Outcome 2*

The elements and their performance criteria are organised under four classifications to match the problem-solving cycle:

1. **Formulate**: identify, select and interpret mathematical information embedded in a real-world context and decide what mathematics to use.
2. **Act on and use mathematics**: perform mathematical actions and processes in order to complete tasks. This includes the use and application of a range of technologies.
3. **Evaluate and reflect**: check and reflect on the mathematical problem-solving processes and the results in relation to the real-world context.
4. **Communicate and report**: use a combination of informal and formal mathematical representation to document and report outcomes and results.
5. Formulate

When mathematical problems are embedded within real-world contexts, students need to identify the essential features to be accommodated when transforming the real-world situation into a mathematical problem. This requires students to identify and name the mathematics embedded in the context or scenario, and make decisions about how the task can be best approached and solved mathematically. Students need to develop a plan of the actions they need to undertake, including providing an overview of the scenario and any related background information, and specify the related mathematical questions of interest, conjectures, or hypotheses.

1. Act on and use mathematics

This stage of the problem-solving cycle involves undertaking the mathematical aspects of the task identified in the previous stage. It requires the utilisation of mathematical processes and problem-solving techniques, facts, and procedures in order to solve the problem, and the selection and use of appropriate tools, representations and technologies. For example, students may need to undertake measurements; perform calculations; select and solve equations; make logical deductions from mathematical assumptions; perform symbolic manipulations; create and extract information from mathematical tables and graphs; represent and manipulate geometrical objects in 2D and 3D; or analyse data.

1. Evaluate and reflect

Responses to real-world numeracy tasks, including any mathematical solutions and results, judgements, decisions, or conclusions, require review and critical reflection and evaluation. Any results should be critically evaluated against the original situation in terms of its reasonableness and relevance as to its final solution; with comparisons made to the initial estimates before decisions are made to accept the solution and/or make revisions and adjustments before presenting the final solutions. In cases where decisions or judgements are being made about the solution, other factors might also be considered, such as social or economic consequences. These processes are often referred to as contextual judgements.

1. Communicate and report

The results of any numeracy task require a summary of the work to be compiled and developed, including the presentation and interpretation of the findings from the mathematical activities and related applications. This stage requires students to prepare a range of representations to communicate the mathematical results. This will involve both oral and written language, and the use of formal and informal mathematical visualisations and representations including the use of a range of different formats, media, or technologies.

Outcome 3

On completion of this outcome the student should be able to apply the appropriate mathematical tool to undertake the numeracy tasks required in Outcomes 1 and 2. The toolkit should be applied and should underpin all learning activities in both Outcomes 1 and 2.

The purpose of Outcome 3 is for students to develop a mathematical toolkit to use where necessary as they undertake their numeracy practices, activities and tasks. At the end of Units 3 and 4, students should be productive and informed users of both analogue and digital technologies with the ability to select and effectively use a wide range of appropriate mathematical tools (analogue and digital/technological) to solve and communicate mathematical problems embedded in practical contexts.

A student’s toolkit should include: existing, traditional tools such as measuring equipment (e.g. tape measures, rulers, kitchen scales); software applications such as spreadsheets; and a range of new and emerging devices and applications from across different technologies (e.g. measurement, angle and level apps available through technological devices). Students should be ready to adapt to emerging technologies into the future, for example, the use of drones and mobile technologies to measure and quote for jobs; or the use of internet applications (such as measuring and photography apps) for costing and ordering of materials for an onsite job.

In undertaking their numeracy tasks and activities as part of Outcomes 1 and 2, students should demonstrate understanding and knowledge of the following:

* contemporary technological and online and digital media, including software and applications based on computers, tablets, calculators and hand-held devices, and the accuracy, relevance, appropriateness and validity of their use and application
* keeping abreast of emerging technologies and their use and representations
* a range of analogue tools which may include concrete objects and manipulatives such as clocks, tape measures, tools of trade and industry
* a range of digital tools which may include mobile technology, software (including spreadsheets) and applications
* the conventions and use of such analogue and digital tools appropriate to the individual, community and workplace, and comparisons between technologies
* the conventions and language for the representations of mathematical and statistical information, objects and processes, using different technologies and digital media
* the numerical, graphical, symbolic, geometric and statistical functionalities of this range of technologies for working mathematically
* the conditions and settings including accuracy for a given purpose, and for effective and appropriate application of a given technology and its functionality
* awareness of online safety when using technologies.

Students should demonstrate competence in the following skills:

* use a range of both analogue and digital/technological tools and devices to carry out tasks and derive results
* use technology to carry out computations and analysis
* use technology to visualise and represent information, such as to produce diagrams, tables, charts, infographics, and graphs which model situations and solve practical problems
* use technology to help interpret and communicate the results of a numeracy task
* understand accuracy and error with different technologies and its implications for results
* make decisions regarding inputs into technology and then evaluate and discuss the outputs of technology
* reflect on and evaluate use of tools and technology used in relation to comparing estimates to results
* reflect on and evaluate any tools and technologies used and the outcomes obtained relative to personal, contextual, and real-world implications, appropriateness and reasonableness.

**Note:** Outcome 3 should be applied and underpin all learning and teaching activities in both Outcomes 1 and 2.

Areas of study

The areas of study name and describe a range of different mathematical knowledge and skills that are expected to be used and applied across the three outcomes. There are eight areas of study:

* Area of study 1: Number
* Area of study 2: Data
* Area of study 3: Dimension and direction
* Area of study 4: Shape
* Area of study 5: Quantity and measures
* Area of study 6: Relationships
* Area of study 7: Uncertainty
* Area of study 8: Systematics.

Selecting the areas of study

Students will cover the eight areas of study at least once across Units 3 and 4.

Areas of study are to be selected to support the teaching and learning for each of the six numeracies, as appropriate to the situations and contextual problems being solved. The order in which the areas of study are taught, and how they are combined with other areas of study, is decided by the school and the teachers. This flexibility is an essential aspect of an applied learning approach.

These combinations can therefore be based on the needs and interests of the student cohort and its community, and related vocational and work requirements.

Schools and teachers must make their selection of the areas of study based on the following guidelines:

* Each unit must include three numeracies.
* All six numeracies must be covered across Units 3 and 4.
* Select either one or two areas of study to support each selected numeracy.
* Select a minimum of four and a maximum of six areas of study per unit.

Area of study 1: Number

This area of study includes single- and multi-step operations and tasks applied to a range of numbers, including positive and negative numbers, fractions, decimals and percentages and numbers expressed using familiar power notations. Students should be confident to select the appropriate method or approach required and communicate their ideas. They should be at ease with performing calculations both manually and using software tools and devices.

Key knowledge

* whole numbers, fractions, decimals up to 3 places, and reading numbers expressed in digits or words
* multiplication facts and knowledge of factors and multiples
* rounding whole numbers and decimals up to 3 decimal places
* positive and negative numbers
* powers up to an index of 3 and square roots
* equivalence of decimals, fractions and percentages
* simple proportions and ratios.

Key skills

* fluently read very large and very small numbers
* solve a range of practical calculations including positive and negative numbers, including rounding whole numbers and decimals up to 3 places
* solve problems involving fractions, decimals and percentages, including calculating percentage increase and decrease
* solve problems involving powers and square roots
* solve simple problems with ratio and proportions.

Area of study 2: Data

Data can be found in everyday life, workplaces, and society. Students are to be able to collect, represent and undertake different analyses of data to discover patterns in data, undertake summary statistics, and derive meaning from data located within relevant but possibly unfamiliar or non-routine contexts. Data should be examined for comparison and analysis. Students should draw conclusions from the data and their analysis and be confident to represent, describe and reflect on any patterns, outcomes and trends.

Key knowledge

* data collection tools, categorisation, processes and production
* display of data with commonly used tables and graphs including axes and scales
* simple measures of central tendency and spread of data
* straightforward analysis of data sets and their displays.

Key skills

* collect, collate and organise data sets and display these using the most appropriate format, including axes and scales
* choose and find the most appropriate common measures of centre and spread for data sets, such as mean, median and range of data
* discriminate between the different measures of centre and spread and understand how they can change conclusions from data
* read and interpret results from data presented in multiple forms of tables, graphs and summary statistics, to describe patterns, variations and trends in the data
* draw conclusions from the data analysis.

Area of study 3: Dimension and direction

The study of dimension includes the understanding and use of space direction, and location in relation to landmarks and compass directions. Students should be able to accurately give and follow complex directions to multiple locations based on digital and printed maps and diagrams. The study of dimension also includes angles with degrees and spatial awareness.

Key knowledge

* location and direction in relation to objects and landmarks
* location and direction in relation to maps and technologies
* oral and written instructions for moving to specified locations
* a range of angle measures and representations.

Key skills

* give direction and location instructions between multiple destinations, including unfamiliar locations using appropriate maps or technology
* understand and use compass directions and use appropriate language such as NE, SSW, N15°W
* demonstrate an understanding of angles using degrees
* understand where an object is in space using one-, two- and three- dimensions and use the appropriate language to describe an object’s position and movement in space.

Area of study 4: Shape

This area of study includes the recognition and naming of a range of two-dimensional shapes and three-dimensional objects. Students should be able to classify, manipulate represent and construct a range of simple and compound shapes in diagrammatical and concrete forms. This area also includes different characteristics and properties used in classifying shapes.

Key knowledge

* properties and names of a range of two-dimensional shapes and three-dimensional objects such as cones, pyramids
* reflectional and rotational symmetry and similarity of a range of shapes and objects
* key angle properties of shapes including degrees in triangles/quadrilaterals
* patterns in and between a range of different shapes
* appropriate technologies that create and manipulate a range of two-dimensional shapes and three-dimensional objects
* scaling in relation to enlargement and reduction in size.

Key skills

* describe and classify a range of different two-dimensional shapes and three-dimensional objects
* determine reflectional and rotational symmetry, and use these to manipulate shapes
* understand common angle properties in relation to two-dimensional shapes
* use ideas of congruence and self-similarity
* create compound two-dimensional shapes and three-dimensional objects and describe the relationship between these, including through the use of technology
* determine, name, and describe patterns according to different properties of shapes such as in engineering, architecture and design, for example, bridges, buildings, sculptures.

Area of study 5: Quantity and measures

This area of study includes an understanding of metric measurements and their units of measurement applied to multi-step measurement tasks including working with commonly used non-metric measurements and their units of measurements. Students will conduct estimations of measurements, perform a range of measurement calculations, and undertake conversions with the embedded use of different technologies.

Key knowledge

* a range of measures of distance, perimeter, area, volume and capacity including the use and application of common and routine measurement formulae
* a range of metric and relevant non-metric units of measurement and conversion between units
* a range of units of time and temperature
* a range of measurement estimation strategies
* a range of measurement tools
* understanding of accuracy and tolerances in measurements.

Key skills

* estimate and measure objects and distances by using measurement tools with appropriate accuracy and tolerance
* undertake calculations and determine measurements of distance, perimeter, area, volume and capacity for routine, more complex two-dimensional shapes and three-dimensional objects including compound shapes, including the use of *pi* in circular measurements
* convert between both metric and non-metric units where relevant such as cm/inch and Celsius/Fahrenheit, grams/pounds
* read and interpret units of analogue and digital time including 24-hour time and time zones
* read, interpret and calculate with temperature measurements
* perform calculations using multiple units of time, including time zones, and calculate time durations, including the use of calendar months, weeks, days, as well as hours, minutes, and seconds.

Area of study 6: Relationships

This area of study includes the recognition, understanding and representation of relationship and change in more formal mathematical terms, where it exists in relevant real-life contexts and applications. Students should understand when change is occurring and be able to identify and use formal mathematical relationships, variables, and mathematical processes to determine the results of change.

Key knowledge

* a range of rates of change such as RPM, m/s
* relevant and straightforward ratios and proportions
* common, relevant and real-life algebraic formulae, relationships and algebraic expressions and thinking
* representation and visualization of change such as algebraic expressions and formulae, conversion charts or graphs
* standard conventions used in the development, use and writing of a range of algebraic expressions.

Key skills

* describe relationships between variables and explain their significance in relationship to the applied context
* develop and represent relationships with mathematical expressions, or graphical or tabular representations
* use and apply formulae to solve real-life problems
* use and apply rates to solve problems such as $/m3, L/hr, wages/hr
* use and apply relevant ratios and proportions to solve problems such as scales on maps and plans, in the mixing of chemicals or ingredients, or calculating magnification factors.

Area of study 7: Uncertainty

This area of study includes concepts of randomness, chance, and probability. Students should be able to make mathematical predictions about the likelihood of events occurring or not occurring. They should be able to consider and make conclusions about likelihood based on the data and make straightforward inferences. Students should be familiar with the concept of risk and apply the idea of uncertainty to risk.

Key knowledge

* likelihood of events or occurrences happening and how to represent them
* simple unconditional probability events with randomness and chance
* relevant language of chance and their relationship to numerical values associated with chance and probability
* randomness and chance of unconditional probability events
* inferencing from likelihood estimates to inform decision making in relation to real-life events, including risk.

Key skills

* identify possible outcomes of an event and create visual representations of sample spaces or options
* estimate, predict and calculate the likelihood of events occurring using decimals, ratios and percentages
* compare different real-life events or probabilities
* make decisions based on inferences about sets of accessible, relevant and appropriate data and information
* evaluate risk in relation to relevant and appropriate problems with reference to likelihood of events occurring.

Area of study 8: Systematics

This area of study encompasses the understanding of inputs and outputs of technology, including emerging technologies, that can be used for the purposes of planning, collecting, sorting, or categorising a range of quantitative or mathematical data and information. Students should be confident in choosing multiple inputs of data, compare the outputs and results, and analyse, review and make decisions and conclusions based on the representations and any summary information derived from the technology.

Key knowledge

* relevant and appropriate information and data inputs and outputs
* relevant and appropriate computational data collection and interpretation tools and applications
* collating, organising, categorising, planning, scheduling and table creation of relevant information and data using different technologies.

Key skills

This area of study includes the use of technology (such as spreadsheets, software, mobile technologies and apps) to:

* choose appropriate technologies such as spreadsheets, software or applications to input or record real-life data and information
* use technology to collect, organise and sort relevant data and information
* use different technology systems to plan and schedule different actions
* make informed decisions on inputs and interpret outputs mathematically such as from interactive maps, PTV, online calculators/applications/planners
* decide, set, and adjust parameters of inputs to optimise outputs and solutions for real-life situations and contexts.

Assessment

Demonstration of achievement of all outcomes should be based on the student's performance on a selection of evidence encompassing the three outcomes:

* Outcome 1 including each of the six numeracies
* Outcome 2 the problem-solving cycle
* Outcome 3 the use of technologies.

Assessment should be undertaken as an ongoing process which integrates students knowledge and skills with their practical applications over a period of time. It will require a combination of evidence collected through teacher observations along with the collection of records of students’ work.

Assessment could consist of a combination of the following, but is not limited to:

* Investigations and projects: for example a diary on a “week in the life of me”, outlining budgets (pay rates and tax), travel (how do I get places), shopping (best deals).
* Multimedia Presentation or Oral Report: for example an outline of food requirements for an athlete preparing for their sport including nutrition, recipes, calories required and exerted, energy requirements, and measurements including distances.
* Interview or Role Play: for example students may prepare job interview questions and responses to include details on scheduling a diary and planning, what resources are needed using data and tables, and understanding cost calculations.

Where teachers allow students to choose between tasks, they must ensure that the tasks they set are of comparable scope and demand.

The student’s level of achievement for Units 3 and 4 will be determined by a combination of school-assessed coursework tasks and four investigations.

School-assessed coursework and the investigations must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. It must be completed mainly in class under supervision, and within a limited timeframe.

All investigations should comprise of the three outcomes:

1. one numeracy
2. the use and application of the problem-solving cycle
3. the use and application of tools and technologies.

Investigations may be subject to auditing, and copies of student work should be collected and retained for moderation purposes.

Evidence for assessment

It is expected that all of the performance criteria in the table below be covered at least once across the different numeracy tasks for each unit. However it is not expected that all of the performance criteria are covered in each investigation or school-assessed coursework task.

|  |  |
| --- | --- |
| **Element** | **Performance Criteria** |
| Elements describe the essential outcomes. | Performance criteria describe the performance needed to demonstrate achievement of the element. |
| 1. *Formulate*: identify, select, and interpret mathematical information embedded in a numeracy context and decide what mathematical knowledge and skills to use to solve the problem.
 | 1.1 Decide on the purpose of the task and the questions to be posed and answered.1.2 Identify and interpret the relevant mathematical information embedded in the selected numeracy context and materials. 1.3 Describe and define the mathematical operation(s), processes and tools needed to solve the problem.1.4 Develop a detailed plan of the activities to be undertaken to perform the mathematical actions. |
| 1. *Act on and use mathematics*: perform relevant mathematical actions and processes in order to complete the numeracy task
 | 2.1 Select and implement mathematical problem-solving processes for completing the numeracy task. 2.2 Undertake estimations required prior to completing the numeracy task.2.3 Select and use appropriate technology, tools and applications to complete numeracy task.2.4 Undertake relevant mathematical actions, processes and calculations to complete the numeracy task. |
| 1. *Evaluate and reflect*: check and reflect on mathematical results
 | 3.1 Check and reflect on estimations, actions and any calculation outcomes to see if results are as expected.3.2 Review the appropriateness and reasonableness of results of the numeracy task and adjust if necessary.3.3 Critically reflect on and evaluate the mathematics used and the outcomes and results obtained relative to personal, contextual and real-world implications and consequences. |
| 1. *Communicate and report*: use informal and formal mathematical representation to document and report outcomes and results
 | 4.1 Use informal and formal written mathematical representations to document and report on the mathematical processes used and the results and the evaluation of the numeracy task.4.2 Use informal and formal oral mathematical language to present and discuss the mathematical processes used and the results of the numeracy task.4.3 Use of a range of different formats, devices or technologies to represent and document the numeracy task. |

Range of performance statements for Outcome 2: Units 3 and 4

The table below specifies the range of actions, the complexity of the numeracy tasks and the levels of performance that are expected for students studying Units 3 and 4 for each of the above elements and performance criteria. It also indicates the levels of support that teachers can provide.

|  |  |
| --- | --- |
| **Element** | **Range of performance statements to be met in Units 3 and 4** |
| 1. *Formulate:* identify, select, and interpret mathematical information embedded in a numeracy context and decide what mathematical knowledge and skills to use to solve the problem.
 | * Identifies, interprets, and comprehends a range of mathematical information that is embedded in a range of relevant but possibly unfamiliar or non-routine texts materials, texts, and tasks where the mathematics content needs to be identified and extracted from its contextual situation.
* Draws on a combination of hands-on, contextually appropriate materials, personal experience, mathematical and prior knowledge to select appropriate solution strategies selected from the range of mathematical processes described in the areas of study.
* Develops a mathematical plan that is detailed and explicit, using a combination of both informal and formal written mathematical language and symbols.
 |
| 1. *Act on and use mathematics:* perform relevant mathematical actions and processes in order to complete the numeracy task
 | * Tasks will require the use and application of a range of multiple and different mathematical steps or processes.
* Uses a blend of personal 'in-the-head' methods, formal pen and paper methods and digital/technological calculators, software, apps, and tools to undertake the required calculations or problem-solving processes.
* Selects and uses the appropriate tools, hand-held devices, computers, and technological processes to perform the mathematical tasks required.
 |
| 1. *Evaluate and reflect:* check and reflect on mathematical results
 | * Applies estimation and personal experience, mathematical and other prior knowledge, to check and critically reflect on the results and their reasonableness and appropriateness to the context and task, and can explain why a problem could not be solved if this is the outcome.
* Independently initiates and uses support from a range of established resources to evaluate the mathematics used and to critically reflect on the outcomes and results obtained relative to personal, contextual, and real-world implications and consequences.
 |
| 1. *Communicate and report:* use informal and formal mathematical representations to document and report outcomes and results
 | * Uses a combination of both informal and formal written mathematical representations and general language to document and report on the mathematical and problem-solving process and the results and the evaluation.
* Uses a combination of both informal and formal oral mathematical and general language to present and discuss the mathematical and problem-solving process and results and the evaluation.
* Uses a range of formal mathematical representations, symbolism, diagrams, graphs, and conventions relevant to the mathematical knowledge as specified in the Areas of Study.
 |

Learner support

In Units 3 and 4, students are expected to work independently, to initiate and use support from a range of established resources, and to not be dependent on the teacher for direction or for materials that set out the problem-solving process and tasks for the students to follow. Where requested and initiated by the student, some advice and support may be provided. The level of support can consist of actions such as, but not limited to:

* the provision of open-ended questions that can be used to prompt students to address the different problem-solving cycle steps
* responding to student questions about the tasks at hand, in order to direct the student to where they might access the knowledge or information requested
* encouraging students to document and report on their work and investigations in a way they feel most comfortable with – orally, in writing, using an audio or video recording, an image or a graphic. It should not be expected that all students will do this in the same way.