Study Area Specification

Prevocational Mathematics
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I Rationale

Numeracy is the ‘effective use of mathematics to meet the general demands of life at home, in paid work, and for participation in community and civic life’\(^1\). Prevocational Mathematics is designed to help students improve their numeracy by building their confidence and success in making meaning of mathematics. It aims to assist students to overcome any past difficulties with, or negative attitudes towards, mathematics, so that they can use mathematics efficiently and critically to make informed decisions in their daily lives.

Numeracy is more than being able to operate with numbers. It requires mathematical knowledge and understanding, mathematical problem-solving skills, literacy skills and positive beliefs and attitudes. When students become numerate\(^2\) they are able to manage a situation or solve a problem in real contexts such as everyday life, work or further learning. This involves responding to these contexts by identifying or locating, acting upon, interpreting, and communicating mathematical ideas and information. Students learn to represent these ideas and information in a number of ways.

This study area specification provides teachers with the flexibility to design courses of study that cater for the broad range of skills, attitudes and needs of students. Students study five topics (number, data, location and time, measurement and finance) integrated into teaching and learning contexts which have relevance to them. Because these contexts foster cooperation, and are supportive, enjoyable and non-competitive, students develop positive attitudes towards the use of mathematics.

Students’ confidence improves when they have sufficient time to discover how to solve problems, discuss, guess at answers, take chances, try things out, be wrong, and most importantly, experience success. Students learn that there is rarely one way of doing things and that workplace mathematics is often very different from school mathematics because of the particular requirements in different industries where mathematical skills are adapted to ensure efficiency. As students become more confident in using mathematics, they willingly contribute to class and group discussions — they question, propose, argue, challenge, seek advice and clarification, and become aware of the benefits of working independently and in groups.

The teaching and learning contexts of this study area specification also provide opportunities for the development of the seven key competencies\(^3\). In a course of study based on this study area specification, students, while working independently and in groups,

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\(^1\) EQ Australia Assessment Spring, 1997, Curriculum Corporation — www.curriculum.edu.au/eq/archive/eq_97/mclean.htm


\(^3\) The seven key competencies referred to in this subject are: KC1: collecting, analysing and organising information; KC2: communicating ideas and information; KC3: planning and organising activities; KC4: working with others and in teams; KC5: using mathematical ideas and techniques; KC6: solving problems; KC7: using technology.
employ mathematical ideas and techniques as well as communicate ideas and mathematical information. These activities are supported by collecting, analysing and organising information, planning and organising activities, investigating solutions to problems or tasks, and using suitable technologies where relevant.

In summary, Prevocational Mathematics provides opportunities for students to improve their numeracy to assist them in pursuing a range of vocational and personal goals. It develops not only students’ confidence and positive attitudes towards mathematics but also their mathematical knowledge and skills (through the general objectives: knowing and applying), and their communication skills (through the general objective: explaining)\(^4\).

\(^4\) This study area specification is informed by the four strands of level 3 of the National Reporting System, that is: meaning-making strategies, problem-solving strategies, mathematical knowledge and mathematical representation. It has also been written to build on levels 3 and 4 outcomes of the Years 1–10 Key Learning Area (KLA) syllabus (Mathematics) or their equivalent.
2 Aims

During a course of study, students should:

- build confidence and experience success when using mathematics in everyday contexts
- improve their preparedness for entry to work, apprenticeships, traineeships, or further study by developing their numeracy
- develop skills such as using a calculator, identifying, measuring, locating, interpreting, estimating, applying, communicating, explaining, problem solving, making informed decisions, and working cooperatively with others and in teams
- be able to organise mathematical ideas and represent them in a number of ways such as objects and pictures, numbers and symbols, rules, diagrams and maps, graphs, tables, and texts
- be able to present findings orally and in writing
- be able to use relevant technologies
- be able to make informed decisions.
3 General objectives

The experience of mathematics as conceptualised in this study area specification takes place in a supportive social context. Students are encouraged to work both independently and cooperatively to carry out tasks of a real-life nature, with scaffolding from the teacher. Learning experiences are provided, from which informal and formal assessment opportunities arise. Students develop and apply their knowledge and skills, and communicate how they carried out tasks to suit the contexts in which they were operating.

A teaching and learning context is one that has personal relevance to students and is related to real life, for example, buying a car, budgeting for leaving home, understanding pay slips, managing mobile phone costs, designing and making a set for the school production, or applying mathematics in work-related contexts.

The general objectives of Prevocational Mathematics are: knowing, applying, explaining and affective. Affective objectives are concerned with attitudes, values and feelings. Student achievement of affective objectives is not summatively assessed.

The general objectives of knowing, applying and explaining are seen as equally important and this balance is reflected in the exit criteria. They are also interrelated, that is, each influences the other. For example, the development of knowledge of mathematical concepts can occur independently but is also an integral part of applying mathematics in real-life contexts. Communication in both mathematical and everyday language occurs while knowledge is being acquired and applied.

The general objectives incorporate the seven key competencies mentioned in the ‘Rationale’ section. Each of the objectives requires that students ‘communicate ideas and information’ about mathematics that involve ‘planning and organising’, together with ‘collecting, analysing and organising information’ and ‘solving problems’. The practical nature of this subject allows for opportunities for students to work in groups — thus they ‘work together and in teams’. Using suitable technologies is especially encouraged.

3.1 Knowing

Knowing involves knowledge of content and the use of basic skills such as working with given rules, operations and procedures in simple situations. It also involves learning how to use measuring instruments and calculators. The use of computer software is strongly encouraged. The recall of rules is not a requirement of this objective.

In knowing, students demonstrate knowledge of content and use given rules, operations and procedures to carry out simple, familiar tasks.
3.2 Applying

Applying involves students using familiar mathematics in different contexts in a supported environment. This means that when carrying out tasks, students interpret and analyse these contexts to identify familiar mathematics. This allows them to develop strategies (for example, organising, comparing and validating), select and apply rules and procedures (for example, measuring, calculating) and, where relevant, predict consequences and reach decisions.

In applying, students interpret and analyse different contexts, identify familiar mathematics, develop strategies, then select and apply rules and procedures to carry out tasks.

3.3 Explaining

Explaining involves students using basic mathematical and everyday language to present and explain their responses to tasks in both familiar and different contexts. Their responses can be presented in various forms for different purposes to suit the task: orally, visually or in writing. To explain their responses, students describe, state opinions, outline arguments, comment on and give reasons for suggested consequences, proposed recommendations or decisions.

In explaining, students use basic mathematical and everyday language to present and explain their responses to tasks in both familiar and different contexts.

3.4 Affective

Throughout a course of study, students should:

- develop confidence in using mathematics in everyday contexts
- appreciate that understanding and being able to use the familiar mathematics in the world around them, allows them to organise and control many facets of their lives
- become aware of the usefulness of mathematics in preparing them for future life roles
- appreciate the benefits of working as individuals and in groups to solve problems
- value becoming numerate citizens who can make informed decisions about issues involving mathematics.
4 Course organisation

4.1 Developing a course of study

4.1.1 Assumed knowledge and prior experience

It is assumed that students entering a course based on this study area specification have basic mathematical skills consistent with at least level 3 of the 2004 Years 1–10 Key Learning Area (KLA) syllabus (Mathematics) or equivalent. They therefore require supervision and highly scaffolded and supported learning that incorporates concrete, realistic hands-on experiences.

4.1.2 Time

The minimum number of timetabled school time including assessment that this syllabus has been designed to cater for is 55 hours per semester, over 4 semesters: a total of 220 hours.

4.1.3 Topics for a course

A course of study is based on five topics that are grouped into three categories\(^1\) according to the purposes and functions of using mathematics in various contexts. These categories are:

- **Interpreting society**: this relates to interpreting and reflecting on numerical and graphical information of relevance to self, work or the community.
- **Personal organisation**: this relates to the numeracy requirements for personal matters involving money, time and travel.
- **Practical purposes**: this relates to the physical world in terms of designing, making and measuring.

\(^1\) Based on the framework of the 2002 Victorian Certificate in General Education for Adults ARIS, Language Australia, Melbourne.
The five topics are:

**Mathematics for interpreting society: number (study area core)**

**Mathematics for interpreting society: data**

**Mathematics for personal organisation: location and time**

**Mathematics for practical purposes: measurement**

**Mathematics for personal organisation: finance.**

The intention of the syllabus is that the topics be studied, not as stand-alone, but in combination and in contexts that are meaningful to students. The topics may be revisited in different contexts during the course.

In developing a course, teachers should:

• take the school, community and workplace contexts into account
• be aware of the expectations of the learners outlined in section 5.2
• provide a range of learning experiences that:
  – include concrete, practical, hands-on activities
  – draw from a variety of everyday and workplace contexts
  – may span several topics
  – provide opportunities for students to revisit concepts and consolidate their understanding
• provide assessment tasks that complement and reflect the learning experiences (see ‘Assessment strategies’, section 6.2).

Refer to appendix 1 for examples of courses of study.

### 4.1.4 Resources

Suggested resources that can support this study area specification:

• a DAL (direct algebraic logic) 2-line display calculator with a fraction key
• a 4-function basic calculator
• a ruler and protractor
• a globe, wall maps
• access to the internet
• mathematics software
• games
• a wide range of concrete and visual manipulatives
• brochures, timetables, pamphlets
• videos, DVDs
• guest speakers.
4.2 Details of topics

Introduction

The topics are presented with the details for each, grouped under the headings of the general objectives of knowing, applying and explaining. The details for knowing indicate the minimum that should be covered in the course, while the details for applying and explaining are indicators only of depth and manner of treatment as each school will develop their own course of study. Hence the listing for applying and explaining is deliberately incomplete. Although schools may offer additional material or allow students to study topics in greater depth, this should not be at the expense of the material listed in the study area specification.

Examples of learning experiences, assessment activities and techniques are provided in a table at the end of each topic to indicate the level of challenge expected. The tables are not prescriptive or exhaustive — they are intended as starting points for planning a course of study. They also include some additional ideas that could be used to study the topic in greater depth depending on student interest and abilities.

Topic 1 is the study area core and is the basis for all of the other topics. Relevant parts of topic 1 should be taught where required so that this study area core topic is integrated throughout the course.

Topic 1 Mathematics for interpreting society: number (study area core)

Topic purpose

The student can read, write, interpret, compare and do calculations with a calculator involving:

• whole numbers
• common fractions, decimal fractions and common percentages
• ratios, rates and proportions

for personal, work or community life purposes.

Whole numbers

Knowing

• write whole numbers in words and numerals, for example, when writing cheques
• write everyday representations of numbers (for example, 20K/20 000, $1.5million/$1.5m, $3 billion/$3b)
• concepts of less than, greater than, and equal to
• rounding numbers in everyday contexts, e.g. to nearest 5 cents, nearest kilometre
• with a calculator:
  • add, subtract, divide and multiply whole numbers
  • perform mathematical operations in the correct order (for 4-function calculators).
Applying

- select the most effective operation to suit the purpose.
- apply suitable mathematical operation/s (singly and in combination) to simple everyday problems

Explaining

- use common words, phrases and symbols for mathematical operations
- explain to teacher or peers (orally or in writing) the steps involved in solving simple problems

Fractions, decimals and percentages

Knowing

- commonly-used fractions (such as \(\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{8}\))
  - the concept of a fraction (parts of a whole)
  - equivalent fractions
  - proper and improper fractions
  - mixed numbers
  - decimal fractions
  - the decimal number system — place value, different numbers of decimal places
- commonly-used percentages
  - what is meant by a percentage (a fraction of 100)
  - whole percentages
  - fractional percentages, for example, 12.5 per cent
  - percentages greater than 100 per cent
- the connection between common fractions, decimals and percentages
- rounding of decimals
- with a calculator:
  - add, subtract, multiply and divide common fractions and decimals
  - find one quantity as a fraction or percentage of another
  - find a given percentage of a quantity
  - convert between simple common fractions, decimal fractions and percentages

Applying

- solve simple everyday common fraction problems on a calculator
- on a calculator, solve simple everyday problems that involve commonly-used percentages

Explaining

- present solutions to problems using common words, phrases and symbols (orally or in writing) to teacher or peers
- comment on the reasonableness of answers determined using a calculator
Ratios, proportions, and rates

Knowing

- ratios
  - a ratio as a comparison of two or more parts
  - symbol for ratio ( : )
  - simple equivalent ratios
  - simple everyday ratios such as 1 part juice concentrate to 4 parts water
- rates
  - a rate is a comparison of two measurable quantities of different kinds
  - simple everyday rates such as kilometres per hour, $ per kg
- direct and inverse proportion
- with a calculator:
  - simplify ratios
  - determine equivalent ratios
  - divide a quantity into a particular ratio
- form a ratio from given information

Applying

- solve simple ratio problems
- solve simple rates problems such as:
  - calculate everyday rates, for example, for a mobile phone
  - compare rates to determine the best buy
- solve simple (direct) proportion problems such as calculating the cost of 5 items given the cost of 2
- identify situations where direct and inverse proportion do not work, such as discount for quantity of purchases (students do not need to know the terms ‘direct’ and ‘inverse’)
- …

Explaining

- present solutions to problems using common words, phrases and symbols (orally or in writing) to teacher or peers
- comment on reasonableness of solutions in relation to rates and/or proportion
- …
### Some examples of learning experiences linked to assessment

<table>
<thead>
<tr>
<th>Learning experience</th>
<th>Assessment ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generate a collection of everyday expressions in which fractions occur and discuss their meanings, e.g: ‘possession is nine-tenths of the law’, ‘a split second’, ‘I have half a mind to do that’, ‘half a mo’.</td>
<td>No assessment.</td>
</tr>
<tr>
<td>Discuss ways of altering a simple recipe to suit different group sizes.</td>
<td>Students decide on quantities needed; make decisions about minimum package sizes to be purchased. Class party with each student supplying a plate of prepared food; altered and original recipes to be supplied.</td>
</tr>
<tr>
<td>Interpret the usage details on an electricity bill; visit website to find tariff rates.</td>
<td>Determine the usage per week over 1 month and average daily use; compare this average with that on electricity bill and discuss possible reasons for the difference. Worksheet on usage.</td>
</tr>
<tr>
<td>Examine star rating on appliances. Discuss ways of conserving energy in the home.</td>
<td>Hypothetical – buying an appliance – make a recommendation to suit a given context. Short two paragraph report.</td>
</tr>
<tr>
<td>Use advertising brochures to find costs of grocery items; determine 'best buys' for particular consumer. Explore different ways to advertise discount, for example, buy one and get the second item for half price.</td>
<td>For a given group of items, calculate total cost and round to the nearest 5 cents. Check prices of different quantities of the same item and determine the most economical size; discuss why it may not, in fact, be the best buy. Complete worksheet and present data collected.</td>
</tr>
<tr>
<td>Compare the size of commonly-used fractions, for example, by comparing measuring cups (¼, ½, ¾ cup); lengths (⅛, ¼ metre) etc.</td>
<td>Recognise equivalent fractions by using diagrams, a calculator and by converting to decimal fractions. Practical task using a range of edible manipulatives. Teacher to prompt as required.</td>
</tr>
<tr>
<td>Use a calculator to find percentages of a given quantity.</td>
<td>Solve a variety of practical problems, for example, a food label indicates that a 220g can of baked beans contains 52 per cent navy beans. Calculate the mass of beans in the can. Student demonstrates correct use of calculator to solve percentage problems.</td>
</tr>
<tr>
<td>Teacher-led class discussion on uses of proportion in different workplaces, for example, mixing hair colours, fertiliser, herbicides, paint colours, pool chemicals. Investigate a variety of situations in which quantities are in direct proportion.</td>
<td>Given various scenarios, solve problems that include experimental work, e.g: without counting them all, estimate number of grains of rice in a 1 kg bag of rice. Students each prepare a short test based on the proportion topic, then working in pairs, exchange and work tests. Authors then correct the work. Informal observation of students’ approaches to solving proportion problems.</td>
</tr>
<tr>
<td>Investigate a variety of situations in which quantities are in inverse proportion or not in proportion.</td>
<td>Given various scenarios involving proportion, decide on the relationship between two quantities (labels of 'direct', 'inverse' not needed). Identify relationships and explain to peer.</td>
</tr>
<tr>
<td>Investigate the relationship between measurements in the human body compared to those used in designing children’s toys, for example, Barbie, GI Joe.</td>
<td>Measure your arm span and height in centimetres. Express these as a ratio in the form 1:?. Repeat using 3 other people. Compare the ratios obtained. Compare other pairs of measurements, for example, hand length : arm length. Present results (measures and ratios) in table form. Draw conclusions about the results. Discuss use of this information in the matching of people to particular sports.</td>
</tr>
</tbody>
</table>
Topic 2  Mathematics for interpreting society: data

Topic purpose

The student can:
• collect, access and organise data using different methods
• identify features of ungrouped data
• display/present/represent data in the form of tables and graphs
• interpret trends in data

for personal, work or community life purposes.

_In this topic, students should be encouraged to make extensive use of computer software._

Collect, access and organise data, identify features

Knowing
• collect and access data, for example, through observations, experiments, surveys, sampling, existing data
• record and organise grouped and ungrouped data using standard methods, for example, templates such as tables, tallies and lists
• features of data, for example, range, bias, and the mean and median of ungrouped data
• calculate the mean of ungrouped data
• determine the median of ungrouped data, for example, for small groups under 20
• effects of chance on people’s lives (including the student’s own life)

Applying
• select and apply procedures to collect and organise data
• interpret features of data and make decisions and predictions about them in terms of, for example, personal implications, social consequences
• identify obvious flaws and/or bias in data collection methods
• ...

Explaining
• use common words, phrases and symbols for collecting, recording and organising data
• comment on how the way data is collected affects its interpretation and use, and vice versa
• outline arguments for presenting data in a particular form
• ...

Display/present/represent and interpret data

Knowing
• how to use standard methods for displaying/presenting data such as: tables (including frequency tables), graphs (pictograph, pie with percentages and/or values, bar, column, line, simple compound)
• read data that has been presented using standard methods
• draw tables and graphs, such as pictograph, simple bar, column, line, using electronic or manual means
• conventions of tables and graphs such as: headings/title, labels and scales on axes, coordinates/ordered pairs, keys and legends
• how graphs can distort data

**Applying**
• select and apply standard methods and conventions for displaying data to suit the context
• interpret data and predict obvious trends, such as: increasing, decreasing, constant, fluctuating
• extract data from graphs
• …

**Explaining**
• present data to teacher or peers in different forms
• identify and explain distortions of data presented graphically, such as: misleading scales, using pictograms to exaggerate
• comment on how the way data is presented affects its interpretation and use, and vice versa
• …
### Some examples of learning experiences linked to assessment

<table>
<thead>
<tr>
<th>Learning experience</th>
<th>Assessment ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learn how to input data into a spreadsheet that has formulae in place, and then</td>
<td>Given data about DVD sales, input data into a spreadsheet, then interpret and analyse the data and predict trends. Student gives informal oral analysis with</td>
</tr>
<tr>
<td>present it in different forms.</td>
<td>predictions to teacher.</td>
</tr>
<tr>
<td>Investigate ways of assisting the school tuckshop with monitoring stocks of food</td>
<td>Carry out a simulated activity using real tuckshop data for a month. Present results to tuckshop convener and recommend using (or not using) a spreadsheet for</td>
</tr>
<tr>
<td>and drinks using a spreadsheet.</td>
<td>monitoring stocks.</td>
</tr>
<tr>
<td>Discuss how chance can lead to losing money or making money — could link this to</td>
<td>Using an online downloadable casino game, simulate gambling to investigate the chance of winning or the percentage return for ‘money’ gambled. See Australian</td>
</tr>
<tr>
<td>a comparison of the risks associated with, for example, betting in a casino,</td>
<td>Stock Exchange (ASX) website—<a href="http://www.asx.com.au">http://www.asx.com.au</a>. Present an oral or written account of the results of the investigation; state conclusions that are</td>
</tr>
<tr>
<td>investing in houses, shares, coins.</td>
<td>substantiated with evidence.</td>
</tr>
<tr>
<td>Use population data to investigate life expectancies, for example, the chance of</td>
<td>Investigate the different influences on population numbers. Compile a list of influences with a sentence about each.</td>
</tr>
<tr>
<td>the students’ generation living to 80 years of age, etc.</td>
<td></td>
</tr>
<tr>
<td>Explore the role of chance in playing games.</td>
<td>Play games, for example, Monopoly, Snakes and Ladders, Billionaire. Design a game that uses chance. Demonstrate to peers or teacher how to play the game.</td>
</tr>
<tr>
<td>Develop awareness of games of chance that have pre-set outcomes.</td>
<td>Model scratch-its and model poker machines. Design a public awareness campaign in any format entitled: ‘Winner Takes All?’</td>
</tr>
<tr>
<td>Gather data about the speed of traffic passing the school at different times of the</td>
<td>Using a speed gun, collect data on the speed of passing cars; interpret and discuss the data. In small groups, process the data and make recommendations (supported with data) that can be presented to the school administration.</td>
</tr>
<tr>
<td>day.</td>
<td></td>
</tr>
<tr>
<td>Interpret graphs on company sales and profit; view internet streamed or video of</td>
<td>Interpret a given set of graphs (real data). Scenario — roleplay: half the class are the board of a company who are presenting the annual report (a series of profit and loss graphs) to shareholders (the other half of the class) who react to the report. Teacher observation.</td>
</tr>
<tr>
<td>part of an annual general meeting (AGM).</td>
<td></td>
</tr>
<tr>
<td>Examine a variety of surveys to determine bias, if any. Discuss the purposes of</td>
<td>Design a short survey to deliver a preconceived result.</td>
</tr>
<tr>
<td>bias in survey construction; find examples of biased questions.</td>
<td></td>
</tr>
<tr>
<td>Discuss ways of presenting data to different audiences.</td>
<td>Present the same data in different forms that will lead to different interpretations.</td>
</tr>
</tbody>
</table>
Topic 3  Mathematics for personal organisation: location and time

Topic purpose
The student can:
• read and use maps to locate points and places using the conventions of distance and location
• interpret time, clocks and timetables
for personal organisation needs such as time management and planning.

Read and use maps to locate points and places

Knowing
• know and understand angle (degrees) and SI units of measurement of length (mm, cm, m, km)
• with a calculator, convert measurements of length from one unit to another, for example, from cm to mm, m to km
• know how to use a ruler or tape measure and a protractor
• direction: 8 compass points in relation to the rising and setting of the sun: N, NE, E, SE, S, SW, W, NW
• read a variety of maps such as: mud maps, street directories, maps in an atlas, site maps (for example, school, shopping centre, hospital), online maps, globes, maps in travel brochures
• conventions of maps:
  − scale and distances
  − grid references
  − latitude and longitude
  − direction of North
  − keys and legends
  − titles

Applying
• apply concepts such as direction and mapping conventions to interpret location, direction and distance from maps
• make decisions about efficient travel by using methods such as:
  − interpreting maps and/or distance:time tables to determine the quickest route to a destination
  − calculating the time to travel a given distance given the map and the speed of travel
• …

Explaining
• describe routes in oral or written language using direction and distance details such as ‘head 40 km north from Warwick’, ‘take the third street on the left after the red house’
• draw a mud map and use it to explain how to get from one place to another
• give reasons why one particular route is preferred to another
• explain how straight line distances between locations on maps can be used to make rough estimates of distance and time

• …

**Interpret time, clocks and timetables**

*Knowing*

• units
  - relationships between units:
    • seconds, minutes, hours
    • days, weeks, fortnights, months, years
  - link between longitude and time
  - fractional and decimal representation of time, for example, 2.25 equals 2 hours and 15 minutes

• conventions of representing 12-hour time and 24-hour time
  - the relationship between ante meridiem (a.m.) and post meridiem (p.m.) and 24-hour times
  - converting between 12- and 24-hour time, for example, 1900 hours = 7pm

• read, record and calculate with 12- and with 24-hour time
  - timetables, for example, study, bus, train, tides, airline, exams, medication
  - calendars, for example, school, sports, festivals, performances, rehearsal
  - electronic appliances

• time zones:
  - Australian time zones, for example, Eastern Standard Time, Central Standard Time
  - daylight saving time and its implications within Australia
  - international time zones (for example, Greenwich Mean Time, International Date Line) and their relationship with longitude

*Applying*

• select and apply knowledge to construct timetables and calendars to plan and organise events or activities

• interpret and solve problems related to time management and time zones, for example, internet and mobile phone usage, travel

• …

*Explaining*

• present advice about time management and planning using common words, phrases and symbols (orally or in writing) to teacher or peers

• explain choices such as fastest journey based on distance, direction and speed of travel

• present reasons for the division of the world into time zones

• explain uses for 24-hour clock, for example, in terms of shift workers, airline timetables, military time

• …
## Some examples of learning experiences linked to assessment

<table>
<thead>
<tr>
<th>Learning experience</th>
<th>Assessment ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigate time zones in the context of watching sports in different parts of</td>
<td>Oral questioning of student — teacher notes response, for example:</td>
</tr>
<tr>
<td>Australia.</td>
<td>• what time do you have to turn the radio on in Perth if the cricket is being played in Sydney in summer?</td>
</tr>
<tr>
<td></td>
<td>• what would most Londoners be doing when you are having breakfast?</td>
</tr>
<tr>
<td>Use a map or street directory or RACQ website journey planner to plan the route for</td>
<td>Teacher uses checklist and asks students to answer questions orally about a given a portion of a map:</td>
</tr>
<tr>
<td>a cross-country course.</td>
<td>• describe in words how to get from point a to point b</td>
</tr>
<tr>
<td></td>
<td>• why is this the preferred route?</td>
</tr>
<tr>
<td></td>
<td>• using the given scale, state the actual distance from point a to point b</td>
</tr>
<tr>
<td></td>
<td>• estimate the time it would take to walk from point a to point b at 5 km/h</td>
</tr>
<tr>
<td></td>
<td>• give the grid reference for a particular feature on the map.</td>
</tr>
<tr>
<td>Compare methods of giving directions.</td>
<td>1. Draw a mud map showing how to get to some location (for example, local shop) from your home and present on OHT for peer review.</td>
</tr>
<tr>
<td></td>
<td>2. Given instructions for travel, draw a rough sketch of the course, then draw an accurate scale drawing, for example, walk 5 km east of starting</td>
</tr>
<tr>
<td></td>
<td>point, then walk 2 km north west etc. Demonstration by student.</td>
</tr>
<tr>
<td>Use directions to complete an orienteering course.</td>
<td>In teams, compete for the fastest time to complete the course by solving clues at each station or waypoint. Documentation of activity by</td>
</tr>
<tr>
<td></td>
<td>recording and photographing or video recording.</td>
</tr>
<tr>
<td>Discuss the things to consider when planning travel.</td>
<td>Prepare an itinerary based on collected brochures, timetables and accessed websites.</td>
</tr>
<tr>
<td>Discuss the characteristics of useful calendars; compare different calendars.</td>
<td>Prepare a calendar (hand-drawn or on computer), for example, school, sports, festivals, performances, rehearsal.</td>
</tr>
<tr>
<td>Play video games that require the use of maps or site plans. Compare different</td>
<td>Draw a screen shot of an aerial view of a game using mapping conventions.</td>
</tr>
<tr>
<td>ways of presenting maps or site plans in video games.</td>
<td>Access timetables and service times for different types of public transport. As a class, discuss and evaluate the effectiveness of the public</td>
</tr>
<tr>
<td></td>
<td>transport service at different times of the day or year. As a class, discuss and evaluate the effectiveness of the public transport service in the</td>
</tr>
<tr>
<td></td>
<td>local area.</td>
</tr>
<tr>
<td>Read and interpret a variety of timelines.</td>
<td>Develop a timeline in any format for simple activities, for example, school formal.</td>
</tr>
</tbody>
</table>
Topic 4  Mathematics for practical purposes: measurement

Topic purpose

The student can:
• convert between units using the metric system and measure accurately using a range of equipment
• calculate attributes of two-dimensional shapes and regular solids using given rules
• present the relationship between everyday two-dimensional shapes and regular solids using a scaled drawing for practical purposes.

The metric system and measuring equipment

Knowing

• units of measurement:
  – length (mm, cm, m, km)
  – mass (mg, g, kg, tonnes)
  – area (mm$^2$, cm$^2$, m$^2$, ha, km$^2$)
  – volume/capacity (cm$^3$, m$^3$, mL, L, kL)
  – temperature (degrees Celsius, for example, 4°C)
  – tyre pressure (kPa)
• measure and record data to required level of accuracy using equipment such as:
  – a magnetic compass
  – scales, for example, kitchen and bathroom scales, supermarket scales, letter/parcel scales
  – gauges, for example, blood pressure, pulse rate, rain, tyre pressure
  – meters, for example, electricity, light meter, gas, ammeter, voltmeter
  – standard containers to measure capacity, for example, measuring cups, spoons, cylinders
  – thermometer, forehead thermometer (skin patch), for example, temperature in degrees Celsius
• convert between metric units using a calculator and conversion tables

Applying

• select and use the correct equipment to measure length, mass, area, volume, and temperature
• select and apply the correct units when measuring length, mass, area, volume, temperature
• …

Explaining

• explain why one’s own estimates or approximations of lengths (including perimeters), mass, areas, volumes (of regular and irregular shapes and objects), temperature and pressure are reasonable
• explain how the level of accuracy needed for estimates is determined by the situation
• explain to a peer or teacher how to measure a given unknown
• …
Two-dimensional shapes and regular solids

Knowing

• perimeters of irregular shapes
• with a calculator and substituting into given rules, including teacher-manipulated rules, calculate measures such as:
  – perimeter of two-dimensional shapes (squares, rectangles, triangles and circles)
  – areas of two-dimensional shapes (squares, rectangles, triangles and circles)
  – volumes of regular solids (boxes, cylinders, Toblerones)
• practical methods of constructing right angles, for example, the 3-4-5 rule

Applying

• select and apply knowledge about two-dimensional shapes and regular solids and their attributes for practical purposes, for example, painting a room, laying a carpet or tiling
• find perimeters and areas of simple combinations of two-dimensional shapes for practical purposes
• find volumes of simple combinations of regular solids for practical purposes
• …

Explaining

• comment on the reasonableness of an estimate of, for example, length, mass, area, volume, temperature
• suggest the consequences of poor estimation in different real-life measuring activities, for example, wastage in carpeting a room, excess grass delivered for landscaping
• …

Representing everyday two-dimensional and regular solids

Knowing

• reductions and enlargements of simple shapes using a scale factor
• conventions of scale using ratios such as 1:10, 1 cm:1 km
• accurately convert measurements from scale to actual size and vice versa with a calculator using the given ratio
• draw scale drawings of everyday two-dimensional shapes
• read plans and elevations of simple regular solids
• represent regular solid using nets

Applying

• apply knowledge of two-dimensional shapes, regular solids and drawing conventions to accurately design and draw scale drawings for practical purposes (manually or with CAD or animation software) — for example, floor plan for own house, camping ground, stage set
• interpret scale drawings and plans
• …
Explaining

- state an opinion on whether models, diagrams or plans are representative of an original shape or regular solid or vice versa; support this opinion
- describe how to use different scales for everyday tasks
- ...

Some examples of learning experiences linked to assessment

<table>
<thead>
<tr>
<th>Learning experience</th>
<th>Assessment ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigate the existence and use of online unit converters.</td>
<td>Write a report on internet sites searched to find measurement converters; select one of the converters and give examples of how it may be used (written report in class with access to information gathered and teacher guidance when required).</td>
</tr>
<tr>
<td>Investigate finding the lengths along curves using a piece of string or paper.</td>
<td>Given a ruler, piece of string and curve, find the approximate length of the curve. Demonstrate the method to the teacher.</td>
</tr>
<tr>
<td>Investigate council safety regulations concerning the relationship between the people capacity of venues and the floor area of the venues.</td>
<td>Prepare a PowerPoint presentation to teacher or class detailing the information you have discovered.</td>
</tr>
<tr>
<td>Investigate the curing rate of concrete under different conditions by mixing concrete and using moulds.</td>
<td>Draw up a table showing the data collected; present this data graphically using any graph software such as Excel. Present table to teacher who provides feedback before graph is drawn; present graph to teacher when completed.</td>
</tr>
<tr>
<td>Investigate the initial and final pulse rates for a number of different physical activities and examine recovery times.</td>
<td>Student selects format for presenting data and analysis. Supports conclusions with reference to the data.</td>
</tr>
<tr>
<td>Draw scale diagrams of different areas.</td>
<td>Given a drawing to one scale, re-draw to a different scale.</td>
</tr>
<tr>
<td>Investigate watering systems for lawns.</td>
<td>Using a design template and catalogue from garden suppliers, design and cost a watering system for an area of lawn. Present the design with costing as a tender. See Appendix 2 (context 4) for ideas on setting out a tender.</td>
</tr>
<tr>
<td>Investigate the length of various bones of the human body and their part in establishing the height of student ‘victims’ in forensic science.</td>
<td>Complete an anthropometry study. Predict the height of a student after measuring arm length. Complete a worksheet.</td>
</tr>
<tr>
<td>Investigate the squareness of objects, for example, door frames, windows, buildings, floors.</td>
<td>Explain how you would determine whether a doorway in the classroom is square or not. Demonstrate the method.</td>
</tr>
</tbody>
</table>

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6 This is the technique of measuring the human body in terms of dimensions, proportions, and ratios. Once the standard approach to racial classification and comparing humans to other primates, the technique is now used for deciding the range of clothing sizes to be manufactured and determining the nutritional status of people (from www.GuruNet.com).
Topic 5  Mathematics for personal organisation: finance

Topic purpose

The student:

- knows how to obtain an income
- can make informed choices about spending, investing and borrowing money
- knows that consumers have rights and responsibilities.

Obtaining an income

Knowing

- forms of income including wages or salary, social security payments and pensions
- information about income tax such as purposes of taxation, tax file numbers, that tax is determined using rates and scales, tax returns involving wages/salary, simple deductions and Medicare levy
- how to access information about obtaining an income

Applying

- interpret entries on a selection of wage or salary payslips, timesheets and simple tax returns
- interpret tables of award rates to decide on pay rates for different ages in the one industry, and different categories under the same award, for example, hospitality, childcare, construction, hairdressing, horticulture
- calculate total earnings given relevant details in simple contexts
- calculate tax payable including Medicare levy given current tax tables (note that this does not involve completing a tax form)
- ...

Explaining

- explain the similarities and differences between ways of obtaining an income
- explain when a person is entitled to social security payments and pensions in straightforward situations relevant to students
- ...

Spending money

Knowing

- the concept of rounding, for example, round an amount of to the nearest 5 cents, the nearest dollar, the nearest 10 dollars
- use a calculator (handheld or online) or spreadsheet to calculate percentages of amounts of money such as discounts, mark-ups and mark-downs
- credit, debit and store cards, associated fees and charges
- GST and other government charges
- how to budget to meet needs
• methods of payment such as cash, cheque, electronic and phone banking, direct debit, BPAY
• how to access information about consumer rights

**Applying**
• create a budget for a specific purpose
• adapt a budget to meet particular personal needs
• examine different types of credit for different situations
• analyse and compare the effects of changes in taxes and charges for different situations
• …

**Explaining**
• explain how the GST works and how the ‘black economy’ affects the collection of the GST
• justify decisions made about methods of payment in different situations
• …

**Investing and borrowing money**

**Knowing**
• types of short-term investments such as savings accounts, cash management accounts
• types of long-term investments such as term deposits, collectables, superannuation, managed investments, shares, real estate
• forms of credit such as credit cards, store cards and their associated fees and charges
• types of loans such as personal loans, pawnbrokers, loan sharks, paying on terms
• risks involved in investing and borrowing money
• how to calculate simple interest using a given rule and compound interest, by means of on-line calculators or tables
• how to access information about investing and borrowing

**Applying**
• select the most suitable investment or borrowing strategy for simple situations
• predict consequences of financial decisions
• calculate simple interest in a given real-life situation
• interpret financial statements such as for a credit card or personal loan
• identify and assess risks in simple situations
• compare the costs of financial products for a given purpose (such as personal loan, credit card)
• …

**Explaining**
• explain choices made when investing and borrowing
• comment on the consequences and/or risks of various financial decisions
• …
### Some examples of learning experiences linked to assessment

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Investigate entitlements as outlined in awards in a relevant industry. In groups, discuss and compare entitlements in industries in which students have part-time jobs.</td>
<td>Individually compile findings in a table accompanied by a written paragraph stating own opinions about the different entitlements, referring to supporting information in the table. Short written report comprising table and paragraph.</td>
</tr>
<tr>
<td>Practise completing payslips. Individually complete hypothetical or actual payslips and timesheets with given data. In groups, compare the completed payslips and correct errors.</td>
<td>Individually write a short ‘how to’ guide for completing payslips. The guide should alert the reader to any pitfalls and provide examples of correctly completed payslips. The ‘how to’ guide and associated payslips may be presented in any format, for example, booklet, poster, CD.</td>
</tr>
<tr>
<td>Discuss the purposes of a personal budget. Investigate the implications of running over budget (could apply this to the state and federal budgets if students are interested). Use a spreadsheet with given formulae and hypothetical data.</td>
<td>Prepare a personal budget, for example, for paying off and running a car, household expenses, leisure and entertainment, further education expenses, mobile phone. Complete the budget activities in the Office of Fair Trading teachers’ resource kit (Credit and Budgeting Activities — see website), or transfer suitable ones to a spreadsheet.</td>
</tr>
<tr>
<td>Investigate where to get (independent) information and where to get assistance with financial problems. As a starting point, students could use the section titled ‘Three steps for fixing a financial services problem’ in the Office of Fair Trading booklet Get Out There: A survival guide for young adults (downloadable from their website).</td>
<td>Discuss real examples of people who have been in financial difficulty and how they have been assisted. Make a flow chart based on a ‘what if’ scenario to show young adults what to do if they are in financial difficulty.</td>
</tr>
<tr>
<td>Investigate how to make an effective complaint, for example, through the Small Claims Tribunal.</td>
<td>In groups, roleplay a case before the Small Claims Tribunal. Roles could include the disgruntled customer, the seller of the goods, other customers as witnesses, the ombudsman. Student groups should supply the faulty goods as evidence. Video the roleplay for peer assessment of the effectiveness of the roles as played by different class groups.</td>
</tr>
<tr>
<td>Carry out calculations to work out income derived in different ways, selected by the teacher from the following: full time, part time, casual, short-term contracts, weekly/fortnightly/monthly earnings given annual salary, wage plus commission, piece rates, bonuses, retainers, award rates and conditions including superannuation guarantee, earnings based on hourly rate and overtime (students do not need to know how to do all of these — at teacher’s discretion).</td>
<td>Given different scenarios and details of earnings, calculate total earnings. Present calculations and totals in written form.</td>
</tr>
<tr>
<td>As a class, discuss some of the problems associated with managing mobile phone costs based on own experience or that of others.</td>
<td>Evaluate the advice, ‘Going mobile’, in the Office of Fair Trading (Queensland) booklet Get Out There: A survival guide for young adults (downloadable from their website). Present the evaluation orally (to the class or to the teacher only); the student comments on whether the advice requires revision or not and why.</td>
</tr>
</tbody>
</table>

(Table continues over page.)
<table>
<thead>
<tr>
<th>Learning experience</th>
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</tr>
</thead>
<tbody>
<tr>
<td>As a class, explore the financial risks in different situations involving investing and borrowing money.</td>
<td>Develop a set of questions to ask a guest speaker who is a financial planner; space is to be left under each question for notes on the speaker’s replies. Ask the questions, making brief notes of the responses in the spaces on the question sheet. Hand in the completed question sheet to the teacher.</td>
</tr>
<tr>
<td>Discuss the ‘pluses’ and ‘minuses’ listed under the section titled ‘Do I need a credit card?’ in the Office of Fair Trading teachers’ resource kit: <em>Credit and Budgeting Activities</em> (see website).</td>
<td>Examine and interpret real and hypothetical credit card statements. Complete the activity titled ‘Credit cards: using them wisely’ in the downloadable booklet.</td>
</tr>
<tr>
<td>As a class, develop a definition of gambling and brainstorm examples of gambling from the conventional to the unusual.</td>
<td>Select and investigate a form of gambling that involves money; gather data about how much money is spent on this form of gambling and information about the social consequences. Present a written report that has data displayed in tables or graphs and three paragraphs on social consequences.</td>
</tr>
</tbody>
</table>
5 Learning experiences

5.1 Overview

The intent of this subject is to build confidence and success in using mathematics in everyday contexts by reducing or removing anxiety when doing mathematical activities; by countering deep-seated negative beliefs and attitudes towards mathematics learning (through providing a supportive environment and scaffolded activities in which students can succeed); and by increasing students’ repertoire of skills with practical time-saving strategies.

Therefore, to assist teachers in designing a course of study that reflects the intent of this subject, the expectations of the learner have been outlined with a range of teaching strategies in sections 5.2 and 5.3. These sections have been provided to characterise teaching and learning in this study area specification, and differentiate it from the strategies used in teaching Authority mathematics subjects.

5.2 Expectations of the learner

The expectations listed below are drawn from and align with level 3 (and some level 4) standards of the National Reporting System (NRS), (Commonwealth and ANTA, 1994-5) and are to be read in combination with the teaching strategies outlined in section 5.3.

When making meaning, problem solving and communicating, the student is expected to:

- develop practical mathematical skills such as:
  - representing concepts with concrete and visual materials
  - measuring with a range of instruments
  - estimating in everyday contexts
  - using a calculator extensively
  - becoming proficient at using and interpreting displays on calculators and computers
  - working individually and in groups

- develop mental computational abilities such as:
  - determining the reasonableness of an answer
  - recognising limitations in the accuracy of data and measurements
  - rounding numbers to suit the context
  - selecting a suitable degree of accuracy.
When **making meaning**, the student is expected to:

- draw on a combination of hands-on (concrete and visual) and real-life materials, diagrams, language and symbols to derive mathematical meaning
- draw on personal experience, prior knowledge and basic operational mathematical knowledge within everyday contexts to make predictions and check reasonableness
- reflect and question by relating the mathematics to personal experience, prior knowledge, and the experience and opinions of others
- clarify the intended meaning of an activity by asking questions which go beyond repetition and rephrasing
- use dictionaries for assistance with general and mathematical vocabulary when necessary.

When **problem solving** the student is expected to:

- use a number of different pieces of mathematical information
- interpret information from easily accessible texts, (for example, plans, maps, newspaper articles and graphs, information fliers, television programs, videos, online texts, etc.)
- use a blend of personal 'in-the-head' methods, pen-and-paper and calculator procedures
- begin to adapt prior experience and examples in the selection of suitable and efficient methods of fulfilling task requirements
- use some approximation with reference to relevant experience to check that the result fits the task or activity
- solve straightforward problems and provide answers in the context of the problem
- make informed decisions *with assistance when needed* in contexts in which the choice of actions required is usually clear and the actions are not very complex
- apply learned strategies to a limited range of predictable problems
- develop skills and confidence to contribute to the efforts of a group
- collaborate with others as part of a group in some complex or non-routine activities.

When **communicating**, the student is expected to:

- comprehend activities or tasks which include *limited formal mathematical symbolism, abbreviations and language*, and which come from a variety of sources
- use some of the symbolism and conventions of formal mathematics
- provide explanations in predictable situations using informal language and some mathematical language
- interpret and analyse how mathematics is represented and used
- use some unfamiliar information as long as it is accessible (in terms of culture, gender, literacy, etc)
- demonstrate a basic understanding of the use of rules to generalise about everyday situations
- use, but not necessarily manipulate, given rules
- use a variety of formal and informal strategies (such as concrete and visual materials, oral and written mathematical and general language, some symbolism and diagrams), singly or in combination, to indicate the problem-solving process and results
- participate actively in group discussions with peers and teacher.
5.3 Teaching strategies

5.3.1 Overview

In this subject, the role of the teacher is ‘to increase the range of options for students by helping them deepen their mathematical knowledge and understanding so that they can make choices in tune with their needs and desires, taking control of their lives when they choose to’ (Johnston et al 2001, page 24 – see footnote).

The following strategies⁷ aim to help teachers develop a balance between those practices and skills that are necessary for functioning in the world, and those that are viewed by students as useful and meaningful. These strategies take into account how and when students actually do mathematics away from school, whether for employment, interest, enjoyment or informed citizenship.

These strategies go hand in hand with a supportive learning environment that develops students’ confidence and ensures they experience success in a variety of contexts. In a supportive learning environment:

• learning is cohesive: highly-structured, scaffolded and in manageable steps under close supervision
• students’ own experiences are valued and used as starting points for teaching instead of viewing students in terms of the ‘deficit model’
• activities are varied sufficiently to increase attention span and improve memory by:
  − allowing students to move around to other locations in the classroom (or outside as a class) for some activities rather than remaining continuously desk-bound
  − including whole- and small-group class discussions, roleplays, seminars, etc. rather than relying primarily on ‘teacher talk’
  − using humour where suitable to engage the emotions
• assistance such as hints, rules and modelled examples are provided to help students make informed decisions
• more than one opportunity is provided for students to demonstrate their understanding
• adequate time is provided for students to process information
• encouragement and constructive feedback are given freely
• students are praised, reassured and rewarded for improvement in learning — thus the learning environment is non-threatening
• there is a range of different stimuli such as posters (that are changed regularly), plants, soft background music, videos, guest speakers, games, computer software, manipulatives.

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5.3.3 Approaches to consider when choosing teaching strategies

1. **Ascertain and evaluate attitudes and beliefs regarding both learning mathematics and using mathematics: getting to know your students.**

Many students come to the classroom with negative attitudes and beliefs that prevent them from engaging in mathematical tasks in meaningful ways and from trusting their own mathematical intuitions. For many, negative attitudes towards mathematics initially develop in response to early school experiences of failing to understand, followed by a lack of further explanations or assistance from the teacher, leading to a loss of confidence and panic over the loss of control of his or her own learning.

As these experiences are repeated, the student feels frustrated and assumes it is futile to expect to understand mathematics. Finally, the student ‘switches off’ to distance him/herself from the situation.

**Suggestions**

- Conduct a series of lessons at the beginning of the course that provides students with the opportunity to explore their feelings and attitudes towards mathematics and to share them with other members of the class. Discuss previous classroom learning experiences and produce a student-generated contract that establishes the climate of the learning environment for this course (see appendix 3 for a detailed outline on how these lessons could be structured).
- To understand the students’ existing numeracy practices, encourage students to talk or write freely in a trusting environment about their attitudes and beliefs, what engages their interest, what they desire; share your own fears and experiences.
- Point out, and encourage students to look for evidence of their existing (even if informal) mathematical understandings, of which they may be unaware, to encourage the development of feelings of comfort and control.
- Ensure that all students experience success early in the course so that their confidence can be built up, for example, record and reward small successes of individuals and groups with tick sheets or stars, or use online games that reward the player with encouraging comments.

This strategy should be used throughout a course since different negative attitudes and beliefs may be tied to different topics.

2. **Determine what students already know about a topic before instruction.**

While many students may have learned little formal mathematics in the past, their background of real-life experiences probably included counting, sorting, measuring, playing games of chance, and, most importantly, handling money. Some students might not even recognise the mathematical activities in their daily lives. Identifying students’ partial and fragmentary understandings is important, because new learning will be filtered through and become integrated with prior knowledge. Each student’s informal knowledge should be identified so that new instruction can be designed to link with what already has meaning to the student. Students may well have invented valid alternative strategies in their everyday lives that teachers can value and adapt. At the same time, attention must also be paid to incorrect ideas or ‘patchy’ knowledge so that they do not distort new learning or cause confusion.

This helps students to begin linking bits of disconnected prior knowledge into a structure without the competing demands of computation. It also allows them to share different
strategies, to challenge the notion that there is always only one right answer and to realise that the suitability of one strategy rather than another is influenced by social and mathematical factors. Social factors can include work or gender relations, personal values, or power relations embedded in social interactions. Mathematical factors can include the degree of precision needed, the power of the chosen strategy and the range of mathematical options available.

**Suggestions**

- As the starting point for a new topic, explore what students already know through informal discussion of students’ real-world and school experiences as well as hypothetical situations. Encourage students to share their strategies and solutions.
- Do not view gaps in student knowledge as deficits but as a way of understanding how the student is constructing meaning. This can then be used to scaffold new learning.
- Work from students’ passions and interests as well as needs, for example, if a student is learning to drive then she will need to estimate distances in order to pass the driving test, hence she will be interested in learning about metres in relation to stopping and safe following distances.
- *Avoid using a computation pretest to determine students’ prior knowledge* as this produces anxiety for the student and reinforces a sense that mathematical tasks involve only computation.

3. **Provide opportunities and time to explore mathematical ideas with concrete or visual representations and hands-on activities.**

Students will find the mathematics they are learning more meaningful if they can link the ideas, procedures, and concepts to realistic situations, concrete representations, or visual displays. These will:

- help them to ‘see’ and ‘feel’ how and why computational algorithms work
- provide them with a way of monitoring their own computations and procedures, and help them to pinpoint gaps in understanding when they might have difficulty identifying and describing these gaps using more abstract language
- help them to develop backup strategies that can be used when they become confused with the mechanisms of newly-learned strategies or when they want to be certain that computations are correct
- familiarise them with the genres used in mathematics before they use them for practical purposes, for example, timetables, street directories, maps (real or online), graphs, spreadsheets.

**Suggestions**

- At the beginning of a new topic, have students solve a number of related problems using real objects (for example, apples, coins, cups, body unit such as a hand span or foot, string), or representations (for example, drawings, diagrams, charts, puzzles, games, models, flowcharts, the teacher explicitly roleplaying and miming), and then have students move between these activities and numbers.
- Encourage students to talk about these examples, make observations, and explain how processes work before carefully and slowly introducing formal notations or mathematical rules.
- Have students practise the concrete and visual activities frequently and in short sessions.
• After students are comfortable with new concepts in a concrete context, a discussion could follow in which these concepts are generalised and more abstract principles are formulated. Some students, of course, will not be able to move to the abstract but will confidently demonstrate understanding in a concrete or visual everyday context.

Students may find that manipulatives such as pattern blocks, base 10 blocks, fraction circles, Cuisenaire rods, Geoboards, counters etc, are useful as representative objects for specific topics. Transparent versions of these objects are also available for use with an overhead projector. In addition, manipulatives can also be inexpensive everyday objects such as toothpicks, beans, cards, nails, buttons, pieces of stiff paper cut to size, etc.

4. **Encourage the development and practice of estimation skills.**

Many everyday or work tasks do not require precise, computed answers, but rather quick approximations of numbers, distances, timeframes, etc., based on some known information. The demands of the situation will determine how precise or imprecise an estimate has to be and whether it can be made mentally or requires written work or a calculator, for example, when shopping, it is more convenient to approximate a total cost mentally instead of using a calculator or doing a written computation to determine whether one is carrying enough cash to pay for groceries or to confirm that the total at the cash register is correct. Good estimation skills can also be used to find computational errors resulting from misplaced decimal points or from errors while using a calculator.

**Suggestions**

- Have students identify everyday and work situations for which estimates may be more suitable than exact answers, reinforcing the notion that estimating is a valuable skill, not merely something you do when you don’t know how to compute an answer the ‘right’ way.

- Discuss reasons for the need to estimate and the inevitable trade-off between the benefits of estimating and the possible cost in error due to lack of precision.

- Stress that there are no right or wrong estimates, only ones that are closer or farther from a computed answer, and that the importance of the degree of exactness (which may determine the estimation strategy to use) depends on the requirements of the situation.

- Encourage students to share with each other the estimation strategies they use (such as multiplying by 10 instead of 9 and then subtracting a little), and supplement the class repertoire with strategies that you use in your everyday life.

- Differentiate between rounding numbers as a strategy for estimating and rounding an answer that has been computed.

- Encourage students to ask themselves questions such as:
  - How reasonable (close) is the estimate?
  - Does this degree of accuracy suit the purposes of the situation?
  - Was the method or strategy the most suitable for the situation?
  - Does the situation suggest making a high or low estimate (when making sure I have enough money for groceries, I may want my estimate to err on the high side)?

- For classroom estimation practice, ask students to estimate amounts in their own everyday contexts where an exact answer is not normally required (for example, the number of kilometers per tank of petrol, approximate cost of a basket of groceries, number of kilometers between their home and school as represented on a map and time it will take to travel by bus/train/car from one to the other) as well as to estimate answers to traditional arithmetic exercises before carrying out the computations.
• Use sample test items with multiple-choice responses for estimation practice to give students an opportunity to see that a good estimate can often replace tedious computation and point to a reasonable response.

5. **Encourage development of mental mathematics skill as an alternative computational strategy.**

Mental mathematics involves doing mathematical tasks without pencil and paper (or a calculator) by using ‘in my head’ mathematical procedures. In everyday life, we often want to know answers, not estimates, to questions involving numbers but do not want to stop to write a computation, or we realise that while the written procedure is cumbersome, an answer can be arrived at quickly in another way, for example, compare how you multiply $3.99$ times $4$ in your head with how you do it on paper. Mental mathematics is not simply carrying out the mental equivalent of pencil-and-paper algorithms but involves making use of the properties of particular numbers and relationships between quantities. Mental strategies aim to reduce the amount of information necessary to keep in mind at once, thus reducing errors and improving accuracy.

Students who develop mental mathematics skill are able to:

• gain confidence in being able to carry out a calculation because they focus attention on entire numbers rather than only on selected digits — this is especially useful if they have difficulty remembering multi-step procedures that are not really meaningful to them
• provide a quick response to an everyday or workplace number-laden situation
• adapt mental procedures to suit the particular numbers involved
• provide an early approximation of the answer.

**Suggestions**

• Reassure students who are afraid of, or uncomfortable with mental mathematics that it can come in handy in many everyday contexts and can save time.
• Identify, discuss, and practise a repertoire of mental mathematics strategies (including your own) with students, first with small numbers and then with larger or more complex numbers in different situations until they trust their abilities enough to use them when needed.
• Have students discuss the differences and similarities, and advantages or disadvantages between what they figure out in their heads, and what they do with paper and pencil.
• Refer frequently to previously studied material to help students see the connections between different mathematical concepts, such as fractions, decimals, and percentages, so that students become flexible in switching from one system to another when performing mental mathematics, for example, 25 per cent is one fourth, so divide by 4.

6. **View computation as a tool for problem solving, not an end in itself.**

While the acquisition of computational skills is important, it is of little use unless students also develop the ability to determine when certain computations are suitable and why. These skills should be developed and applied in both familiar and less familiar situations. Understanding why a particular computational procedure is needed in a particular situation requires an understanding of what is happening as a procedure is being used, and of the differences and similarities between procedures — which students can describe in concrete or representational terms. Understanding is not demonstrated by rote learning of a series of steps as an end in itself because this can give students the impression that they ‘know’ the mathematical content and that it is ‘useful’ to them.
Suggestions

- Reinforce connections between computational skill and applications by asking:
  - specific ‘what if’ questions to provide contexts for discussions of alternative solutions
  - students to write their own word problems targeting a particular procedure (that is, multiplying fractions) and discuss this with other class members — this will help students to realise that they need to select the most suitable solution method, rather than use only one (‘because it is fractions, you have to multiply’).
- Use manipulatives and other visual aids while solving problems to help students develop a sense of why one procedure works while another is unsuitable.
- Give students time to question and discuss the meaning of answers or methodologies rather than leave a problem as soon as a correct answer has been reached.

7. **Encourage the use of multiple solution strategies.**

Students who lack confidence with mathematics often believe that there is only one proper (or best) way to solve a mathematics problem. When students feel that they do not have the specific knowledge or skill needed for a particular problem and they feel rushed for time, they quickly give up in frustration rather than persevering and looking for alternative paths to solutions. By working through multiple-solution strategies or representations, different students may find some strategies more meaningful than others. By having alternatives available, more students will be able to connect new learning with their individual experiences and perspectives.

Suggestions

To help students become flexible problem solvers:

- have them play games that have mathematics embedded in them but are not seen as mathematical games, such as Monopoly, Squatter, chess, video games (for example, sports simulations, puzzle games, strategy games, roleplaying games-RPGs)
- allow them sufficient time to explore, solve and reflect on problems, rather than rushing on to the next one
- include explanations and demonstrations of many ways to arrive at a good solution to a problem, including mental mathematics strategies
- model learning-to-learn strategies such as:
  - risk taking (having a go)
  - investigating self-generated issues/questions
  - asking for and accepting help/advice/feedback from a variety of sources
  - reviewing and reflecting whether the answer is reasonable by checking against an estimate
  - linking new information to existing knowledge
  - learning from mistakes
  - changing the approach
- as soon as a problem has been solved, ask if any student can think of another way to approach it, and ask why they did what they did and what they could have done instead
- continuously point to connections between mathematical representations, concepts, and procedures including those previously covered
- develop computational algorithms logically so students see that the algorithms are simply shortcuts for time-consuming procedures (such as multiplication for repeated addition and division for repeated subtraction) or alternatives for other representations (such as
percentages for fractions)

- while exposing students to new methods, allow them to continue to use ‘lower level’ strategies (such as finger counting when adding or subtracting, and multiple addition rather than multiplication) if they need to do so; when they see that certain strategies are cumbersome and they feel more secure with new strategies, they will probably begin using the ‘higher level’ strategies. Even if they never get to that point, they will at least be able to use a strategy that is dependable and meaningful to them.

8. **Develop students’ calculator and computer skills.**

Students should have opportunities to become skilled at using what have become accepted and essential workplace tools. Although calculators and computers may take the place of tedious computation and ensure accuracy, they do not replace deep understanding of mathematical concepts and procedures, and they cannot make decisions or solve problems. By using calculators as an instructional tool, students quickly observe the results of many calculations, see patterns, make generalisations about mathematical processes, and focus on understanding without getting bogged down in lengthy calculations.

**Suggestions**

- Make certain that each student knows how to use a DAL (direct algebraic logic) 2-line display calculator with a fraction key, and a 4-function basic calculator.

- Use calculators in activities such as:
  - checking mental or written calculations
  - investigating what happens when 2 decimal fractions less than 1 are multiplied together, or what 10 per cent of any number is, compared to tedious written calculations
  - substitute values into the given version of simple rules (not manipulate the original version of the rule to find the unknown)
  - keeping records of experiments and then drawing conclusions from patterns.

- In realistic problems, have students discuss and determine for themselves when it is better to use a calculator rather than estimating, using mental mathematics strategies, or written computation.

- Use computer software integrated with other classroom activities and discussions to help students develop specific mathematical skills, for example, graphing software, databases, spreadsheets, games, simulations, word processing.

9. **Provide opportunities for group work.**

Students entering the workforce must be able to work with others in teams, teach others, negotiate, often problem solve with numerical information and communicate about numerical issues (negotiating a contract, making business or purchasing decisions, defending an estimate, etc.).

**Suggestions**

- Create an atmosphere in which students frequently have to work together, help or teach each other — this will not usually be accomplished in small and brief tasks.

- Teach students, as a class, how to work in groups, for example, how to share responsibilities, interact and cooperate, rules for behavior within groups — with students involved in determining suitable interactions.
• Develop long-term, realistic projects to suit group work, for example:
  − organising a group trip
  − arranging a party or a meal (including planning, deciding on and managing schedules, budget, supplies, materials, division of labor, etc.)
  − conducting a survey about a meaningful issue (including collecting, analysing, and reporting on findings and implications).

10. **Provide opportunities for students to communicate about mathematical issues.**

In the workplace and in real-world situations, students need to, not only solve mathematical problems, but also to communicate their reasoning and the results or implications of their work to others. Methods of explaining to others might include drawing a diagram (of a room to plan carpeting), writing a letter about an error on an electricity bill, calling someone to report that a shipment arrived with less than the ordered amount, negotiating terms of a sale, and so forth. Thus, reading, writing, and communicating are activities that should be taught and practised with mathematical content. These skills will enable students to clarify and organise their thinking so that a target audience will clearly understand their information or argument.

**Suggestions**

• Raise awareness of social and community issues and practices (related to numeracy) that influence and have an effect on students’ lives and which they may find interesting to communicate about.

• Use everyday and mathematical language to explain (in short sentences) ideas, concepts and terminology so that students can copy this model when they communicate.

• Limit the use of ‘terminology’ to the essential.

• Teach the genres that students will need to use to communicate about mathematics.

• Encourage students to put into words for others what they are doing and why, using both written and oral formats, such as:
  − letters of complaint to companies clearly detailing billing problems, for example, a credit card statement
  − letters to the editor of a newspaper or magazine, or to the chair of a civic group explaining an opinion based in part on some numerical information
  − editorials, short essays, debates, seminars in which students respond to one another, arguing another side of an issue by interpreting the same numerical information in a different way
  − conduct a survey and write a report detailing a description of what was done, results, and implications; and then make an oral presentation with visuals to the class.

11. **Plan for practical and contextualised learning.**

Students can see clearly that what they are learning will be directly applicable to situations in their own lives if they are using their new skills in environments that are very similar to the life and work environments in which they will have to function, rather than just in context-free environments such as workbooks with extensive isolated arithmetic practice exercises. Contextualised learning is more likely to interest and motivate students, provide opportunities for success and show them that mathematics is a necessary lifeskill that can also be fun. Teachers may decide to teach students the prerequisite knowledge and skills and then help them to apply these in a context, or use the context in which to develop knowledge and skills. For detailed examples of contextualised learning, refer to appendix 2.
Suggestions

• Use students’ experiences of situations in which mathematical issues arise, their interests and needs, as well as current events to develop meaningful, realistic contexts for problem-solving tasks. These tasks must be practical and not trivial (whether actual or hypothetical) and could also reflect situations students know about or are likely to encounter after leaving school. They should also not be written as extensive word problems that take excessive decoding before the mathematics is revealed. For example, if students live in an area that has some public transportation, a project could be developed around whether to buy a car or not — they could investigate car costs (car payments including interest, upkeep, insurance, and frequency of usage) in relation to public transportation costs and limitations.

• Encourage students to reflect on what is different between school, everyday and workplace problem solving (in terms of constraints, skills, beliefs, dispositions, degree of accuracy expected, tools used, etc.), for example:
  − When shopping, to decide whether a block of tasty cheese is overpriced, school ratios are not used because this method is too time-consuming — instead, a shopper will simply find a different brand of cheese of similar weight and compare prices by observation.
  − Pool builders do not use formal measurement and geometry; instead, they use more informal, more efficient and common sense mathematics that reduces mistakes.
  − Cash registers at fast food outlets are pre-coded with text or icons so that no data entry or calculations by the user are required.
  − Boat builders mix fiberglass and binders by the feel of the mix, adjusting the amount of binder by trial and error when necessary (such as on a humid or cold day).
  − Carpet layers not only have to calculate the area, but also have to take into account the nap of the carpet, the pattern (if any) and where to place the seams to avoid wastage and cost blow-outs.

• Organise field trips, excursions, and visits away from the classroom to different workplaces to investigate how they use mathematics, and to local places of interest where data and information can be collected, surveys conducted, photographs taken, etc, to be analysed back in the classroom.

• If possible, arrange for students to have work experience in a workplace that interests them — they can learn how their numeracy practices can be applied or adapted as well as the particular numeracy practices of the industry.

• Support students with poor literacy skills when setting contextualised learning tasks by:
  − ensuring that the written wording uses short sentences and is concise
  − keeping terminology to a minimum
  − using diagrams, flow charts or steps to follow
  − helping students to understand the task by explaining.

12. Develop students’ skills in interpreting numerical or graphical information in everyday texts.

When students read and view a variety of visual, written or spoken texts (on television, in newspapers, magazines, brochures and online) in which graphs or simple statistical information is presented in tables or text, they will often skim over the article or accept it without question. However, these texts often require little or no computation, only

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interpreting and applying understanding of the numerical information and comprehending the text. These are essential skills without which the text loses meaning and students are unable to understand important information.

**Suggestions**

- Have students draw a circle graph (possibly using computer software) showing how they spent the last 24 hours, or a bar graph showing how many bottles of soft drink they drank each day for a week. Students will see the connections between events in their lives and the graphs they create as well as understanding how other graphs are constructed.

- Model and encourage the development of a critical eye for articles or advertisements that draw conclusions from summarised data (for example, ‘9 out of 10 doctors....’). During class discussions, show students how to challenge presented information and its implications by asking probing questions such as:
  - where did the data on which this statement is based come from?
  - how reliable or accurate are these data?
  - could the study have been biased in some way?
  - are the claims made here sensible and justified from the data?
  - is any information missing?

- Model for students how to summarise articles and interpret and draw conclusions about numerical information. Have students read or view articles containing numerical information and present a summary of that information orally or in writing to other students. Alternatively, all students in one class could read the same article or document and discuss its implications. In these discussions, be certain that students understand the vocabulary and any technical terms.
The purposes of assessment are to provide feedback to students and parents about learning that has occurred, to provide feedback to teachers about the teaching and learning processes, and to provide information on which to base judgments about how well students meet the general objectives of the course. In designing an assessment program, it is important that the assessment tasks, conditions and criteria are compatible with the general objectives and the learning experiences. Assessment, then, is an integral aspect of a course of study. It can be formative or summative. The distinction between formative and summative assessment lies in the purpose for which that assessment is used.

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

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

### 6.1 Underlying principles of exit assessment

The policy on exit assessment requires consideration to be given to the following principles when devising an assessment program for the 2-year course of study:

- information is gathered through a process of continuous assessment
- balance of assessments is a balance over the course of study and not necessarily a balance over a semester or between semesters
- exit achievement levels are devised from student achievement in all areas identified in the study area specification as being mandatory
- assessment of a student’s achievement is in the significant aspects of the course of study identified in the study area specification and the school’s work program
- selective updating of a student’s profile of achievement is undertaken over the course of study
• exit assessment is devised to provide the fullest and latest information on a student’s achievement in the course of study. These principles are to be considered together and not individually in the development of an assessment program. Exit assessment must satisfy concurrently the 6 principles associated with it.

Continuous assessment

The major operating principle is continuous assessment. The process of continuous assessment provides the framework in which all the other 5 principles of balance, mandatory aspects of the study area specification, significant aspects of the course, selective updating, and fullest and latest information exist and operate.

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

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

Balance

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

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

Mandatory aspects of the study area specification

Judgment of student achievement at exit from a course of study must be derived from information gathered about student achievement in those aspects stated in the study area specification as being mandatory, namely

• the general objectives of knowing, applying and explaining, and
• the five topics: number (the study area core), data, location and time, measurement, finance.

The exit criteria and standards stated for the strand must be used to make the judgment of student achievement at exit from a course of study.

Significant aspects of the course of study

Significant aspects refer to those units/electives/contexts that the school selects in accordance with the particular structure of the strand. Significant aspects can complement mandatory aspects or be in addition to them. They will be determined by the context of the school and the needs of students at that school to provide choice of learning experiences.
appropriate to the location of the school, the local environment and the resources available. The significant aspects must be consistent with the general objectives of the study area specification and complement the developmental nature of learning in the strand course.

Selective updating

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

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

The following conceptions of the principle of selective updating apply:

- a systemic whole subject-group approach in which considerations about the whole group of students are made according to the developmental nature of the course and, in turn, the assessment program. In this conception, developmental aspects of the course are revisited so that later summative assessment replaces earlier formative information.
- an act of decision-making about individual students — deciding from a set of assessment results the subset which meets study area specification requirements and typically represents a student’s achievements, thus forming the basis for a decision about a level of achievement. In the application of decisions about individual students, the set of assessment results does not have to be the same for all students. However, the subset which represents the typical achievement of a student must conform to the parameters outlined in the school’s study plan for the strand.

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

Fullest and latest information

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

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

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

Overview

The following strategies are developed from the expectations of the learner and the teaching strategies outlined in section 5. Because students may be fearful of formal assessment, informal assessment can validly be used to provide additional evidence upon which to award a level of achievement. Once students’ confidence has been built up sufficiently with supportive teaching strategies, they may be able to demonstrate achievement of the general objectives in more formal assessment tasks.

Regardless of whether assessment is informal or formal, it should extend well beyond examining students’ ability to find the right answer for a computational exercise. It should assess the many additional skills and knowledge areas that are part of being numerate, such as interpreting claims about data, acting upon numerical information in technical documents and forms, applying mathematical reasoning and solving realistic problems, communicating about mathematical issues and explaining one’s reasoning.

Suggested strategies

1. Conduct assessment mostly in class time.

So that students can be fully supported and scaffolding provided, assessment should be conducted mostly in class time. This includes not only assessing responses to small tasks in class time under the teacher’s close supervision, but also projects and investigations that are carried out over several weeks. This strategy can provide many opportunities for the teacher to record observations of students, assist them in completing tasks, and authenticate student work. It also means that students will have access to resources, and sufficient time for problem solving and group work.

2. Encourage students to talk about what they are doing and the choices they are making.

In order to be able to communicate about issues involving mathematics, students should be encouraged to explain how they are working with given rules, operations, procedures and open-ended problems. This enables teachers to not only assess understanding, but also to diagnose difficulties and provide guidance. Records of observations of the student’s explanations can contribute to evidence of their achievements.

Explanations by the student can be given:

• in informal discussions with the teacher and peers
• more formally, for example as a:
  – presentation
  – demonstration.
  – roleplay
  – mock interview
  – debate.

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3. **Develop contextualised assessment tasks.**

Genuinely contextualised assessment is real and meaningful to the student because it is practical and realistically related to the world of work, personal organisation, and interpreting society. Examples of contextualised tasks are provided in appendix 2.

4. **Use open-ended extended tasks that may have more than one reasonable solution and/or solution path.**

Students should not be restricted to working on sequences of sums or word problems in a book to which there is only one correct answer. They should be involved in open-ended tasks that require them to:

- understand and apply mathematical concepts
- explain their reasoning and the significance of their solutions
- present their work in the form of combinations of:
  - graphs
  - tables
  - drawings
  - timelines
  - posters
  - PowerPoint presentations
  - flowcharts
  - short written or oral reports describing a problem-solving process (of an individual or a group)
  - written recommendations for a course of action
  - simulated memos aiming to communicate about issues with specific real-world audiences (and demonstrating both appropriate mathematical know-how and literacy skills)
  - simulations of real-world tasks relevant to a particular student population.

5. **Assess a broad range of skills and reasoning processes using a range of written and non-written methods.**

Because this study area specification emphasises contextualised assessment of a broad range of skills and reasoning processes and is not test-based, **it is strongly recommended that examinations be kept to a minimum or not used at all. If they are used, then they should be ‘open book’ — students should be able to bring resources to the examination to help them.**

Suggested written methods

*Short written answers* (one word, sentence, or paragraph) such as:
- questions requiring short answers or paragraph responses
- matching/true/false/classification
- cloze passages and sentence completion
- multiple-choice questions
- student self-assessment sheets

*Extended written answers* (at least three paragraphs — not essays)
- written reports of investigations, projects, case studies
• journal entries
• websites entries

Suggested non-written methods
• oral presentation of results, for example, using audiovisual facilities, navigating own material on a website for the class
• roleplay
• demonstration of particular practical skills, techniques or processes, for example, estimating using a calculator, measuring using a range of equipment, using mathematics software to solve a problem
• simple diagrams
• sketches
• flow charts
• digital photographs or video as record of the project
• diagrams: hand-drawn, using a computer, or sourced on the internet
• making real two-dimensional or three-dimensional models, for example, a set for a school production, landscaping for the senior lunch area
• virtual models using computer software
• websites based on visual material

6.3 Developing tasks

Tasks should:
• state whether the student response is to be a demonstration, oral, visual, written, multimedia or a combination of any or all of these
• provide clear descriptions, written in a manner that is logically sequenced and easily understood by students — this may require the use of graphics and text in boxes to enhance presentation and readability
• provide scaffolding or guidelines that clearly explain how to complete the task, including:
  − step-by-step instructions which may be presented in a flow chart
  − expectations in relation to things such as time management, cleaning of workspaces, safety issues, noise control, etc
• apply the principles of equity and fairness to all students and take account of students with special needs
• provide suitable stimulus material to help students generate ideas and complete tasks, such as:
  − newspaper and magazine articles
  − letters to the editor
  − internet information
  − industry-based information, pamphlets, manuals
  − brochures, advertisements for coming events
  − audiotapes or videotapes
  − photographs
  − computer software
  − films, television programs
— guest speakers
— excursions

• include criteria and standards
• identify conditions involved, for example, individual/group, own/class time, access to teacher, duration (for example, 1 week, 1 semester).

Teachers may need to support students further by providing an oral explanation of the tasks and modelling of some of the steps.

6.3.1 Special consideration

Guidance about the nature and appropriateness of special consideration and special arrangements for particular students may be found in the Queensland Studies Authority’s policy statement, *Special Consideration: Exemption and Special Arrangements: Senior Secondary Assessment* (30 May 1994). This statement also provides guidance on responsibilities, principles and strategies that schools may need to consider in their school settings.

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

6.4 Exit criteria

In Prevocational Mathematics, judgments made about student achievement in the general objectives of *knowing*, *applying* and *explaining* contribute to the exit level of achievement. The exit criteria reflect these objectives.

The exit criteria therefore are:

• knowing
• applying
• explaining.

**Exit criterion: knowing**

Students demonstrate knowledge of content and use given rules, operations and procedures to carry out simple, familiar tasks.

**Exit criterion: applying**

Students interpret and analyse different contexts, identify familiar mathematics, develop strategies, then select and apply rules and procedures to carry out tasks.

**Exit criterion: explaining**

Students use basic mathematical and everyday language to present and explain their responses to tasks in both familiar and different contexts.
6.5 Awarding exit levels of achievement

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

- Very High Achievement
- High Achievement
- Sound Achievement
- Limited Achievement
- Very Limited Achievement

The school must award an exit standard for each of the three criteria (knowing, applying and explaining), based on the principles of assessment described in this study area specification. The criteria are derived from these general objectives and are described in section 6.4.

The typical standards associated with the three exit criteria (that is: mid A, mid B etc) are described in section 6.5.1. When teachers are determining a standard for each criterion, the standard awarded should be informed by how the qualities of the work match the descriptors overall.

For Year 11, particular standards descriptors may be selected from the matrix and/or adapted to suit the task. These standards are used to inform the teaching and learning process. For Year 12 tasks, students should be provided with opportunities to understand and become familiar with the expectations for exit. The exit standards are applied to the summative body of work selected for exit.

All of the seven key competencies are relevant to this subject and are embedded in the descriptors in the standards matrix. The descriptors refer mainly to aspects of mathematical ideas and techniques, analysing and organising information and communicating ideas.

When standards have been determined in each of the three criteria of knowing, applying and explaining, the following table is used to award exit levels of achievement, where A represents the highest standard and E the lowest. The table indicates the minimum combination of standards across the criteria for each level.

<table>
<thead>
<tr>
<th>Level of achievement</th>
<th>Minimum combination of standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>VHA</td>
<td>Standard A in any two exit criteria and a B in the third criterion</td>
</tr>
<tr>
<td>HA</td>
<td>Standard B in any two exit criteria and a C in the third criterion</td>
</tr>
<tr>
<td>SA</td>
<td>Standard C in any two exit criteria and a D in the third criterion</td>
</tr>
<tr>
<td>LA</td>
<td>Standard D in any two exit criteria and an E in the third criterion</td>
</tr>
<tr>
<td>VLA</td>
<td>Standard E in the three criteria</td>
</tr>
</tbody>
</table>

 KC1: collecting, analysing and organising information; KC2: communicating ideas and information, KC3: planning and organising activities; KC5: using mathematical ideas and techniques; KC6: solving problems; KC7: using technology
6.5.1 Typical standards associated with exit criteria

Although all students need teacher support during assessment, students who are awarded a standard C, D, or E, typically require much more specific and continual support to demonstrate the standard. These standards should be read with this in mind.

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>Knowing</td>
<td>The student: • demonstrates a thorough knowledge of content</td>
<td>The student: • demonstrates a working knowledge of aspects of content</td>
<td>The student: • demonstrates a working knowledge of aspects of content</td>
<td>The student: • uses given rules, operations and procedures to carry out simple, familiar, often-rehearsed tasks</td>
<td>The student: • follows some given rules or procedures to partially carry out aspects of some tasks within different contexts</td>
</tr>
<tr>
<td>Applying</td>
<td>The student: • effectively uses given rules, operations and procedures to carry out simple, familiar tasks</td>
<td>The student: • interprets a variety of different contexts</td>
<td>The student: • interprets different contexts</td>
<td>The student: • follows learned strategies, then selects and applies suitable rules and procedures to successfully carry out tasks</td>
<td>The student: • uses basic mathematical and everyday language in familiar contexts and some different contexts</td>
</tr>
<tr>
<td>Explaining</td>
<td>The student: • uses basic mathematical and everyday language in familiar contexts and some different contexts</td>
<td>The student: • presents detailed responses that explain their mathematics</td>
<td>The student: • presents responses that explain their mathematics</td>
<td>The student: • presents responses that partly explain their mathematics</td>
<td>The student: • presents responses that partly explain their mathematics</td>
</tr>
</tbody>
</table>
Equity means fair treatment of all. In developing work programs from this study area specification, schools are urged to consider the most appropriate means of incorporating the following notions of equity.

Schools need to provide opportunities for all students to demonstrate what they know and what they can do. All students, therefore, should have equitable access to educational programs and human and material resources. Teachers should ensure that the particular needs of the following groups of students are met: female students; male students; Aboriginal students; Torres Strait Islander students; students from non–English-speaking backgrounds; students with disabilities; students with gifts and talents; geographically isolated students; and students from low socioeconomic backgrounds.

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

It is desirable that the resource materials chosen recognise and value the contributions of both females and males to society and include the social experiences of both sexes. Resource materials should also reflect the cultural diversity within the community and draw from the experiences of the range of cultural groups in the community.

Efforts should be made to identify, investigate and remove barriers to equal opportunity to demonstrate achievement. This may involve being proactive in finding out about the best ways to meet the special needs, in terms of learning and assessment, of particular students. The variety of assessment techniques in the work program should allow students of all backgrounds to demonstrate their knowledge and skills in a subject in relation to the criteria and standards stated in this study area specification. The study area specification criteria and standards should be applied in the same way to all students.

Teachers may find the following resources useful for devising an inclusive work program:

*Guidelines for Assessment Quality and Equity* 1996, Australian Curriculum, Assessment and Certification Authorities. Available through the Queensland Board of Senior Secondary School Studies (QBSSSS), Brisbane.

*A Fair Deal: Equity guidelines for developing and reviewing educational resources* 1991, Department of Education (Education Queensland), Brisbane.
Access and Equity Policy for the Vocational Education and Training System 1998, Department of Training and Industrial Relations, Queensland, Brisbane.

Policy Statement on Special Consideration 1994, Queensland Board of Senior Secondary School Studies, Brisbane.

Language and Equity: A discussion paper for writers of school-based assessment instruments 1995, Queensland Board of Senior Secondary School Studies, Brisbane.

8 Resources

The resources listed are a sample of what is available and are therefore not exhaustive. Website addresses were last accessed on 1 December 2004.

8.1 Teacher texts


*Car Costs: Six units of mathematics around the theme of car ownership*, Language Australia available from Peppercorn Books, Melbourne, Australia.


*The Numeracy Handbook: A resource for literacy and numeracy teachers*, Lukin, A. & Ross, L. 1997, NSW Adult Migrant English, Service (AMES) and National Centre for English Language Teaching and Research (NCELTR), Surry Hills, NSW.


8.2 Videos, CD-ROMs and DVDs


The following are suitable for this study area specification:


*Problem Solving*, 2003 (22 min).


*Measure for Measure Series*, four programs (*Weight, Time, Temperature, Length*), 1995 (each 30 min).
8.3 Websites

Arcytech: Improving education through technology, http://arcytech.org/java/. A range of applications based on applets, that allow students to manipulate objects on screen; some of the applications on shapes and fractions are suitable.

Australian Bankers’ Association, http://www.bankers.asn.au/?ArticleID=613. Free downloadable fact sheets on personal finance, for example, Handy Budget Planner with ‘how to’ instructions written in easy-to-understand language, and Borrowing Money: Obtaining and managing credit. There are also booklets, for example, Banking on the Internet and Smarter Banking: Making the most of your money.

Australian Bureau of Statistics, http://www.abs.gov.au/. Includes data based on different themes such as aging, crime and justice, mortality, family and community, retail, and tourism as well as educational resources (teaching tools and classroom activities, key steps in running a survey, links to other data sites).

Australian Stock Exchange (ASX), http://www.asx.com.au/education/Games_IE2.shtm. ASX sharemarket games for schools: ‘take a hypothetical $50,000, create your own virtual share portfolio and experience what it is like to invest in the sharemarket without spending a cent of your own money!’ Supported with free sharemarket lessons for teachers to use.


Commonwealth Bank Dollars and Sense, http://www.dollarsandsense.com.au. This site is about making sense of your money. Topics include mobiles, schoolies, dream generator, getting the things you want, borrowing and lending, running your own business, you and financial services, getting the right deal, ask an expert, jobs, work and money.

Commonwealth Government Consumers Online, http://www.consumersonline.gov.au/. Information on consumer rights when shopping, privacy and the law (when providing personal information to retailers), scams, shopping online. The Consumer Handbook Online allows you to search for the contact details of over 730 private, community and government organisations that handle consumer complaints.


Key Skills (from Wales), http://www.keyskillssupport.net/resources/workbased/download/resource_sheets/resourcesheets_num_pdf_dl.asp. Resources for number – worksheets (are zip files).

King’s List of Online Mathematics Activities, http://www.k111.k12.il.us/king/math.htm. A range of links to activities, some of which are suitable for this study area specification.

National Council of Teachers of Mathematics, http://illuminations.nctm.org/tools/index.aspx. A variety of online animations that students manipulate (not all are suitable for this study area specification). Some that students may find interesting: bar grapher, circle grapher, making three-dimensional cubes, cutting corners (shapes), electronic abacus, equivalent fractions, probability of fire in a forest, fractal tool, fraction game, graph creator, pool table, sound sketch tool, spreadsheet (simplified).

National Library for Virtual Manipulatives: Interactive mathematics, http://matti.usu.edu/nlvm/nav/grade_g_4.html. Some of the online manipulatives are suitable for this study area specification.
Numeracy on Line (from the Department of Education, Science and Training),

Office of Consumer and Business Affairs (South Australia),


Useful websites

<table>
<thead>
<tr>
<th>Site</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>RACQ Road Travel Planner <a href="http://www.nowwhereroute.com/RACQ/RoadTravelPlanner/">http://www.nowwhereroute.com/RACQ/RoadTravelPlanner/</a></td>
<td>Plan road journeys anywhere in Australia. Print road maps and driving directions.</td>
</tr>
<tr>
<td>Scale drawing and house plans <a href="http://www.smallblueprinter.com/">http://www.smallblueprinter.com/</a></td>
<td>Design your house plan blueprints online with ‘smallblueprinter’, then take a three-dimensional walk through your design, check out an isometric view and print out your plan. It’s free and easy to use. An offline version is now available. A garden planner is also available but it is not free.</td>
</tr>
<tr>
<td>IKEA kitchen planning tool <a href="http://www.ikea.com./ms/en_AU/rooms_ideas/kitchen/download.html">http://www.ikea.com./ms/en_AU/rooms_ideas/kitchen/download.html</a></td>
<td>See your new kitchen on the screen before you see it in reality, with the IKEA kitchen planner. The planning tool lets you move in a whole new kitchen without getting out of your chair. Drag and drop pieces into a layout, view them in a three-dimensional view, try different colours and print your design. Information from the site: ‘Since most of our visitors only use a PC, we have chosen at this point to only develop a PC version of our kitchen planning tool’.</td>
</tr>
</tbody>
</table>

The following websites are from the Commonwealth Bank Online calculator, 
http://www.commbank.com.au/personal/other/useful_tools.asp. Most banks have the same type of calculators

**Foreign exchange**

<p>| Foreign exchange calculator | Convert from Australian dollars to a foreign currency or convert from a foreign currency to Australian dollars. |</p>
<table>
<thead>
<tr>
<th>Site</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Budgeting and saving</strong></td>
<td></td>
</tr>
<tr>
<td>Savings term calculator</td>
<td>How long will it take? This calculator will help you to determine</td>
</tr>
<tr>
<td></td>
<td>how much time it will take to reach your savings goal with regular</td>
</tr>
<tr>
<td></td>
<td>monthly savings.</td>
</tr>
<tr>
<td>Target deposit amount calculator</td>
<td>How much will I have? This calculator will help you to determine</td>
</tr>
<tr>
<td></td>
<td>the approximate final balance of your savings after different periods</td>
</tr>
<tr>
<td></td>
<td>of time.</td>
</tr>
<tr>
<td>Monthly savings calculator</td>
<td>How much do I need? This calculator will help you to determine</td>
</tr>
<tr>
<td></td>
<td>how much you need to save each month to achieve your particular</td>
</tr>
<tr>
<td></td>
<td>savings goal.</td>
</tr>
<tr>
<td>Budget planner</td>
<td>See how much money you spend and on what, and decide how much you</td>
</tr>
<tr>
<td></td>
<td>can potentially afford to invest for your future prosperity. It’s</td>
</tr>
<tr>
<td></td>
<td>the first step to effectively planning your financial future.</td>
</tr>
<tr>
<td>Student budget calculator</td>
<td>This budget calculator will tell you where your money is going. Find</td>
</tr>
<tr>
<td></td>
<td>out how much more money you can put away regularly to meet your</td>
</tr>
<tr>
<td></td>
<td>goals sooner.</td>
</tr>
<tr>
<td><strong>Your home</strong></td>
<td></td>
</tr>
<tr>
<td>Home Equity Guide</td>
<td>The Commonwealth Bank Home Equity Guide calculates an estimate of the</td>
</tr>
<tr>
<td></td>
<td>equity you have in your home, based on what you know about your</td>
</tr>
<tr>
<td></td>
<td>property and our knowledge of fluctuations of the property market in</td>
</tr>
<tr>
<td></td>
<td>your area.</td>
</tr>
<tr>
<td>Commonwealth Bank Property Value Guide</td>
<td>Property Value Guide is a free, comprehensive, up-to-date insight</td>
</tr>
<tr>
<td></td>
<td>into what the property market is doing from month to month.</td>
</tr>
<tr>
<td>Home loan calculator</td>
<td>Use the home loan calculator to find out what your monthly loan</td>
</tr>
<tr>
<td></td>
<td>repayments might be, or how many years it could take to repay your</td>
</tr>
<tr>
<td></td>
<td>Home Loan. Calculate your loan amount, your repayments, your loan</td>
</tr>
<tr>
<td></td>
<td>term and your frequency of repayments to establish the right</td>
</tr>
<tr>
<td></td>
<td>product for you.</td>
</tr>
<tr>
<td>Home loan selector</td>
<td>How do you find a home loan that’s a perfect fit financially? Choose</td>
</tr>
<tr>
<td></td>
<td>the home loan that suits your financial needs by using the home loan</td>
</tr>
<tr>
<td></td>
<td>selector to find the perfect home loan in an instant.</td>
</tr>
<tr>
<td>How much can I borrow?</td>
<td>Estimate how much you can borrow based on your income and expenditure.</td>
</tr>
<tr>
<td></td>
<td>Use this calculator to estimate how much you can borrow for your</td>
</tr>
<tr>
<td></td>
<td>new home or investment property and how much your repayments will be.</td>
</tr>
<tr>
<td>Total home-buying costs calculator</td>
<td>This calculator will estimate the cost to purchase a property based</td>
</tr>
<tr>
<td></td>
<td>on the property purchase price and the loan amount you plan to</td>
</tr>
<tr>
<td></td>
<td>borrow.</td>
</tr>
<tr>
<td><strong>Personal loans</strong></td>
<td></td>
</tr>
<tr>
<td>Personal Loan Calculator (Java enabled)</td>
<td>There are two personal loan calculators available, designed to help</td>
</tr>
<tr>
<td></td>
<td>you with your application and to manage your finances.</td>
</tr>
<tr>
<td></td>
<td>• Calculate my repayments — helps you establish the most</td>
</tr>
<tr>
<td></td>
<td>affordable repayment schedule based on weekly, fortnightly or</td>
</tr>
<tr>
<td></td>
<td>monthly repayments.</td>
</tr>
<tr>
<td></td>
<td>• How much can I borrow? — provides you with an idea of how</td>
</tr>
<tr>
<td></td>
<td>much money you may be able to borrow.</td>
</tr>
<tr>
<td>Personal Loan Calculator (HTML version)</td>
<td></td>
</tr>
<tr>
<td>**Home, contents or investment home</td>
<td></td>
</tr>
<tr>
<td>insurance**</td>
<td></td>
</tr>
<tr>
<td>Home insurance calculator</td>
<td>An interactive calculator to help you calculate the value of your</td>
</tr>
<tr>
<td></td>
<td>home or investment property for insurance purposes.</td>
</tr>
<tr>
<td>Contents insurance calculator</td>
<td>Use this calculator to estimate the value of your home contents for</td>
</tr>
<tr>
<td></td>
<td>insurance purposes.</td>
</tr>
</tbody>
</table>
The following website is useful for topic 2 (Mathematics for interpreting society: data), http://www.shodor.org/interactivate/elementary/#pr. It contains different types of graphs for students to draw that don’t require them to have the skills required to drive an Excel program. They are also a very good teaching tool.

<table>
<thead>
<tr>
<th>Graph Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Histogram</strong></td>
<td>Have students view their own data, ranging from shoe sizes to the cost of DVDs, using a histogram. A histogram is a bar graph that looks at frequency.</td>
</tr>
<tr>
<td><strong>Pie chart</strong></td>
<td>Have students manipulate a pie chart to represent their data. Pie charts can also be used to familiarise students with percentages and their relationship to a whole, while practising their graph-reading ability.</td>
</tr>
<tr>
<td><strong>Stem and leaf plotter</strong></td>
<td>Help students organise and graph data they have collected into stem and leaf plots. This applet can also be used help students practise calculating mean and median.</td>
</tr>
<tr>
<td><strong>Boxplot 1</strong></td>
<td>Represent and organise data students have collected using a box plot. This tool allows students to view their data in individual sets as well as compiling all their data into one large set. This applet can also be used to introduce students to the terminology used with box plots. This box plot applet does use the median to calculate the interquartile range.</td>
</tr>
<tr>
<td><strong>Boxplot 2</strong></td>
<td>Represent and organise data students have collected using a box plot. This tool allows students to view their data in individual sets as well as compiling all their data into one large set. This applet can also be used to introduce students to the terminology used with box plots. This box plot applet does not use the median to calculate the interquartile range.</td>
</tr>
<tr>
<td><strong>Bar graph</strong></td>
<td>Enter data to create a bar graph, then manipulate the graph’s maximum and minimum values.</td>
</tr>
<tr>
<td><strong>Circle graph</strong></td>
<td>Enter data categories and the value of each category to create a circle graph. Similar to the pie chart graph but the user can define the dataset.</td>
</tr>
<tr>
<td><strong>Plot it</strong></td>
<td>Allow students to graph their information using a simple bar graph and investigate mean and median. Parameters: range for observations.</td>
</tr>
<tr>
<td><strong>Measures</strong></td>
<td>Have students enter data and view the mean and median of the dataset. Parameters: number of observations, range for observations, which statistics to view, identifiers for the data.</td>
</tr>
</tbody>
</table>
The following website is useful for assisting in developing an elementary understanding of chance. Probability could be an extension of the data topic. [http://www.shodor.org/interactivate/elementary/#pro](http://www.shodor.org/interactivate/elementary/#pro)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding experimental probability</td>
<td>Experiment with experimental probability using a fixed-size section spinner, a variable section spinner, 2 regular 6-sided number cubes or design your own number cubes.</td>
</tr>
<tr>
<td>Racing game with one die</td>
<td>Introduce students to probability by having them work in pairs and experiment with the applets parameters allowing them to “see” the effects of each variable on race results.</td>
</tr>
<tr>
<td>Racing game with two dice</td>
<td>Further develops students’ concept of probability and understanding of the effects different variables have on race results. This applet allows the students to be challenged with more complex mathematics concepts than the Racing Game with One Die applet because it adds another die to the game and allows the race to have multiple contestants.</td>
</tr>
<tr>
<td>Monty Hall game</td>
<td>Students choose 1 of 3 doors to experimentally determine the odds of winning the grand prize behind one of the doors, as in the TV program Let’s Make a Deal. Parameters: staying or switching between the 2 remaining doors.</td>
</tr>
<tr>
<td>Crazy choice game</td>
<td>Allow students to explore theoretical and experimental probability in groups of 3 playing games of chance using dice, cards, spinners or coin tosses.</td>
</tr>
<tr>
<td>Spinner</td>
<td>Allow students to explore theoretical and experimental probability. Parameters: number of sectors, number of trials.</td>
</tr>
<tr>
<td>Adjustable spinner</td>
<td>Allow students to explore theoretical and experimental probability. Parameters: sizes of sectors, number of sectors, number of trials.</td>
</tr>
<tr>
<td>Marbles (use in simple situations only)</td>
<td>Allow students to explore and learn about sampling with and without replacement by modelling drawing marbles from a bag. Parameters: number and colour of marbles in the bag, replacement rule.</td>
</tr>
<tr>
<td>Dice table (use in simple situations only)</td>
<td>Allow students to practise their fraction to decimal and decimal to percentage conversion skills while experimenting with the outcome distribution for a roll of 2 dice by playing a dice-throwing game. Parameters: which player wins on which rolls.</td>
</tr>
</tbody>
</table>
Appendix 1: Examples of courses of study

Introduction

Three different course overviews have been provided by teachers to illustrate some ways courses of study may be organised.

Overview 1 is designed around themes lasting a whole semester — each theme deals with several of the five topics. The assessment consists of a student folio collected as the learning is taking place including a presentation in the last few weeks of the activity. Two short formal examinations (60 minutes) occur in Semesters 1 and 3. Context 1 and associated tasks in appendix 2 provide more detail about part of this overview.

Overview 2 is designed around a number of large and small projects. Assessment consists of a variety of techniques including teacher observations, folios, interviews, and short written responses. The three class tests in semesters 1, 2 and 3 are open book with unseen questions. Contexts 5, 6 and 7 and associated tasks in appendix 2 provide more detail about part of this overview.

Overview 3 is designed around many short units that are not connected by a theme. Assessment consists of a number of projects, investigations and short reports but no class tests or examinations.
# Course overview 1

<table>
<thead>
<tr>
<th>Semester</th>
<th>Unit description</th>
<th>Topics</th>
<th>Time</th>
<th>Suggested assessment</th>
</tr>
</thead>
</table>
| 1 Formative | **Becoming employed**  
- identifying job  
- industrial awards  
- applying  
- being interviewed  
- moving to take up a job  
- budgeting  
- credit  
- mobile phones  
- pitfalls | 1,3,4,5 | 17 weeks | test |
| 2 Formative | **Self-employed: developing a market garden (context 1)**  
- planning  
- designing  
- marketing the produce  
- using the profits | 1,2,3,4,5 | 16 weeks | project  
checklist  
oral power point presentation |
| 3 Summative | **Becoming an employer**  
- other small business concepts  
- profit/loss lines  
- hygiene  
- protection  
- publicity  
- budgeting | 1,2,3,4,5 | 16 weeks | project  
checklist  
oral power point presentation |
| 4 Summative | **Having a break**  
- planning a destination  
- at home versus overseas  
- costs  
- procedures  
- precautions  
- budgeting  
- spending | 1,2,3,4,5 | 15 weeks | test  
investigation  
test |
## Course overview 2

<table>
<thead>
<tr>
<th>Term</th>
<th>Project description</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semester 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Term 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 11</td>
<td><em>Planning a grandparent’s surprise birthday party — relatives from Perth and Christchurch; Two weeks</em></td>
<td>Poster display (party details); budget; transport and accommodation arrangements for at least 1 relative from Perth and 1 relative from Christchurch</td>
</tr>
<tr>
<td></td>
<td><em>DollarSmart: A financial toolkit for teenagers (complete unit supplied by Financial Planning Association); Three weeks</em></td>
<td>Teacher observation on students’ preparedness to be involved, participation in class and completeness of activity folder</td>
</tr>
<tr>
<td></td>
<td>*Four-week expository teaching on topics:</td>
<td>Classroom test — students can access textbook and anything they have written down during class or for homework</td>
</tr>
<tr>
<td></td>
<td>- Location and Time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Finance (basic calculations associated with financial mathematics).</td>
<td></td>
</tr>
<tr>
<td><strong>Term 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 11</td>
<td><em>Computer games; Three weeks</em></td>
<td>Check sheet for students to record progress. Verified by teacher through use of logs or some other method.</td>
</tr>
<tr>
<td></td>
<td><em>Mathematics Circus 1 and/or 2 and/or 3 and Hot Dog Stand — Outnumbered</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>You and your money; Six weeks</em></td>
<td>Work portfolio of worksheets completed in class that relates to selected topics.</td>
</tr>
<tr>
<td></td>
<td>- Mini projects:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- giving change</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- advantages and disadvantages of buying second-hand</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- modelling the average legal return from Golden Casket</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- modelling the average legal return from poker machines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- the mathematics behind the chain letter;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- what do mathematics and alcohol have to do with each other?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- fast food and fast facts and fast money; what does your pay slip tell you?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- how does superannuation affect you? What is the superannuation guarantee?</td>
<td></td>
</tr>
<tr>
<td><strong>Semester 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Term 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 11</td>
<td><em>How efficiently does the school fill in the morning and empty in the afternoon? Five weeks</em></td>
<td>Slide show presentation to member of school administration — data must be displayed and analysed in the presentation; Group work</td>
</tr>
<tr>
<td></td>
<td><em>Examination of road system, provision of footpaths and parking arrangements at the school.</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Five-week expository teaching:</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Data (skills required to display and interpret data)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Measurement (basic skills and applications)</td>
<td></td>
</tr>
<tr>
<td><strong>Term 4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 11</td>
<td><em>Four-week expository teaching:</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Measurement (volume and Pythagoras’s theorem)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Location and time (understanding latitude and longitude and how it relates to time and weather)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Work portfolio of selected worksheets completed in class and/or for homework that relates to selected topics; classroom test — students can access textbook and anything they have written down during class or for homework.</em></td>
<td></td>
</tr>
<tr>
<td>Term</td>
<td>Project description</td>
<td>Assessment</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Semester 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Term 1</td>
<td>Two-day holiday using timetables and public transport (context 6)</td>
<td>Individual holiday itinerary; peer assessment of itinerary; ability to read maps and direct students during the excursion</td>
</tr>
<tr>
<td>Year 12</td>
<td>Five weeks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Exploration of online financial tools</td>
<td>Tick sheets for in-class observation of selected tasks requiring student to use internet</td>
</tr>
<tr>
<td></td>
<td>Two weeks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Three-week expository teaching: Finance (calculations associated with earning an income including awards)</td>
<td>Classroom test:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• students supplied with simple worked examples</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• rules supplied as required</td>
</tr>
<tr>
<td>Term 2</td>
<td>Does the school have sufficient shade areas? (context 7)</td>
<td>Written report to Parents and Friends Association involving the display and analysis of information; pair work</td>
</tr>
<tr>
<td>Year 12</td>
<td>Five weeks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Platonics Solids</td>
<td>Individual work using concrete materials to complete series of activities that relate to the Platonics Solids kit available from shops such as the National Geographic Shop.</td>
</tr>
<tr>
<td></td>
<td>• What is special about the platonic solids?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• What shapes do we need to make them?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two-week project</td>
<td></td>
</tr>
<tr>
<td>Term 3</td>
<td>Finances: The next 5 years: Investigation of possible financial situations that students may encounter over the next 5 years</td>
<td>Individual work with some pair work. Students to prepare a poster suitable for display at awards night; information must be accurate, relevant and displayed in an interesting and informative way.</td>
</tr>
<tr>
<td>Year 12</td>
<td>Five weeks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Location! Location! Location!</td>
<td>Individual interview with student (10 minutes)</td>
</tr>
<tr>
<td></td>
<td>Series of worksheets on given theme</td>
<td>• students asked to perform various tasks that are similar to the activities undertaken during class lessons</td>
</tr>
<tr>
<td></td>
<td>• street directory and index pages</td>
<td>• verbal answers and activities that may require students to trace routes, etc.</td>
</tr>
<tr>
<td></td>
<td>• shopping centre site maps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• school site maps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• large tourist attractions site maps (Dreamworld)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• significant building site maps (war memorial in Canberra)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two weeks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Three-week expository teaching: Finance (investing money).</td>
<td>No test — this work is preparation for the next project.</td>
</tr>
<tr>
<td>Term 4</td>
<td>Two-week expository teaching: Data (work required for the project)</td>
<td>Individual interview with student (10 minutes) relating to work covered in class</td>
</tr>
<tr>
<td>Year 12</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Profiling the Year 12 population:</td>
<td>No assessment — the skills gained here will be used in the project that follows.</td>
</tr>
<tr>
<td></td>
<td>• Use of bias in data gathering and display</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Importance of comparative analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Four weeks</td>
<td>Individual work:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• students to write a report on their findings in two areas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• display of data in various forms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• analysis of data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• some comparative analysis</td>
</tr>
</tbody>
</table>
## Course overview 3

<table>
<thead>
<tr>
<th>Semester</th>
<th>Unit description</th>
<th>Topics</th>
<th>Time</th>
<th>Suggested assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Formative</strong></td>
<td>Landscaping and designing</td>
<td>1,3,4,5</td>
<td>4 weeks</td>
<td>In-class project</td>
</tr>
<tr>
<td></td>
<td>Tuckshop management</td>
<td>1,2,4,5</td>
<td>3 weeks</td>
<td>Survey and report</td>
</tr>
<tr>
<td></td>
<td>Planning an overseas trip</td>
<td>1,3,4,5</td>
<td>4 weeks</td>
<td>In-class project</td>
</tr>
<tr>
<td></td>
<td>Healthy bodies and nutrition</td>
<td>1,2,4,5</td>
<td>4 weeks</td>
<td>In-class project</td>
</tr>
<tr>
<td></td>
<td>Keeping domestic pets</td>
<td>1,2,4,5</td>
<td>3 weeks</td>
<td>Investigation</td>
</tr>
<tr>
<td><strong>2 Formative</strong></td>
<td>Small business and budgeting</td>
<td>1,2,5</td>
<td>4 weeks</td>
<td>Prepare a budget</td>
</tr>
<tr>
<td></td>
<td>Finding your way</td>
<td>1,2,4</td>
<td>4 weeks</td>
<td>Practical activity</td>
</tr>
<tr>
<td></td>
<td>Healthy bodies and exercise</td>
<td>1,2,4,5</td>
<td>4 weeks</td>
<td>In-class project</td>
</tr>
<tr>
<td></td>
<td>Taking a chance</td>
<td>1,2,4,5</td>
<td>3 weeks</td>
<td>Investigation</td>
</tr>
<tr>
<td></td>
<td>Catering for barbeques and parties</td>
<td>1,2,4,5</td>
<td>3 weeks</td>
<td>Assignment</td>
</tr>
<tr>
<td><strong>3 Summative</strong></td>
<td>Buying and running a car</td>
<td>1,2,4,5</td>
<td>4 weeks</td>
<td>In-class project</td>
</tr>
<tr>
<td></td>
<td>Interior design</td>
<td>1,3,4,5</td>
<td>3 weeks</td>
<td>Design project</td>
</tr>
<tr>
<td></td>
<td>Building and construction</td>
<td>1,3,4,5</td>
<td>4 weeks</td>
<td>Design project</td>
</tr>
<tr>
<td></td>
<td>The environment</td>
<td>1,2,3,4,5</td>
<td>3 weeks</td>
<td>Investigation</td>
</tr>
<tr>
<td></td>
<td>Investing</td>
<td>1,5</td>
<td>4 weeks</td>
<td>In-class project</td>
</tr>
<tr>
<td><strong>4 Summative</strong></td>
<td>Sport</td>
<td>1,2,4,5</td>
<td>5 weeks</td>
<td>Report</td>
</tr>
<tr>
<td></td>
<td>My first job</td>
<td>1,2,5</td>
<td>3 weeks</td>
<td>Oral presentation</td>
</tr>
<tr>
<td></td>
<td>Moving out (looking for a place to live)</td>
<td>1,5</td>
<td>3 weeks</td>
<td>Assignment</td>
</tr>
<tr>
<td></td>
<td>Planning the school formal</td>
<td>3,5</td>
<td>4 weeks</td>
<td>Progressive reports</td>
</tr>
</tbody>
</table>
Appendix 2: Examples of contextualised tasks

Introduction

This appendix provides examples of tasks in seven different contexts. Each example has been developed and used by teachers. Context 1 applies to course overview 1, and contexts 5, 6 and 7 apply to course overview 2 (in appendix 1).

Some other contexts that schools have used include:

• basic stock market using the internet
• building own home
• buying and managing the costs of running a mobile phone
• buying and selling cars
• catering (and business applications)
• designing, for example, murals, stage sets, three-dimensional models
• hairdressing
• leadlighting
• movie/CD/DVD mathematics
• planning, costing and running a school function
• preparing plans and costing for school barbeque area
• running a house
• the mathematics of bushfires
• the mathematics of early childcare centres
• the mathematics of the retail environment (including cash register and cash handling skills).
Context 1: Developing a market garden — a business enterprise

This context accompanies course overview 1.

Over a period of six months, two teams of students grow plant produce using different growing methods — either building up the soil above ground level or digging down below ground level. They then compare the success or otherwise of their harvests in terms of profitability of their respective businesses. Produce is sold to the school canteen.

<table>
<thead>
<tr>
<th>Item</th>
<th>Built up (student group 1)</th>
<th>Dug down (student group 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Three beds each 3m x 2m</td>
<td>Three beds each 3m x 2m</td>
</tr>
<tr>
<td>Responsibilities</td>
<td>Three groups with each group responsible for the completion of tasks; any absenteeism by members of the group must be covered by the remainder of the group to ensure timelines are met.</td>
<td>Three groups with each group responsible for the completion of tasks; any absenteeism by members of the group must be covered by the remainder of the group to ensure timelines are met.</td>
</tr>
<tr>
<td>Vegetables</td>
<td>• broccoli • strawberries • cauliflower • snow peas • capsicum • lettuce • sweet corn • carrots</td>
<td>• broccoli • strawberries • cauliflower • snow peas • capsicum • lettuce • sweet corn • carrots</td>
</tr>
<tr>
<td>Fundraising</td>
<td>Joint effort in: sausage sizzles pizza days car washes</td>
<td>Joint effort in: sausage sizzles pizza days car washes dollar-for-dollar subsidy from the Mathematics department</td>
</tr>
<tr>
<td>Advertising</td>
<td>Joint effort: publisher, computer graphics, mathematics in art/logos</td>
<td></td>
</tr>
<tr>
<td>Budgeting</td>
<td>Tools, vegetable seedlings, soil, mushroom compost, mulching, watering system</td>
<td></td>
</tr>
<tr>
<td>Assessment</td>
<td>Throughout the activities using checklists, presentations, collection of planning schedules, spreadsheets, graphs and timesheets done in class — these collectively form a folio of work</td>
<td></td>
</tr>
<tr>
<td>Activities</td>
<td>• planning and carrying out fundraising, keeping financial records, ins and outs, spreadsheets • planning and designing garden, working out quantities, work scheduling to develop the garden, watering schedule, harvesting schedule • maintenance — time, costs, growth speeds, growth measurements, no pesticides (later graphed, examined commented upon) • graphing records, spreadsheets on graphics calculators transferred to computer records • time sheets — sign in, sign out with rates of pay and total pay due worked out using relevant industrial award researched on the internet • presentation of results, some PowerPoint work, some digital still shots, some digital video shots</td>
<td>• planning and carrying out fundraising, keeping financial records, ins and outs, spreadsheets. • planning and designing garden, working out quantities, work scheduling to develop the garden, watering schedule, harvesting schedule. • maintenance — time, costs, growth speeds, growth measurements, no pesticides (later graphed, examined commented upon) • graphing records, spreadsheets on graphics calculators transferred to computer records • time sheets — sign in, sign out with rates of pay and total pay due worked out using relevant industrial award researched on the internet • presentation of results, some PowerPoint work, some digital still shots, some digital video shots</td>
</tr>
</tbody>
</table>
Context 2: Landscaping: establishing a yard area

In this assignment students fulfil the role of a landscape contractor quoting for a hypothetical project of establishing the yard area for a new residential block. Students work independently or in teams in the completion of this assignment. However, they each submit their own work. Each of the five parts to this assignment is assessed and feedback given by the teacher before the student proceeds to the next part.

Sketch of the area to be landscaped
Description

You have been asked to:

(i) develop the proposed grass areas by:
   • laying base soil
   • laying turf
   • developing an effective sprinkler system

(ii) prepare the entertainment area by:
   • laying bedding sand
   • laying paving
   • screening the entertainment area

(iii) develop the proposed garden area by:
   • bringing in garden soil
   • mulching the garden area.

The completion of this assignment will involve submitting plans in five parts:

**Part 1:** Developing a scale drawing of the proposed project and analysing some tasks to be performed.

**Part 2:** Planning and costing the turf for the proposed grass areas, researching, planning and costing the reticulation systems to the rear grassed area.

**Part 3:** Planning and costing the development of the proposed garden area.

**Part 4:** Planning and costing the proposed entertainment area.

**Part 5:** Working out the cost of the wages for the proposed workforce.

Specific details needed for each part will be in the brief given to you for each part of the assignment.

**Part 1: Scale drawing of the work area — the brief**

**Task 1**

Using the rough sketch provided, draw up a scale drawing of the project area using a scale of 1 cm = 1 m. The drawing is to be done on the attached A3 page. Ensure you have clearly indicated your name in the top right-hand corner of the page. Clearly label your drawing with the appropriate measurements and labels to identify each area of the yard.

**Task 2**

You are to analyse the proposed project by answering the following questions. All working must be shown to explain your analysis. These calculations and responses must be completed on A4 size paper and stapled to the back of your scale drawing.

**Questions**

What area is covered by the existing house?

What area is covered by the proposed garden area?

If the house, garage and entertainment areas are classified as the living area, what fraction of the residential block is covered by the living area?
Part 2: Laying turf and developing the watering system — the brief

Task 1: Laying the turf

All proposed grass areas are to have a layer of topsoil to a depth of 15 cm on which the turf is to be laid. The volume of soil required must allow an additional 12 per cent to cover contingencies such as potholes and uneven ground. The number of square metres of turf required must allow an extra 10 per cent for contingencies.

The table below shows the total costs for the soil and the turf available from your usual supplier.

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top soil</td>
<td>$32 per cubic metre</td>
</tr>
<tr>
<td>Turf</td>
<td>$12 per square metre</td>
</tr>
</tbody>
</table>

The supplier is willing to give you an 8 per cent trade discount on your cost of purchasing the materials because you are a good customer.

If you wish to make a profit of 15 per cent on this part of the job, what is the cost you would charge the homeowner?

Task 2: The proposed sprinkler area

To complete this task you are to research the topic of sprinkler system design and to complete a scale drawing of the proposed sprinkler area showing how your design will water every part of the area. Draw your scaled diagram on the attached grid paper using the scale 1 unit = 1 metre.

Possible internet research sites:

- Irrigation design: landscape sprinkler system design tutorial — http://www.irrigationtutorials.com/sprinkler00.htm

Your final diagram must show the types and position of the sprinklers you have decided to use. You are not required to work out the pipe layout or other features for this task such as costs.

Part 3: The proposed garden area — the brief

The task

The garden area is to be prepared by firstly digging in a quantity of gypsum to help break down the clay in the existing ground. This will make a suitable base for planting. A special blend of garden soil will then be laid over the garden area and topped off with mulch to help with weed control and to help maintain moisture levels.

- The amount of gypsum required to prepare the garden is 750 grams per square metre.
- The soil is to be laid to a depth of 25 cm.
- The mulch is to be laid to a depth of 15 cm.

Unfortunately, your usual landscape supplies merchant recently retired and you need to find a new supplier. The following two businesses have submitted their costs to you for consideration. To be competitive you must go with the cheaper supplier.
<table>
<thead>
<tr>
<th>Item</th>
<th>Jones and Sons</th>
<th>Conditions</th>
<th>Smith and Co.</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gypsum</td>
<td>$20 per bag</td>
<td>Must be purchased in 10 kg bag lots</td>
<td>$22 per bag</td>
<td>Must be purchased in 5 kg bag lots</td>
</tr>
<tr>
<td>Soil</td>
<td>$28 per m³</td>
<td>Will give a trade discount of 8 per cent</td>
<td>$25 per m³</td>
<td>No discount given</td>
</tr>
<tr>
<td>Mulch</td>
<td>$19.50 per m³</td>
<td>Additional delivery charge of $12</td>
<td>$20 per m³</td>
<td>Additional delivery charge of $8</td>
</tr>
</tbody>
</table>

If you wish to make a profit of 15 per cent on this task, what is the cost that should be charged to the customer?

**Part 4: Planning and costing the entertainment area — the brief**

The entertainment area is to be enclosed as shown in the rough sketch using bricks to build brick pillars and low walls with the gaps filled with wooden lattice screens. A rough plan of this section is shown below:

![Rough sketch of the entertainment area]

**Task 1: The pillars and walls**

The pillars and walls are to be constructed using bricks measuring 230 mm by 115 mm by 115 mm as shown below. Each pillar will be 2 m high and will be based on 4 bricks per layer with a 10 mm thickness of mortar. Each wall will be 6 layers high.

When ordering the bricks, an extra 10 per cent must be added to allow for damages and losses. The bricks can only be bought in lots of 100 at a cost of $125 per 100.
The lattice screen will be constructed at a later date by the owners. It will not come into your quote calculations.

Task 2: Paving the floor area

The floor area is to be paved using ‘Cobblestone’ pavers costing $16.50 per square metre. They are to be laid on bedding sand screened to a depth of 15 cm. The bedding sand costs $28 per cubic metre and can be purchased in quarter-, half- or full cubic metre lots. When ordering the bricks, an extra 10 per cent must be added to allow for damages and losses. The bricks can only be bought in whole square metre lots.

What is your quoted cost to the homeowner for the completion of the entertainment area if you add a mark-up of 10 per cent?

Part 5: Paying your workers — the brief

Background

To accomplish the landscaping job you intend to employ the following four permanently employed workers who are paid according to the Nurserymen’s Award — State (Southern Division Eastern District) effective from September 1, 2002 (see The Queensland Government’s Wageline web site at www.wageline.qld.gov.au.)

The workers and their classifications are as follows:

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>John HILLS</td>
<td>Adult</td>
<td>Landscape gardener — leading hand</td>
</tr>
<tr>
<td>Bruce GRASS</td>
<td>Adult</td>
<td>Landscape gardener</td>
</tr>
<tr>
<td>Yo SOIL</td>
<td>Adult</td>
<td>Landscape gardener — assistant</td>
</tr>
<tr>
<td>Teddy PAVER</td>
<td>18-year-old junior</td>
<td>Nursery hand</td>
</tr>
</tbody>
</table>

The following conditions also apply:

- Hours worked are taken across the full day with 1 hour deduction per day for meal breaks.
- Tax is deducted at a rate of 30 per cent of gross pay.
- Superannuation is deducted at a rate of 6 per cent of gross pay.

To cost your labour expenses, you refer to a similar job; its time sheet is attached.

Complete the employee pay details to get an estimate of what this job may cost you.

What would you charge the homeowner for this expense? Explain.
## Employee working hours

### Sign on/sign off times

<table>
<thead>
<tr>
<th>Employee</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Total</th>
<th>Meals</th>
<th>Paid hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hills, J.</td>
<td>7:00am 4:00pm</td>
<td>7:00am 3:00pm</td>
<td>7:00am 4:00pm</td>
<td>7:00am 4:00pm</td>
<td>7:00am 4:00pm</td>
<td>7:00am 12:30pm</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grass, B.</td>
<td>7:00am 4:00pm</td>
<td>7:00am 4:00pm</td>
<td>7:00am 3:00pm</td>
<td>7:00am 4:00pm</td>
<td>8:00am 4:00pm</td>
<td>7:00am 1:00pm</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil, Y.</td>
<td>7:00am 4:00pm</td>
<td>7:00am 4:00pm</td>
<td>8:00am 4:00pm</td>
<td>7:00am 5:00pm</td>
<td>8:00am 5:00pm</td>
<td>7:00am 3:00pm</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pave, T.</td>
<td>7:00am 4:00pm</td>
<td>7:00am 3:00pm</td>
<td>8:00am 4:00pm</td>
<td>7:00am 3:00pm</td>
<td>9:00am 3:00pm</td>
<td>7:00am 3:00pm</td>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Employee pay details

### Hours allocation

<table>
<thead>
<tr>
<th>Employee</th>
<th>Paid hours</th>
<th>Normal</th>
<th>x 1½</th>
<th>x 2</th>
<th>Normal</th>
<th>x 1½</th>
<th>x 2</th>
<th>Gross</th>
<th>Tax</th>
<th>Medicare</th>
<th>Super</th>
<th>Savings</th>
<th>Health</th>
<th>Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hills, J.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Grass, B.</td>
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<tr>
<td>Soil, Y.</td>
<td></td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pave, T.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>
Context 3: Making a three-dimensional scale model of a school room

Students work in groups to build a three-dimensional scale model of a room and its furniture in the school. Each group builds a model of a different room. The models are displayed at mathematics information evenings, open day displays, etc.

Teaching steps to follow:

- Examine a series of photos of different rectangular rooms within the school known to students (photos of the room to be taken from one position within room and show different items in room).
- Discuss the information the photos contain with regard to layout and furnishing of room.
- Using the information gained from the photos, students draw a mud map (rough diagram) showing the room from a top view. The diagram should include the location of items in the room and their relationship to each other (initially use known locations then use unknown locations).
- Expand the idea described above to scale diagrams:
  - consider what measurements need to be taken to draw a two-dimensional scale diagram of room
  - provide the measurements and students draw a scale diagram for top view (investigate possible scales and how to provide appropriate scale)
  - discuss what the room may look like from a side view and then draw mud map
  - consider what measurements need to be taken to draw a two-dimensional scale diagram of side view of the room
  - provide the measurements and draw a scale diagram for the side view (discuss why using the same scale is appropriate).
  - investigate whether or not all side views provide the same information
  - repeat steps relating to drawing scale diagram of side view of room
  - examine the use of 2 side-view scale diagrams and top-view scale diagrams to make a three-dimensional scale model of room
- Discuss other information about the room that can now be determined.
- Examine the furniture in the room and draw rough diagrams of the nets for simple furniture items.
- Use the information already available to make scale nets of simple furniture items (discuss the benefits of using the same scale for these nets).
- Use scale nets to construct models of the furniture items.
- Measure any other useful information (for example, windows, doors, built-in wardrobes etc.) and mark on the scale diagrams.
- Use the scale diagrams to construct a model of the room.
Context 4: Costing a job: tendering

This context is set out as it appears on the website, http://www.aris.com.au/numeracy/anamol/index.htm. The website provides specific examples of each of the seven ideas below with templates that can be used with classes. Only the introduction has been reproduced here.

- Small business schemes
- A catering idea
- Vegie gardening
- Costing a garden
- Designing and costing your pool
- Costing fencing for a volleyball court
- Salaries

Introduction to the concept of tendering/costing

This is a guide to the kinds of issues and questions that could be considered when discussing the issue of tendering. Use it to plan how you might introduce and tackle the topic, and work with students on developing their mathematics skills through tendering activities.

There is a worksheet, the Tendering Grid, to help you plan what mathematics skills could be covered for a range of possible tendering scenarios. There is also a worksheet which could be filled in with some of the answers from this page.

Following on from this guide, there are a number of sample activities written up as worked examples.

What business and why?

Start with an open question to the students to discuss their business experiences and ideas, and to share their successes or failures. Perhaps invite in a guest speaker or two to talk about their experiences.

Possible questions are:

- Why do you/we want to run a business?
- Is it a business that you want to build up and run?
- Is it just a hobby?
- Is it to help support a group — a club, a centre, etc?
- What's in it for you/me?
- How many people does it require? Who?

Big questions/categories

- What equipment/materials/staff do I need?
  - What equipment do I need?
  - What consumables do I need?
  - What staff do I need?
  - What other costs are there? For example, travel, maintenance, etc.
- How long will the job take?
- What should I charge?
What are the rates of pay?
- Is it worth doing the job?

There is a worksheet, the Tendering Grid, that sets out these categories that can be used with students.

**What equipment, materials, and staff do I need?**

This relates to equipment or long-term materials that are required. It could also include space required, for example, office space.

Possible questions are:

- For each job, what equipment is needed?
- What space do I need to work out of? An office? A shed? A room? A car or truck?
- For materials or equipment that lasts, you could ask questions such as: Do I have it now? Do I need to buy it? Could I hire or lease it? Could I borrow it? Is it essential or just desirable?
- What quality do I need? Questions of quality come in here — sometimes cheap is tempting, but not good in the long term.
- How long does it last? One year, 5 years?
- Do some investigation about the relative costs of these things — how long would hiring take to equal the cost of buying?
- Is leasing better because you can upgrade and it's fully tax deductible?
- If a bit of equipment is only used occasionally, do I buy or hire it?
- What are the tax implications/costs?
- What impact will GST have?

**What consumables do I need?**

This relates to the materials that are used up on a day-to-day basis.

Possible questions are:

- For each job what consumables are needed?
- How do I buy them? In bulk? In small quantities? How much do they cost?
- Where can I buy them? What suppliers are there? Wholesale? Retail?
- How long do they last? How do they need to be stored?
- What quality do I need? Questions of quality come in here — sometimes cheap is tempting, but not good in the long term.
- What are the tax implications/costs?
- What impact will GST have?

**What staff do I need?**

This relates to the staffing requirements of the job.

Possible questions are:

- For each job, what staff are needed?
- How many people do I need?
- Who will do what work? Where do I get the people from? Do I know people I can use?
• Who will handle and manage finances?

**What other costs are there?**

This category needs to address hidden costs like travel costs to get to the job site, maintenance of equipment, etc.

Possible questions are:
• What equipment needs servicing?
• How much travel is involved? How much will this cost?
• What banking and government costs are there?

**How long will the job take?**

This category is about how long the task may take and therefore about whether it is worth it.

Possible questions are:
• How long does it take to set up the business/club before it is actually running?
• How long does each job/task/item take to make/produce?
• How soon before the money comes rolling in?

**What should I charge?**

What are the rates of pay?
• How can we find out the going hourly rate?
• Where does the job fit for example, in terms of responsibility, training, etc.
• Look at the market but also ask how long the job will take.
• What might potential customers be willing to pay? (Survey, or at least ask friends and family).
• As an example, think about carpet cleaning. What standard is the standard rate for a standard three-bedroom, lounge? What do you need to add for a bigger house, per room, for moving furniture, etc?
• What are the rates as advertised in jobs in the paper?
• How can you compare rates of pay?

**Is it worth doing the job? Tax, bookkeeping and all that.**

• How much would I make if I mow 1 lawn, or sell 1 painting?
• Is it a large proportion of my weekly income?
• Do I have to pay tax? What could happen if I don't? Does it change how much I need to be paid? Does it depend on who I'm working for? How much does tax add up to, etc.
• What is the tax payable on different levels of salary?
• Do I have to pay super? How much?
• What records do I have to keep?
• What banking needs are there?
• Do I need an accountant/bookkeeper?
• How long will it take me or the bookkeeper?
• Will the outgoing costs leave much of a profit?
- What would that mean in profits per hour?
- Will the amount earned mean that the employee will lose benefits and health card, etc.?
- What is a legal supplement? What should be declared? What do you lose?
- Is it worth not doing the job when Centrelink is recording my activities?
- Can the expenses for your hobby legitimately offset your regular income — how much do you need to make before they do?

**Resources needed**

To discuss and answer some of these questions you will need:
- people with experiences of tendering or running a business or club
- price catalogues
- job advertisements
- tax and superannuation information
- tender advertisements from newspapers.

**Tendering grid**

<table>
<thead>
<tr>
<th>Mathematics: context:</th>
<th>Budgeting/ money/time</th>
<th>Rates</th>
<th>Estimation</th>
<th>Measurement</th>
<th>Location/direction</th>
<th>Design/shape</th>
<th>Rule/ problem solving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking / catering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growing vegies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fence building</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Designing a garden</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport / car fleet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handy person business</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market stall</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Costing a job — worksheet**

1. What equipment/materials do I need?
   - Equipment:           
   - Consumables:        
   - Staff:              
   - Other costs:        

2. How long will the job take?

3. What should I charge?
Context 5: Planning a kitchen

This context accompanies course overview 2.

The kitchen is an important part of the home and many members of the family often gather in the kitchen at the same time. The following tasks require you to plan several different kitchens.

While all kitchens are different, some elements tend to be common in kitchen design. All of the following tasks relate to a kitchen that one could expect to find in a three-bedroom, one-bathroom home. You will need to complete these tasks in the order in which they are listed.

Task 1

- List all major electrical appliances that are found in the kitchen.
- List optional major electrical appliances that are found in many kitchens.
- List other utilities that are found in the kitchen, for example, telephone.
- List groups of items that need to be stored in a kitchen.
- List typical types of storage found in a kitchen.

Task 2

The following kitchen designs are considered to be standard designs. The type of kitchen used is often determined by the space that is available and the individual requirements of the homeowners. Commercial kitchens are not considered as part of this unit. The layout of the kitchen will determine how convenient it is to work in. The work triangle is shown in each of the five kitchens.

The work triangle shows the relationship between the fridge, the stove and the sink.

You are to:

- Measure height, width and depth of the different items in your kitchen at home. Record your findings.
- As a class, decide how to represent the different types of items found in a kitchen if a bird's eye plan was being used.
• Use a single line design to draw a scale plan of the kitchen (viewed from above) that contains the following units: an upright stove width 600; 2 × 450 bottom cupboards; sink unit 600; pantry 450; fridge 600; bottom cupboard 300. All measurements in millimetres. Use 1 cm grid paper. Scale: 1 cm represents 300 mm (1:30).
• Justify your decisions regarding the placement of your units.
• Position yourself in the kitchen looking at your design. Use a suitable scale to draw what you would see.

Task 3

Use the grid below to draw the plan of a kitchen that would be suitable. The kitchen opens onto the family room. A sliding door provides access to the kitchen from the dining room. No extra walls can be added. Remember the kitchen must be functional. All bottom cupboards will have workbench space above them.

<table>
<thead>
<tr>
<th>Items that must be included: electrical</th>
<th>Items that must be included: storage</th>
<th>Optional items</th>
</tr>
</thead>
<tbody>
<tr>
<td>fridge with freezer or fridge and freezer</td>
<td>pot drawers</td>
<td>broom cupboard</td>
</tr>
<tr>
<td>microwave</td>
<td>bottom cupboards</td>
<td>rubbish bin space</td>
</tr>
<tr>
<td>wall oven with hot plates or upright stove</td>
<td>top cupboards</td>
<td>telephone</td>
</tr>
<tr>
<td>dishwasher</td>
<td>bank of drawers</td>
<td>exhaust hood over the stove or hotplates</td>
</tr>
</tbody>
</table>

Other essential items
sink
Task 4

The wall adjacent to the sliding door leading from the kitchen to the dining room has been relocated. How will this affect your plan? Design a kitchen that suits the new wall position. Use the same conditions as required for task 3.

Task 5

By considering the two plans decide which wall position is better. Give reasons for your choice. Remember there is no correct answer. Your explanation is the most important part of this answer.

Task 6

This task requires you to plan a kitchen for the house plan attached. (Note to teachers: For copyright reasons no plan is attached at this time.) You will use the kitchen planner on the IKEA website which requires you to select from their range of goods. Use the information supplied with task 3 to determine which items are essential. Print a bird’s eye view of the kitchen and two different isometric views of the kitchen which show exactly what the kitchen would be like if it were built. You do not need to hand in any rough work; however, you may find it of assistance to roughly sketch the kitchen on grid paper before you begin.

Task 7

Explain why the kitchen you designed in task 6 will work well. This explanation is an important part of the process. It must be at least one paragraph long.

You must hand in all work from tasks 3 to 7.
Context 6: 2-day holiday

This context accompanies course overview 2.

This task was written for students who live in Ipswich as they were able to travel by public transport to Brisbane. It may need to be adapted to be useful in other situations.

Context

You have an overseas relative (for example, your aunt), who has not visited either Brisbane or Ipswich, who will be staying with you for two days in early April. You plan to show her the sights of Ipswich on the first day and the sights of Brisbane on the second day. In Ipswich you have organised the day around a trip to the railway museum, the Court House and a tour of Ipswich’s old homes that feature Queensland architecture. You have organised a late lunch in the Kholo Botanic Gardens and will then finish with a visit to the Japanese Merima Gardens and a barbeque tea in Queen’s Park. On the second day, you plan to take your relative to see the sights of Brisbane.

Your assignment

Your assignment is to plan an interesting day with your relative showing her as much of Brisbane as possible without her feeling as though she is being rushed from one place to the next. She has heard of South Bank and the Goodwill Bridge and definitely wants to go to both of these places. She has also heard that Brisbane is called the river city and the city’s boast is that its weather is ‘beautiful one day and perfect the next’.

Other requirements and some pertinent information:

• Only public transport and people-power are to be used.
• The day begins and ends at the Ipswich Train Station.
• The timeline for the day is approximately 8.00 am to 4.00 pm.
• At least three different modes of public transport must be used.
• At some time you must use free public transport (walking is not considered to be public transport).
• You may assume that your relative is not disabled and is able to do some walking.
• It takes approximately 10 minutes to walk from one end of the Goodwill Bridge to the other.
• You want to see some of the sights of central Brisbane as well as other places of interest outside the central business district and South Bank.
• You cannot arrive in and depart from Brisbane from the same train station.
• You are aware that although Brisbane is ‘beautiful one day and perfect the next’, it does rain sometimes and therefore an alternative plan is required.
• You expect to buy lunch but carry a small backpack with water, morning tea and fruit.
• You relative doesn’t want to spend the day shopping or going to the movies.

Documentation for the assignment

• You must prepare an itinerary listing the public transport that you will use, the activities that you will undertake and include a timeline for the day. (Cost must be included). Don’t forget that you are a student and your relative is an adult for public transport purposes. If possible include at least an approximate cost for lunch.
• You must attach as an *appendix* supporting information for all public transport timetable information. Use a highlighter to highlight the services that you will be using.

• Present the day’s activities in an informative and interesting way on 1 A4 sheet. This is the sheet that you will take with you for the day’s outing. Complete details do not have to be on this page but sufficient information must be included to be useful.

• Include pictures and other interesting information on the sites that you will see particularly if they are of historical significance and will increase the enjoyment that a tourist has when visiting these sites.

**Assessment by peers**

The class will assess your work under the headings listed on the following page. One itinerary will then be selected and the class, with their teachers, will undertake your journey on a suitable date. During the excursion you will be asked to lead the group from point *a* to point *b* to point *c*, etc. You may be required to use the suggested public transport or to walk to the required destination.
Peer assessment

<table>
<thead>
<tr>
<th>Component</th>
<th>Very successfully (far left) to very unsuccessfully (far right)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Component</strong></td>
<td><strong>Place a tick at the point on the line to indicate level of success</strong></td>
</tr>
<tr>
<td>The timeline for the day was approximately 8.00am to 4.00pm.</td>
<td></td>
</tr>
<tr>
<td>The day started and finished at the Ipswich railway station.</td>
<td></td>
</tr>
<tr>
<td>At least three different modes of transport were be used.</td>
<td></td>
</tr>
<tr>
<td>At some time free public transport was used.</td>
<td></td>
</tr>
<tr>
<td>Except for Ipswich railway station, you didn’t use a particular train station more than once.</td>
<td></td>
</tr>
<tr>
<td>Only public transport and people-power was used.</td>
<td></td>
</tr>
<tr>
<td>South Bank was included in the itinerary.</td>
<td></td>
</tr>
<tr>
<td>The Goodwill Bridge was included in the itinerary.</td>
<td></td>
</tr>
<tr>
<td>Sites outside the CBD and South Bank were included.</td>
<td></td>
</tr>
<tr>
<td>Sites inside the CBD and South Bank were included.</td>
<td></td>
</tr>
<tr>
<td>The itinerary was well timed without being too rushed or having too much spare time.</td>
<td></td>
</tr>
<tr>
<td>The itinerary allowed for some flexible time around the stated times of the public transport timetables.</td>
<td></td>
</tr>
<tr>
<td>The timing and location and cost of lunch were appropriate.</td>
<td></td>
</tr>
<tr>
<td>Large amounts of time were not spent shopping.</td>
<td></td>
</tr>
<tr>
<td>The itinerary didn’t include going to the movies.</td>
<td></td>
</tr>
<tr>
<td>The itinerary was interesting &amp; the places of interest that were included as well as the activities that were planned were appealing.</td>
<td></td>
</tr>
<tr>
<td>Public facilities were available as required.</td>
<td></td>
</tr>
<tr>
<td>A complex appendix showing relevant public transport timetables, suitably highlighted, was attached.</td>
<td></td>
</tr>
<tr>
<td>Full costing was included.</td>
<td></td>
</tr>
<tr>
<td>The itinerary was presented in an informative and interesting way on one A4 sheet.</td>
<td></td>
</tr>
<tr>
<td>Information (including pictures) on places of interest was included.</td>
<td></td>
</tr>
<tr>
<td>An alternative wet weather plan was included.</td>
<td></td>
</tr>
<tr>
<td><strong>OVERALL</strong></td>
<td></td>
</tr>
</tbody>
</table>
Context 7: Does the school have sufficient shade areas?

This context accompanies course overview 2.

Background to the task

Queensland has the highest rate of skin cancer in the world! Eighty per cent of all new cancers diagnosed are skin cancers. Research indicates that ‘childhood sun exposure is a significant contributing factor to the development of skin cancer in later life’ (Queensland Cancer Fund).

Schools have adopted many different policies and practices to protect students and staff from the sun. These include promoting the ‘Sun Smart’ message, having a school uniform that has sleeves and is quite long, wearing hats, providing and encouraging the use of sunscreen, providing shade areas, asking teachers and adults to model suitable behaviour, and not timetabling outdoor activities for extended lengths of time in the middle of the day. There is no perfect solution.

There is a chance of 1 in 30 that you will develop a melanoma during your life (Cancer in Australia 1999, AIHW & AACR, 2002). In 2001, there were 2336 new cases of melanoma in Queensland, 213 deaths from melanoma and 104 deaths from other skin cancers (Queensland Cancer Registry, 2001). This means that in Queensland each year more people die from skin cancer than in motor vehicle accidents. Skin cancer is a silent killer.

The task

This task is in the form of a project that requires you to determine how much shade is provided by the school, and to calculate this in terms of area per student.

Steps to accomplish the task

Steps 1–3 are carried out by each student individually.

Step 1

Think about what this project is asking you to do. List information you will need to find out or calculations you think you will need to make. (You are not doing the calculations. Instead, you are thinking about the type of calculations that you will need to make).

Step 2

Walk around the school and look at: the different shade areas that are provided by the design of the building; the type of trees that are growing; the shade structures that are purpose-buit, and the umbrellas that are erected. List these areas. Use a new page for each new area. The areas that you see may be different from the area listed by other students. For example, some students may include the library as it is open to students during lunchtime.

Step 3

Finalise your plan for the project by listing the measurements you need to take and again the calculations that you need to make. Write out the steps in the order that you need to complete them.

The work from steps 1–3 will be submitted with the completed project.
**Step 4 (carried out in pairs or individually)**

Choose one other person to work with. Tell your teacher your partner’s name. This will be recorded. You may choose to work alone. The remainder of this project will be completed together.

Explain your plan to your partner. Together, devise a plan that will allow you to find the shade provided by the school. Write out the plan (each person to write out the plan). Discuss this plan with your teacher. Have your teacher sign and date your planning page after the discussion.

Include the following type of table on your planning page:

<table>
<thead>
<tr>
<th>Our suggestion</th>
<th>Decision after discussion with teacher</th>
</tr>
</thead>
</table>

Discussion with teacher: Signature: ___________________________ Date: ___________________________

**Step 5**

Walk around the school and roughly sketch the shade areas from a bird’s eye view. List the geometric shapes that you have drawn or that you can break your areas into. Remember you know how to find the area of a triangle, rectangle and circle. You can find other areas by counting squares, etc. If you are having difficulty working out how to break down your shapes talk to your teacher.

**Step 6**

Take accurate measurements. Equipment: tape measure, clinometer (this will allow you to measure angles — ask the teacher how to use this instrument), blackboard protractor to measure angles (ask the teacher how to use this). If you make assumptions you must detail them, for example, ‘this is nearly a right angle and so we took it to be a right angle.’

**Step 7**

Use your measurements and your mud maps to draw scale diagrams. You will need a protractor, ruler and grid paper. Discuss your scale with the teacher. Make sure that you use the same scale on all of your diagrams. Use 0.5 cm grid paper. Record your decision and have the teacher sign and date the page.

<table>
<thead>
<tr>
<th>Your decision</th>
</tr>
</thead>
</table>
| Scale: ___________ Signature: ___________________________ Date: ___________________________

<table>
<thead>
<tr>
<th>Discussion with teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale: ___________ Signature: ___________________________ Date: ___________________________</td>
</tr>
</tbody>
</table>
Step 8
Photocopy all of your scale diagrams. You will need to submit them with your completed project.

Step 9
There are many ways of finding area.

- Counting squares: work out the actual area represented by each cell (square) on your grid paper. Count the cells (squares) covered by your scale diagram. Estimate the fraction of each cell (square) covered if only part of the cell (square) is covered (estimate as \(\frac{1}{4}\), \(\frac{1}{2}\), \(\frac{3}{4}\)).

- Area = number of covered cells (squares) × actual area per cell (square).

- Redraw your scale diagram using Geometer’s Sketchpad. Divide your diagram into sections — use drop boxes to select polygon interior and calculate area. Add all the areas and multiply by scale factor squared. (Your teacher will help you with this calculation).

- Break your diagram into recognisable geometric shapes. You may need to take extra measurements. Show your work to your teacher before completing the calculations. Complete all required calculations. Keep these calculations. They will need to be handed in with your completed project.

Rules

Perimeter of closed shape = add the lengths of all the sides.

\[
\text{Circumference of circle} = 2\pi r = \pi D
\]

\[
\text{Area of circle} = \pi r^2 = \pi r \times r
\]

\[
\text{Area of rectangle} = l \times w = lw
\]

\[
\text{Area of square} = s^2 = s \times s
\]

\[
\text{Area of triangle} = \frac{1}{2}bh
\]

Step 10
The final calculation is to determine the area per student. Before you start the calculations, estimate the area that you think each student will have. Measure out each of the estimated areas. For example, if you think 1 square metre (1 m²), then this is an area 1 m by 1 m or \(\frac{1}{2}\) m by 2 m. For example, if you think 10 square metres (10 m²), then this is an area 5 m by 2 m or 2½ m by 4 m.

Estimate the area that you use when you sit down. Measure the seat of your chair. What is the area?

Step 11
Shade per person = \[
\frac{\text{total shaded area in square metres}}{\text{total student population}}
\]

School student population will be provided.
Step 12

You will be supplied with one set of colour digital photos of all of the shade areas in the school. Use these photos and your own diagrams and calculations to present your work on a poster. You do not need to put the actual calculations on the poster.

Place your poster on the display boards. All of your other work will be submitted with your poster. Make sure your work is stapled. Keep a copy of the work you submit and put your name on your work.
Many students come to the classroom with negative attitudes and beliefs that become barriers to them engaging in mathematics in meaningful ways. This sequence of lessons, which is best conducted at the beginning of the course, provides students with the opportunity to:

- share their feelings and attitudes about mathematics with each other
- compare their experiences of learning mathematics in the past
- pinpoint areas of difficulty and/or gaps in their mathematics skills
- establish learning goals
- establish a positive learning environment with the help of a simple student-generated learning contract.

Outline of possible lessons

1. Explain to students that our feelings and attitudes about mathematics have a great impact on how successful we are, and the purpose of the session is to explore these feelings and attitudes. We will look back to primary school and remember what it was like to learn mathematics as well as what it has been like in high school and how we feel now. Also, in small groups we will compare our experiences and see what similarities and differences there are.

2. Explain that a second purpose of the session is to identify some of the mathematics skills we want to develop.

---

3. Hand out the worksheet: *Where am I at?* and ask them to fill it out as fully as possible (worksheet is attached).

4. Arrange students in small groups to share their responses, for example, by taking each question in turn and discussing the similarities and differences in their responses.

5. Bring the class together and discuss the main issues raised.
   - How have your school experiences shaped your attitude towards mathematics?
   - What effect do your parents have?
   - What messages about mathematics are you receiving from your peers? From society in general?

6. Discuss students’ goals.
   - What are the main areas of difficulty?
   - What mathematics skills do you wish to develop?

7. Students to brainstorm the type of classroom learning environment they would like which will provide the best chance for them to be successful. Students design a mini learning contract and sign it as an indication of their commitment (see attached example).

---

**Worksheet: Where am I at?**

Please complete these sentences:

1. I chose this mathematics subject because …
2. Mathematics is …
3. In mathematics classes I usually feel…
4. What I **like** about mathematics classes is…
5. What I **dislike** about mathematics classes is…
6. When I have problems in mathematics classes or I don't understand something, I…
7. My parents feel that mathematics is…
8. The mathematics I have a block about is…
9. I would like to learn about…
10. When and where do I use mathematics?…
11. What job would I like to do when I leave school? Where would I use mathematics in that job?

---

**Sample learning contract**

As a member of the Year 11 Prevocational Mathematics class I would like a learning environment that is positive, friendly, fun, helpful and supportive (no put downs). For my part I will respect each person’s right to make mistakes and I will participate fully in all activities.

Sign here:
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- make a digital copy for research or study
- for administrative purposes, make a digital copy of a work held in printed format
- make a copy of an artistic work to display on their premises if the original is lost or in danger.

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