Study Area Specification

Functional Mathematics

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Study Area Specification in Functional Mathematics

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1. 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] Numeracy encompasses the abilities to interpret, evaluate and communicate mathematical information.[2]

The study area specification *Functional Mathematics* has been designed for young adults in the senior phase of learning who have for many reasons not become functionally numerate to cope in and with society. They may have experienced little success in mathematics or may have social and cultural backgrounds and experiences that have affected development of their numeracy. Therefore, students in this subject will need substantial support in their learning, to help them achieve the general objectives of *knowing*, *applying* and *communicating*.

The study area specifications *Functional Mathematics* and *Prevocational Mathematics* are companion subjects because *Functional Mathematics* may serve as a bridging course to *Prevocational Mathematics*. These two study area specifications aim to build student confidence and success with mathematics and both have clear links with the Years 1 to10 Mathematics Key Learning Area (KLA) syllabus in that they aim to develop students' abilities in thinking, reasoning, and working mathematically. They are specifically designed for young adults in the senior phase of learning because they use contexts that interest these students and which are relevant to their stage of life.[3]

The study area specification *Functional Mathematics* is designed to reflect the National Reporting System (NRS) indicators of competence at levels 1 and 2 in numeracy.[4]

Students undertaking this study area specification will have particular learning needs. It is appropriate for students to access a significant level of support in both learning and assessment and for emphasis to be on real-life learning experiences.

In *Functional Mathematics*, importance is placed on supporting and facilitating learning through creating an environment that responds to students as they make sense of the world around them. It demands learning experiences that are hands-on, concrete and use relevant real-life situations to derive mathematical meaning. Use of personal experience and prior knowledge is crucial to engaging these learners. Assessment in this study area specification arises naturally from such learning experiences and will be carried out across a wide range of tasks to provide reliability and validity.

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[1] Department of Education, Training and Youth Affairs (2000). *Numeracy, a priority for all: Challenges for Australian schools.* Canberra: Commonwealth Government of Australia.

[2] Foster S. and Beddie F. (2005) *Adult Literacy and Numeracy: At a glance* NCVER.

[3] See appendix 1 for details of the relationship between the two SASs.

[4] *National Reporting System (NRS)* Australian Government Department of Education, Science and Training.

The teaching and learning contexts of this study area specification also provide opportunities for the development of the seven key competencies[5]. In a course of study based on this study area specification, students, while working independently and in groups, 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.

[5] 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.

2. Aims

During a course of study in *Functional Mathematics*, students should:

- build confidence and experience success when using mathematics in everyday contexts
- improve their preparedness for entry to work or further study by developing their numeracy
- develop skills such as identifying, measuring, locating, interpreting, approximating, applying, communicating, explaining, problem solving, and working cooperatively with others and in teams
- be able to recognise mathematical ideas and represent them in a number of ways, such as objects and pictures, numbers and symbols, diagrams and maps, graphs and tables
- be able to communicate their findings
- be able to use relevant technologies, such as computers, calculators and other electronic devices
- be able to make decisions informed by mathematical knowledge.

3. General objectives

Functional Mathematics is designed to enable students to experience mathematics in a supportive and inclusive social context. Students are encouraged to work individually and cooperatively to carry out realistic tasks, with extensive scaffolding. Learning experiences, and the assessment opportunities arising from these, should be adjusted to suit the individual learning needs of students. Students develop and apply their knowledge and skills, and communicate how they carry out tasks to suit the contexts[6] in which they are operating.

The general objectives of *Functional Mathematics* are: *knowing*, *applying*, *communicating* and *affective*. By the end of the course, all objectives must be addressed and the first three must be reflected in assessment tasks. The general objectives are interrelated and equally important.

Across all objectives, students should be encouraged to use a range of technologies, where appropriate and available. Flexible and evolving learning contexts allow for continual updating and expansion of new technologies.

3.1 Knowing

Knowing involves demonstrating knowledge of mathematical concepts and using basic skills such as working with given rules, operations and procedures in familiar and predictable situations. It also involves learning how to use measuring instruments and calculators.

> **In *knowing*, students demonstrate knowledge of mathematical concepts and use given mathematical rules, operations and procedures to carry out simple, familiar tasks.**

3.2 Applying

Applying involves students using previously learned mathematics in *familiar and predictable contexts* to carry out tasks that have personal or real-world relevance in a supported environment. This means that students interpret these contexts to recognise relevant mathematics and select appropriate strategies.

> **In *applying*, students interpret familiar and predictable contexts, recognise relevant mathematics, and select strategies to carry out tasks.**

[6] A teaching and learning context is one that has personal relevance to students and is related to real life, for example, preparing for independent living, budgeting for a purpose, buying electrical and electronic items, understanding pay slips, managing mobile phone costs, purchasing a car, designing and making a set for a school production, or applying mathematics in work-related and leisure-related contexts.

3.3 Communicating

Communicating involves students using everyday language and some mathematical symbols to respond to tasks in *familiar and predictable contexts* with assistance from hints, prompts and cues. Their responses can be presented in various forms for different purposes to suit the task: orally, visually, practically or in writing. To communicate their responses, students may describe, state opinions, outline arguments, comment on and give reasons for decisions.

In *communicating*, students use everyday language and some mathematical symbols to respond to tasks in familiar and predictable contexts.

3.4 Affective

Throughout a course of study, students should develop confidence in using mathematics in everyday contexts. They should appreciate that understanding and being able to use familiar mathematics in the world around them allows them to make informed decisions in their lives. Students should also develop the confidence to ask for help from others to solve problems.

4. Course organisation

4.1 Context for developing a course of study

The study area specification *Functional Mathematics* is designed for students in the senior phase of learning, with a diverse range of learning needs. The course builds on learning developed in the Years 1 to 10 Mathematics KLA syllabus and is designed to reflect NRS indicators of competence at levels 1 and 2 in numeracy. Therefore, students of *Functional Mathematics* require intensive support and supervision. Highly scaffolded teaching and learning methods incorporating concrete, realistic, hands-on experiences should be used.

4.2 Time allocation

The time allocation for a course of study in Functional Mathematics is a minimum of 55 hours per semester of timetabled school time, including assessment.

4.3 Topics

A course of study is based on five topics, grouped into three categories[7] according to the purposes and functions of using mathematics in various contexts.

These categories are:

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

The five topics are:

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

Topic 2: *Mathematics for interpreting society: data*

Topic 3: *Mathematics for personal organisation: location and time*

Topic 4: *Mathematics for practical purposes: measurement*

Topic 5: *Mathematics for personal organisation: finance*

Students should study the topics in combination rather than separately, and in contexts meaningful to them. Topics may be revisited in different contexts throughout the course.

[7] Based on the framework of the 2002 Victorian Certificate in General Education for Adults ARIS, Language Australia, Melbourne.

4.4 Developing a course of study

When developing a course:

- consider local school, community and workplace contexts
- be aware of the expectations of the learner outlined in section 5.2
- preserve the mandatory requirements of this subject (i.e. general objectives and the five topics)
- consider inclusive learning and assessment strategies to provide support for students' individual learning needs
- use suggested strategies for teaching and assessing set out in section 5.3.

See appendix 1 for examples of courses of study.

4.4.1 Moving from Functional Mathematics

Where students are successful in their studies of *Functional Mathematics* and have completed at least one full semester of the subject, it may be beneficial for these students to undertake the study area specification in *Prevocational Mathematics*. Decisions of this nature need to be made by the school, taking into account school resources, student achievements and needs. See appendix 2 for details of how *Functional Mathematics* can articulate into *Prevocational Mathematics*.

4.5 Details of topics

Introduction

Topics are presented with details of each grouped under the headings of the general objectives of *knowing*, *applying* and *communicating.*

The details for *knowing* indicate the minimum the course should include, while details for *applying* and *communicating* are only indicators of depth and manner of treatment, as schools will develop courses of study to suit students' needs. Hence lists of information included for *applying* and *communicating* are **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 and assessment ideas 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* but are intended as starting points for planning a course of study. They include additional ideas which 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 of all of the other topics. Relevant parts of topic 1 should be taught where required so that the study area core is integrated throughout the course.

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

Topic 1 is the *study area core* and is the basis of all other topics. This topic should be continually integrated and reinforced throughout the entire course.

Topic purpose

The student can read, write, interpret, compare and do calculations for personal, work or community life purposes involving:

- whole numbers
- commonly used fractions, decimal fractions and percentages.

Knowing

- how to read, write and say whole numbers, including large numbers
- how to recognise and interpret simple fractions, decimals and percentages in everyday use (e.g. 1/3, 1/10, 50%, 25%, 0.25, 0.5, $3.50)
- about place value
- how to order and group numbers
- how to make different representations of numbers
- how to use rounding to make numbers manageable
- about using concepts of addition and subtraction, multiplication and division (single digits up to larger numbers)
- about using mathematical support materials (such as calculators, number fact grids, MAB blocks etc) to perform simple operations on whole and decimal numbers
- how to use a calculator to find a given percentage of a quantity.

Applying

- selecting the most effective operation to suit the purpose
- applying suitable mathematical operation(s), of one or two steps, to familiar and predictable situations
- using informal methods and drawing on relevant experience to check that the outcome fits the task or activity
- …

Communicating

- using common words, phrases and symbols for mathematical operations
- with prompting, explaining to teacher or peers (orally, in writing or diagrammatically) the steps involved in performing tasks or activities
- …

Examples of learning experiences linked to assessment

Learning experience	Assessment ideas
Provide students with aids to help memorise and recall basic facts, for example, number squares, number lines and calculators.	Use these aids to perform simple numerical calculations and solve number problems. Describe how the aids are used to obtain answers.
Use 10 mm grid paper to help organisation and place value accuracy.	Use a grid to lay out workings and calculations for simple numerical problems. Describe how the grid is used to aid understanding.
Discuss discounts on “sale” items in a shop (links with Topic 5 – Finance).	Use a calculator to find the prices of discounted items in a clothing store or hardware shop.
“Tallest on the right, shortest on the left”. Measure the height of classmates and order them from tallest to shortest. Experiment with rounding up or down in varying degrees of precision (links with Topic 2 – Data, and Topic 4 – Measurement).	Measure heights of classmates in centimetres and record measurements in a table. Place the measurements in descending order and convert them to metres, then discuss the effect of rounding up and rounding down.

Topic 2: Mathematics for interpreting society: *data*

Topic purpose

The student can, for personal, work or community life purposes:

- collect, organise and display data using different methods
- interpret and use data and graphs.

In this topic, encourage students to use computer software and prepared templates wherever possible. Students are not expected to design spreadsheets, etc.

Knowing

- how to collect and organise data through observations or simple surveys
- how to record and check collected data
- how to use simple, everyday data to construct basic displays such as tables, picture graphs and bar/column graphs
- how to identify key elements of displays, such as titles, axes and scales
- how to read simple charts and tables
- that recording methods and observational conditions can change the way information is interpreted
- that graphs and tables can misrepresent data
- some language of chance
  - always, sometimes, never
  - likely, unlikely, impossible

Applying

- creating a variety of simple displays
- interpreting a variety of simple displays to investigate their own and others' questions
- using simple charts and tables for everyday purposes
- judging the effect of chance on students' own lives
- …

Communicating

- using common words, phrases and symbols for collecting, recording, explaining and organising data
- presenting data in different ways
- …

Examples of learning experiences linked to assessment

Learning experience	Assessment ideas
Enter routine data into a database or spreadsheet using familiar software.	Use spreadsheet software to produce a bar graph or pie chart within given parameters.
Use bus and train timetables (possible links with Topic 3 – Location and Time).	Use bus timetables to work out when and where to catch a bus or train to get to a certain location at or before a specified time of day.
Plan an end-of-year party (possible links with Topic 3 – Location and Time, and Topic 5 – Finance).	Collect data on classmates' favourite foods and drinks and use the data to plan a menu for the end-of-year party, calculating how much of each food or drink to buy.
Survey friends and colleagues to determine a number of personal preferences.	Collect data on classmates' favourite music, radio station, hobby or pastime, clothing brand, etc. and experiment with presenting the data in a variety of forms and displays. Discuss the advantages and disadvantages of each display type how different display types affect interpretation of data.
Discuss data interpretation from graphs in newspaper or magazine articles.	Describe essential elements of graphs or charts and explain how to make them easy to read.
Use a table to work out postage rates for standard-sized letters and packages (possible links with Topic 5 – Finance).	Calculate the cost of mailing three different-sized letters or packages using postage rate tables.

Topic 3: Mathematics for personal organisation: *location and time*

Topic purpose

The student can, for personal organisation needs such as time management and planning:

- read and use maps to locate places using the conventions of distance and location
- interpret time, clocks and simple timetables.

Knowing

- that maps are representations of the real world
- how to read a variety of simple true-scale and schematic maps
- how to use alphanumeric grids in a variety of contexts
- simple notions of scale and distance
- some language of direction
  - full, half, quarter, three-quarter turns
  - left, right turns
  - clockwise, anti-clockwise
- about simple concepts of direction, four compass points: N, E, S, W
- about units of time
  - seconds, minutes, hours
  - days, weeks, fortnights, months, years
- how to use a variety of different paper and electronic calendars, diaries, etc
- how to read analogue and digital 12-hour and 24-hour clock displays
- that different activities require different lengths of time

Applying

- making and reading simple mud maps
- identifying significant locations on maps
- planning a simple route between two specified locations
- planning a simple sequence of events incorporating timelines where applicable
- sequencing significant dates on a calendar or in a diary
- measuring and comparing durations of time
- making and keeping appointments with reference to place, date and time
- …

Communicating

- describing simple routes giving estimates of direction and distance and/or time
- using maps to explain simply how to get from one place to another
- describing a simple sequence of events
- …

Examples of learning experiences linked to assessment

Learning experience	Assessment ideas
Use simple maps, e.g. school maps, shopping centre maps, to identify and go to specific locations	Draw a mud map of layout of school (or other place) and explain how to get from one place to another.
Use a street directory to plan a simple route between familiar locations.	Plan and describe the route. Follow their own directions to travel between locations.
Describe and explain the rules of moves in board games, such as draughts, Chinese checkers, chess.	Design a "rules of the game" leaflet for a simple board game.
Use a kilometre table to show distances between Australian cities.	Plan own trip within given total kilometre restrictions.
Discuss the display of time on analogue and digital clocks.	Draw times on various clocks using both 12-hour and 24-hour time.
Discuss regular activities at various times of the day.	Discuss starting and finishing times of activities, e.g. morning tea, and show these on clock faces and/or displays.
Plan a simple cooking sequence for a meal.	Estimate how long it takes to cook elements of a simple meal. Calculate when to start cooking each element to have all ready at the same time.
Plan an end-of-year party (possible links with Topic 2 – Data, and Topic 5 – Finance).	Plan and present a timeline for an end-of-year party. Estimate how much time to allocate to activities and/or games, when to start cooking food, etc.
Use internet travel planning software, e.g. whereis.com, RACQ Travel Planner, transinfo.com.au to plan simple journeys.	Discuss times of arrival and departure at destinations. Decide which bus to catch to arrive at a given destination at a certain time.

Topic 4: Mathematics for practical purposes: *measurement*

Topic purpose

The student can measure accurately using a range of equipment for practical purposes.

Knowing

- about concepts of length, area, volume, capacity, mass and temperature
- some units of measurement of length, mass, capacity and temperature
  - personal referents, such as hand span, stride, body mass
  - standard units
- that standard units provide consistency when measuring
- how to use a ruler or tape measure
- how to use a variety of simple mass scales
- how to use a variety of simple devices for measuring capacity
- how to use a thermometer
- about links between simple concepts of length, area and volume
- about the characteristics of common 2-dimensional shapes and some common solids, for example, square, triangle, circle, cube, cylinder, cone, sphere

Applying

- using correct equipment to measure length, capacity, mass and temperature
- applying suitable standard units when measuring length, capacity, mass and temperature
- with assistance, applying knowledge about 2-dimensional shapes and common solids and their attributes for practical purposes, including area and volume
- identifying 2-dimensional shapes and common solids in the real world
- …

Communicating

- describing, naming and drawing 2-dimensional shapes and common solids
- explaining to a peer or teacher how to measure a given unknown
- …

Examples of learning experiences linked to assessment

Learning experience	Assessment ideas
Investigate converting recipes for different numbers of people.	Cook something using a recipe, e.g. pikelets, using a checklist under teacher observation/supervision.
Compare size, weight or volume of a variety of objects	Given a variety of objects, fill in tables, measuring and grouping objects according to size, weight or volume, e.g. under/over 20cm, more than/less than 100g, more than/less than one cup
Investigate objects of different sizes and shapes	Using a ruler, directions (oral or written) and suitable materials, construct a simple craft item. Discuss the shapes involved and the suitability of the units used
Use a variety of weather instruments (thermometer, rain gauge, hygrometer, etc) to keep a record of weather conditions for a set period (possible links with Topic 2 – Data).	Create tables to show weather data collected. Present data graphically using software such as Excel.
Investigate how many small boxes will fit into a larger box.	Present data and conclusions in a variety of formats. Support conclusions with reference to data.
Investigate how many glasses of juice are contained in a variety of different-sized bottles.	Students are verbally questioned and their responses noted: How many glasses are in a particular container if you use different-sized glasses? e.g. 50ml, 100ml, 200ml, etc. How many small bottles are needed to fill a big bottle?
Explore shapes and solids used in the community.	Using a checklist, walk around the school campus or community and identify 2-dimensional shapes and 3-dimensional solids.
Investigate water consumption in the home (possible links with Topic 2 – Data).	Use a copy of a council rates notice and water usage details to compare water consumption. Prepare a table to show water usage for different activities in the home, e.g. washing up, taking a shower.
Investigate how different sized parcels and envelopes have different weights (possible links with Topic 2 – Data and Topic 5 – Finance)	Set up a class post office. Use Australia Post postal charges to role-play being the postmaster, weighing and measuring letters or parcels written and packed by classmates. If he/she is able the 'postmaster' could determine the postal charge.

Topic 5: Mathematics for personal organisation: *finance*

Topic purpose

The student :

- knows how to obtain an income
- can make informed choices about how they use their income
- knows that consumers have rights and responsibilities.

Knowing

- about the decimal currency system
- about aspects of earning an income
  - wages versus salary
  - social security payments
  - superannuation
  - tax file numbers and income tax
- about spending money
  - rounding and making change
  - budgeting
  - cash transactions
  - cheques
  - credit/debit/store cards, EFTPOS
  - lay-by
  - discounts
  - surcharges
- about aspects of banking and financial institutions
  - savings
  - loans
  - interest
  - fees and charges
- how to conduct financial transactions using automated systems (ATM, telephone, internet)

Applying

- determine change expected from transactions
- interpret pay slips and statements of earnings
- develop a personal budget for living with parents and living independently
- make value-for-money comparisons
- interpret account statements, such as mobile phone accounts, bank statements, credit card statements, rates notices, etc.
- compare the costs of borrowing money and purchasing services from different institutions
- …

Communicating

- comment on the consequences of a financial decision
- justify a decision made about a particular method of payment
- …

Examples of learning experiences linked to assessment

Learning experience	Assessment ideas
Use shopping experiences to calculate total cost, tender cash for purchases and work out change: • pick-and-mix lollies • bread rolls and loaves • weekly groceries	Complete shopping worksheet outlining list of shopping items. Go to supermarket and purchase items confirming change given is correct. Vary payment forms i.e. cash, EFTPOS, credit cards. Use catalogues to design a weekly shopping list and approximate shopping budget.
Calculate sale prices, given original price and discount: • 25% off • half-price • 4 cents off per litre	Role-play a shop assistant/customer scenario where customers "buy" various items and calculate discounts and final selling/buying price. Use newspapers to examine discounts offered on a range of goods. Develop a portfolio on the range of discounts given to a particular item (e.g. cars).
Compare quantity, price, quality and additional costs of items from catalogues.	Select a large item to purchase, e.g. a motorbike, and research prices to determine best value. Compare supermarket items in various catalogues to decide on "best buys".
Plan a class barbecue.	Prepare a "cost per student" report on planning a barbecue. – Compile a list of food for the barbecue – Find the cost each item – Calculate the total cost, then cost per student – Present findings and costs to the class
Examine various pay slips and discuss: • wages versus salary • tax file numbers and income tax • social security payments • superannuation	Discuss the advantages and disadvantages of wages versus salary.
Develop an awareness of banking and financial institutions and associated concepts of: • savings • loans • interest • financial charges	Select a large item to purchase which could require a personal loan (e.g. a car). Calculate the cost of a personal loan from a financial institution including repayments, interest and charges. Compare loan cost to saving the purchase amount. Discuss advantages and disadvantages of each.

5. Learning experiences

5.1 Overview

Equal opportunity means all students should be treated in a way that enables them to achieve. The diversity and needs of students should be taken into account when planning learning experiences. The emphasis in this subject is to build success for students by focussing on the types of learning considered essential to become numerate.

Building success is about:

1. determining what the individual student knows and can do at the start of the course (informally, not with a diagnostic test)
2. making *reasonable adjustments*[8] to teaching, assessing and the classroom environment for each student so that they can learn.

Numeracy is taught effectively by:

- maintaining a flexible attitude
- being willing to experiment with different ways to help students learn
- considering how each student 'fits' into the class and how class size affects the level of support possible
- consulting experts to determine support needs for particular students
- requesting extra adult support in the classroom if needed
- taking into account the expectations for the learner (see 5.2)
- reworking and adapting teaching and assessment practices (refer to Teaching strategies to consider, section 5.3, and Assessment strategies, section 6.2)
- applying the following principles to support students' individual learning needs[9]:
  - emphasis should be on improving the students' ability to access, learn and demonstrate knowledge and skills
  - while some students may learn or perform in ways different from others they are still part of the student body as a whole, with the same rights and responsibilities as their peers

[8] Adjustments are 'reasonable' if they can be made while preserving the essential requirements of the course, do not entail additional provision beyond the resources of the school, and do not conflict with the general duty of care to the whole student body (adapted from *Educational Policy and Standards Committee, SENDA (Special Educational Needs and Disability Act), Brief Guidelines for Lecturers and Tutors*, 2001. Accessed from the web, April 7, 2005. http://www.admin.ox.ac.uk/eop/disab/brief.pdf). page 1

[9] Adapted from Barrett, J. February 1999, *Inclusive Practice is Good Practice*, University of Tasmania, (pages 5-13). Accessed from the web 22 November 2005, http://services.admin.utas.edu.au/Gateways/IPIGP_pubs/pdfs/IPIGP.pdf

– students are not a homogenous group: individuality, particular strengths, learning needs, and aspirations should be taken into account.

5.2 Expectations of the learner

The expectations listed below are drawn from and align with level 2 standard of the (NRS)[10], and are to be read in combination with the teaching strategies outlined in section 5.3.

When **making meaning**, the student is expected to:

- rely heavily on hands-on (concrete) and real-life materials, and pictures or diagrams, to derive mathematical meaning
- rely on personal experience and prior knowledge within context to make predictions and check reasonableness
- relate meaning to personal experience, prior knowledge and relevant future action
- clarify the intended meaning of activities by asking for assistance, e.g. alternative representation, rephrasing
- use knowledge of mathematical concepts from first language to English, and use a bilingual dictionary for assistance with general and mathematical vocabulary where required.

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

- use several pieces of related mathematical information, e.g. prices from a menu, measurements of a room
- interpret familiar oral instructions or texts, (for example: menus, timetable, household bills, price lists) where the mathematics content is easily accessible
- use a blend of personal "in-the-head" methods, recording methods and calculator procedures
- rely on prior experience and examples to select suitable methods of problem solving
- use informal methods and draw on relevant experience to check that problem-solving methods fit the task or activity.

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

- comprehend activities or tasks including common formal mathematical symbolism, abbreviations and language, and familiar information that is culturally accessible
- use the symbolism and conventions relevant to the mathematical knowledge of the level, for example: ½ of 1L, 1.6 cm, map reference D5, etc.
- use everyday language and some mathematical language to describe the problem-solving process
- begin to include symbols and diagrams in producing written record of tasks.

[10] *National Reporting System (NRS)* Australian Government Department of Education, Science and Training

5.3 Teaching and learning strategies to consider[11]

1. Before teaching a course, focus on whole-of-class strategies, then on individual requirements.

- Where possible, negotiate directly with students about their needs and to find alternative ways to achieve equivalent learning.
- Consult others, for example specialist services staff, for additional information, advice and resources.
- Avoid making assumptions about what students can and cannot do
- In many instances technology is available which can assist students to achieve what may initially appear to be impossible.
- Prepare class notes and handouts ahead of time and permit lessons to be taped.
- Organise and plan the use of additional support personnel, such as interpreters, readers, note-takers, scribes, and teacher aides to support students.
- Provide flexibility with assessment opportunities and practices so that students are not disadvantaged.
- Resolve any access and safety issues in a manner that respects each student and their rights.

2. Learning must be practical.

Learning should:

- relate to authentic life experiences
- add relevancy and immediacy
- be actively engaged with real-world situations
- cover a range of different learning situations
- avoid gender bias
- be presented in a context that makes it familiar, personal or appealing to students.

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[11] Adapted from the following:

- *Addressing accessibility in mathematics project*, 2003 EDC (Educational Development Center), Massachusetts. Accessed from the web 22 November 2005, http://edc.org/accessmath/resources/StrategiestoConsider.pdf;
- van Kraayenoord, C., Elkins, J., Palmer, C., Rickards, F., 2000. *Students with Disabilities: Their Literacy and Numeracy Learning,* Commonwealth of Australia. Accessed from the web 7 April 2005, http://www.dest.gov.au/sectors/school_education/publications_resources/summaries_brochures/students_with_dis.htm;
- Barrett, J., February 1999, *Inclusive Practice is Good Practice*, University of Tasmania, (pages 5–13). Accessed from the web, 22 November 2005, http://services.admin.utas.edu.au/Gateways/IPIGP_pubs/pdfs/IPIGP.pdf

3. Use strategies to build success.

- Establish a climate of trust and risk taking (refer to appendix 3 for examples of lesson plans).
- Preview and review all materials and activities to ensure all students can access them.
- Adjust:
  - the amount of time to read materials or do activities; consider flexible time arrangements and rest breaks; offer timers to help students with pacing
  - the pacing of lessons and activities to cater for different attention spans of students
  - the amount of work to be done in the time available
  - the number of steps in a task so that each step is manageable
  - the nature of practical activities, workshops, field trips, work experience, or work placement so that all students can participate.
- Use technology supports such as tape recorders, projectors, portable keyboards, calculators, and software programs.
- Provide frequent positive and encouraging feedback.
- Ask students if assistance is required.
- Establish and consistently use prompts, cues, and hints.
- Teach team skills and use techniques such as cooperative groups and peer mentoring.
- Teach organisational strategies to students such as how to:
  - set up an organisational system using diaries, timetables, exercise book
  - use highlighting, colour-coding and ‘post-it’ techniques.
- Help students to develop and use a range of memory aids, for example, use a ruler as a number line, a personal mathematics chart or flip cards for facts, and alternative words for operations.

4. Adjust the physical classroom environment.

- Ensure that your classroom and equipment are physically accessible for teachers and students, considering desk or chair height, space for equipment, positioning of furniture; develop creative solutions in partnership with students — not all solutions are ‘high tech’ or involve a great deal of time and money.
- Provide assistive technology, with time and directed support for students to experiment and gain confidence with it, for example:
  - voice recognition software which produces typed work on a computer
  - software that provides enlarged text, voice output and/or closed circuit televisions to magnify materials
  - predictive software
  - personal FM system which amplifies sound.
- Seat students according to needs (for example, attention, hearing, vision) and to suit the purpose of the activity. Do not seat students who are easily distracted near windows or doors.
- Set up organisational systems, for example:
  - display organisational reminders and checklists
  - post homework in a consistent location
  - post classroom rules.

- Display wall charts with key vocabulary and information.
- Avoid overuse of auditory and visual stimulus materials.
- Display examples of final products for students to use as models.

5. Use a variety of teaching methods.

- Provide explicit teaching.
- Provide visual, auditory and non-verbal cues.
- Face toward the class whilst speaking.
- Use plain English and minimise the complexity of communications.
- Stay on the topic.
- Use concrete examples and learning materials.
- Rephrase information if students do not understand: explain terms, symbols and operations using visual, auditory and tactile methods, each time they are used.
- Have students paraphrase directions and questions, to self-explain.
- Read aloud material that is written on the board or overhead transparencies.
- Use additional and multiple representations or examples.
- Use alternative approaches, for example, whole class activities, small group work, periods of intensive individual instruction.
- Use colour, objects, sound and rhythm, movement and large mathematics props and illustrations to engage all the senses in learning.
- Provide constant repetition, practice and revision of past learning.
- In practical activities:
  - label equipment, tools and materials
  - adjust the practical components to accommodate the needs of students.
- Role-play, mime or act out practical activities to show students what to do.
- Think aloud to model self-questioning and self-monitoring strategies.

6. Present students with a variety of learning materials/organisers.

- Format handouts to reduce distracting elements and increase white space.
- Provide printed material in a variety of formats to support students' differing needs, for example: computer disk/memory stick, audiotape, large text and diagrams/images, tactile graphics.
- Cue students to find key points in handouts by using, for example, colourful stickers and visual cues.
- Provide graphic organisers to help students understand concepts and organise ideas.
- Provide project organisers to help students keep track of tasks.
- Provide templates for tables, graphs, writing and other tasks.
- Provide study guides with key information on concepts to reduce copying and note-taking.
- Provide word and symbol banks for vocabulary (these could be displayed in the classroom).

6. Assessment

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

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

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

6.1 Underlying principles of exit assessment

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

- information is gathered through a process of continuous assessment
- balance of assessments is a balance over the course of study and not necessarily a balance over a semester or between semesters
- exit achievement levels are devised from student achievement in all areas identified in the 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 six principles associated with it.

6.1.1 Continuous assessment

The major operating principle is *continuous assessment*. The process of continuous assessment provides the framework in which all the other five principles of balance, mandatory aspects of the 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.

6.1.2 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 and conditions 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.

6.1.3 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 *communicating,* and
- the five topics: *number* (study area core), *data*, *location and time, measurement, finance*.

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

6.1.4 Significant aspects of the course of study

Significant aspects refer to those learning experiences that the school uses in accordance with the particular structure of the study area specification. 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 a 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 course.

6.1.5 Selective updating

In conjunction with the principle of fullest and latest information, you should selectively update information on student achievement 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 you treat subject matter at increasing levels of complexity, assessment information gathered at earlier stages of the course may no longer be representative of student achievement. You should therefore selectively and continually update (not average) information to accurately reflect student achievement.

The following conceptions of the principle of selective updating apply:

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

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

6.1.6 Fullest and latest information

You must base judgments about student achievement made at exit from your course of study on the fullest and latest information available. You record this information 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 the course 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

Assessment opportunities arise from students' learning experiences. Assessment techniques should be selected to suit the context in which the student is learning and should extend well beyond examining students' ability to find the right answer for a computational exercise. Tasks should assess the many additional skills and knowledge areas, such as acting upon numerical information, applying mathematical reasoning and solving realistic problems.

Table 6.1 provides examples of ways to gather and record evidence from a variety of sources.

6.2.1 Suggested strategies

1. Conduct assessment mostly in class time.

Assessment should be conducted mostly in class time, so that support and scaffolding may be provided. This includes not only assessing responses to small tasks in class time under close supervision, but also projects and investigations carried out over several weeks. This strategy can provide many opportunities for observations to be recorded assist to be provided, and student work authenticated. 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.

Students should be encouraged to communicate about issues involving mathematics, including how they are working with given rules, operations, procedures and open-ended problems. This enables understanding to be assessed, difficulties to be diagnosed and guidance provided. Records of observations can contribute to evidence of students' achievements.

3. Develop contextualised assessment tasks.

Genuinely contextualised assessment is real and meaningful to students 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 4.

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

Do not restrict students to working on sequences of sums or word problems in a book to which there is only one correct answer. Open-ended tasks give students opportunities to:

- explore and apply mathematical concepts
- discuss possible solutions
- present responses in a variety of forms.

Table 6.1: Gathering and recording evidence from a variety of sources

Sources of evidence	Assessment techniques	Recording instruments
• computer-generated presentations • concept maps • debates • discussions with students • games • journals • observations of written work in progress • plans of approach to investigations • projects/assignments • questioning led by teacher or student • reports (e.g. on investigations) • research projects • sketches and drawings • structured whole- or small-group discussions • student explanations of work in progress • student folios • working notes and jottings	**Observation** involves teachers observing students as they participate in planned activities. This occurs continually as a natural part of the learning and teaching process and can be used to gather a broad range of evidence about students' achievements. Observations can also be structured to gather particular kinds of evidence in relation to student achievement. **Consultation** involves discussing student work with students, colleagues, parents/carers. The varying perspectives of the participants in consultations can help enrich the evidence gathered about students' achievement. Consultation can be used to verify the evidence gathered using other techniques. Some consultations may reveal a need for more detailed assessment. **Focused analysis** involves examining student responses to tasks or activities in detail (e.g. computer-generated presentations, group discussions, tests, debates or research projects). This technique provides detailed evidence about students' achievement. **Self- and peer-assessment** involves students using the above techniques to assess their own work and the work of their peers. Self- and peer-assessment allows students' perceptions to be considered when gathering evidence.	• anecdotal records • annotated work samples • audio and visual recordings (including photographs and video) • checklists • feedback sheets • folios • learning logs • observation notes • reflection sheets, diaries or scrapbooks • reports of test results • self- and peer-assessment sheets • self- and peer-reflective journals • statements of anticipated evidence or criteria sheets • student/teacher journals • worksheets

5. Assess a broad range of skills and reasoning processes using a range of methods.

Functional Mathematics emphasises contextualised assessment of a broad range of skills and reasoning processes and is not examination-based. It is strongly recommended that tests are kept to a minimum or not used at all. If tests are used, they should be very short in duration, 'open book' in nature and help must be freely available to students.

6.3 Developing assessment tasks

When presenting assessment tasks:

- state whether the student response is to be a demonstration, oral, visual, written, multimedia presentation or a combination of any or all of these
- provide clear descriptions, which are logically sequenced and easily understood by students —use graphics and text in boxes to enhance presentation and readability
- provide scaffolding and guidelines clearly explaining 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
  - information from the internet
  - industry-based information, e.g. pamphlets, manuals
  - brochures, advertisements for coming events
  - audiotapes, videotapes or DVDs
  - photographs
  - computer software
  - films, television programs
  - guest speakers
  - excursions
- include criteria and standards consistent with those used for determining exit levels of achievement (see table 6.3)
- identify conditions involved, for example, individual/group, own/class time, access to teacher, duration (for example, 1 week, 1 semester).

An oral explanation of the tasks and modelling some of the steps should be provided.

6.3.1 Special consideration

The Authority's policy statement on special consideration, *Special Consideration: Exemption and special arrangements in senior secondary school-based assessment* (30 May 1994) gives guidance about the nature and appropriateness of special consideration and special arrangements for particular students. This statement also provides guidance on responsibilities, principles and strategies that teachers may need to consider in their school settings.

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

6.4 Exit criteria

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

The exit criteria therefore are:

- **Knowing**
- **Applying**
- **Communicating.**

Exit criterion 1: *Knowing*

Students are required to demonstrate knowledge of mathematical concepts and use given mathematical rules, operations and procedures to carry out simple, familiar tasks.

Exit criterion 2: *Applying*

Students are required to interpret familiar and predictable contexts, recognise relevant mathematics, and select strategies to carry out tasks.

Exit criterion 3: *Communicating*

Students are required to use everyday language and some mathematical symbols to respond to tasks in familiar and predictable 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.

Exit standards for each of the three assessment criteria *knowing, applying* and c*ommunicating* based on the principles of assessment, described in section 6.1. The criteria are derived from the general objectives and are described in section 6.4. The standards associated with the three exit criteria are described in table 6.3. When determining a standard for each criterion, it is not always necessary for the student to have met each descriptor for a particular standard; how the qualities of the work match the descriptors overall informs the standard awarded.

All of the seven key competencies are relevant to assessment in this subject[12] and are embedded in the descriptors in the standards matrix, either explicitly or implicitly. The descriptors refer mainly to aspects of mathematical ideas and techniques, organising information and activities and communicating ideas and information.

When standards have been determined for each of the three criteria of *knowing*, *applying,* and c*ommunicating*, table 6.2 is used to award exit levels of achievement, where *A* represents the highest standard and *E* the lowest. The table represents the minimum combinations of standards across the criteria for each level.

Table 6.2: Awarding exit levels of achievement

Level of achievement	*Minimum combinations of standards*
Very High Achievement	Standard A in two criteria with no less than a standard B in the remaining criterion
High Achievement	Standard B in two criteria with no less than a standard C in the remaining criterion
Sound Achievement	Standard C in two criteria no less than a standard D in the remaining criterion
Limited Achievement	At least two standard D results
Very Limited Achievement	Standard E in two criteria

[12] 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

Table 6.3: Standards associated with exit criteria

All students should have access to teacher support during assessment. Standards should be read with this in mind.

Criterion	Standard A	Standard B	Standard C	Standard D	Standard E
Knowing	The student: • demonstrates a thorough knowledge of functional mathematics concepts • uses given mathematical rules, operations and procedures to carry out simple, familiar tasks	The student: • demonstrates a working knowledge of functional mathematics concepts • uses given mathematical rules, operations and procedures to carry out simple, familiar and often-rehearsed tasks	The student: • demonstrates a working knowledge of aspects of functional mathematics concepts • uses *given* mathematical rules, operations and procedures to carry out simple, familiar and often-rehearsed tasks as instructed	The student: • demonstrates a partial knowledge of aspects of functional mathematics concepts • follows given mathematical rules, operations and procedures to carry out parts of simple, familiar and often-rehearsed tasks as instructed	The student: • always requires assistance to follow given mathematical rules, operations or procedures in relation to simple, familiar, often-rehearsed tasks
Applying	The student: • interprets a variety of familiar contexts • identifies relevant mathematics within these contexts • selects and follows learned strategies to successfully carry out tasks	The student: • interprets a variety of familiar and predictable contexts • recognises relevant mathematics within these contexts • selects and follows simple learned strategies to successfully carry out tasks	The student: • interprets familiar and predictable contexts • recognises some relevant mathematics within these contexts • follows simple learned strategies to carry out tasks	The student: • follows simple learned strategies to carry out aspects of tasks	The student: • follows simple learned strategies to carry out aspects of some tasks
Communicating	The student: • uses everyday language effectively in familiar mathematical contexts • correctly uses familiar mathematical symbols	The student: • uses everyday language effectively in familiar and predictable mathematical contexts • uses familiar mathematical symbols	The student: • uses everyday language in familiar and predictable mathematical contexts • recognises and uses some familiar mathematical symbols	The student: • uses some everyday language in familiar and predictable mathematical contexts • recognises some familiar mathematical symbols	The student: • acknowledges some familiar mathematical symbols

7. Resources

7.1 Learning resources

The recommended use of concrete and visual manipulative materials, experiential learning and up-to-date technology (see section 5), combined with the likely special educational needs of students enrolled in a *Functional Mathematics* course, indicate that an ideal *Functional Mathematics* classroom will feature many, if not all, of the following:

- large dedicated storage and display areas
- good acoustics
- glare-reducing surfaces and windows
- sturdy, moveable furniture
- multiple electrical power points
- multiple desktop or laptop computers with dedicated mathematics software
- internet access
- a designated wet area
- a sink and draining area with hot and cold running water
- a lively and stimulating colour scheme.

Other suggested resources that can support this study area specification are:

- a DAL (direct algebraic logic) 2-line display calculator with a fraction key
- a 4-function basic calculator
- a ruler
- a globe and/or wall maps
- computer-based and/or board games
- brochures, timetables and pamphlets
- videos and DVDs
- guest speakers.

Teachers of this study area specification are encouraged, wherever possible, to access ongoing professional development relating to the teaching of numeracy to students with special educational needs. This will help to extend the knowledge, skills and understanding required to adapt and develop strategies that enable students to achieve the general objectives.

Students enrolled in this course are highly likely to require adult support above and beyond typical classroom resources. If possible, maintain an adult/student ratio of 1:5 or 1:6, where the adult could be teacher, aide, special needs advisor, volunteer, mentor, or resource teacher.

7.2 Teaching resources

Resources listed are samples only, not exhaustive. Websites last accessed January 2006.

Teacher texts

Breaking the Mathematics Barrier, Marr, B. & Helme, S. 1991, ARIS Language Australia, Victoria, Australia.

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

Mathematics: A New Beginning: A resource book for teachers of adults returning to study, Marr, B. & Helme, S. (eds), 1999, ARIS Language Australia, Victoria, Australia.

Rethinking Assessment: Strategies for holistic adult numeracy assessment, Marr, B. & Helme, S. & Trout, D. 2003, ARIS Language Australia, Victoria, Australia.

Strength in Numbers: A resource book for teaching adult numeracy, Goddard, R., Marr, B., & Martin, J. 1996, ARIS Language Australia, Victoria, 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.

The Trouble with Mathematics: A practical guide to helping learners with numeracy difficulties, Chinn, S., & Snowling, M. 2004, Routledge, New York.

Understanding Mathematics: Basic mathematics for adults explained, Lawler, G. 2003, 2nd edition, Trans-Atlantic Publications**,** Philadelphia, PA.

Innovations in Numeracy Teaching in the Middle Years, Zevenbergen, R. (ed.), 2005, Australian Curriculum Studies Association, Deakin West, ACT.

Think Mathematically: How to Teach Mental Maths in the Primary Classroom, McIntosh, A., DeNardi, E. & Swan, P. 1994, Longman Cheshire, Melbourne.

The Think Tank, Burnett, J. 2004, Origo Publications, Brisbane.

Videos, CD-ROMs and DVDs

Measuring up: an interactive multimedia computer resource for numeracy learners, Tout, D. & Marr, B. 1997, Protea Textware, Hurstbridge, Vic.

From VEA Media, 111A Mitchell Street, Bendigo, Victoria 3550. Website: www.vea.com.au. The following are suitable for this study area specification:

Making Sense of Percents: An introduction to percentages, 2001 (21 min).

Problem Solving, 2003 (22 min).

Life by Numbers Series — Shape of the World: Exploration, 1998 (55 min); *A New Age: the Age of Information*, 1998 (52 min).

Measure for Measure Series, four programs (*Weight, Time, Temperature, Length*), 1995

Websites

Site	Use
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 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*.
Australian Bureau of Statistics http://www.abs.gov.au/	Includes data based on different themes such as ageing, 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).
Australia's Wage, Salary and Job Centre http://www.wages.com.au/	Information about payroll, timesheets, salary surveys.
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.
Conversion and Calculation Centre http://www.convertit.com/Go/ConvertIt/	Convert measurement, currency, time.
Currency converter http://finance.yahoo.com/currency	Instant converter that uses latest conversion rates as well as graphs of changes in the selected currencies over time.
Financial Basics Foundation http://www.financialbasics.org.au/teachers/index.html	News and updates from newspapers about aspects of financial literacy, plus web links.

Site	Use
Key Skills (from Wales) http://www.keyskillssupport.net/teachinglearning/individualkeyskills/application/	Resources for number — worksheets (zip files).
King's List of Online Mathematics Activities www.k111.k12.il.us/king/math.htm	A range of links to activities, some of which are suitable for this study area specification (many require Shockwave software).
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).
Numeracy on Line http://www.dest.gov.au/ty/litnet/numeracy/home/nh_0005.htm	Numeracy activities in various industries (from the Department of Education, Science and Training)
Office of Consumer and Business Affairs (South Australia) http://www.ocba.sa.gov.au/consumeradvice/	Advice on a large range of consumer concerns including buying a used car, mobile phone, house, refunds, shopping from home, identity theft, travel.
Office of Fair Trading http://www.fairtrading.qld.gov.au.	Provides teaching resources, advice to consumers on buying used cars, real estate, making good credit choices.
Translink – Public Transport Network http://www.transinfo.qld.gov.au/	Plan journey using public transport. TransLink now provides one single public transport network covering south-east Queensland from Gympie North/Noosa to Coolangatta and west to Helidon.
RACQ Road Travel Planner http://www.racq.com.au/cps/rde/xchg/SID-342D8FD3-5CEBBEAF/racq_cms_production/hs.xsl/2933_ENA_HTML.htm	Plan road journeys anywhere in Australia. Print road maps and driving directions.
Scale drawing and house plans http://www.smallblueprinter.com/	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.

Site	Use
IKEA kitchen planning tool http://www.ikea.com./ms/en_AU/rooms_ideas/kitchen/download.html	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'.
Currency Converter http://www.xe.com/ucc/	Convert amounts when buying or selling Australian dollars. Every world currency available in the Full Universal Currency Converter.
Dollarsmart – Financial Planning Association Guide to Financial Literacy http://www.fpa.asn.au/Home/News/DollarsmartFPAGuidetoFinancialLiteracy.asp	A new financial planning workbook, Dollarsmart is specifically designed to help teenagers learn about money and managing their finances.

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	
Foreign exchange calculator	Convert from Australian dollars to a foreign currency or convert from a foreign currency to Australian dollars.
Budgeting and saving	
Savings term calculator	How long will it take? This calculator will help you to determine how much time it will take to reach your savings goal with regular monthly savings.
Target deposit amount calculator	How much will I have? This calculator will help you to determine the approximate final balance of your savings after different periods of time.
Monthly savings calculator	How much do I need? This calculator will help you to determine how much you need to save each month to achieve your particular savings goal.
Budget planner	See how much money you spend and on what, and decide how much you can potentially afford to invest for your future prosperity. It's the first step to effectively planning your financial future.

Student budget calculator	This budget calculator will tell you where your money is going. Find out how much more money you can put away regularly to meet your goals sooner.
Your home	
Home Equity Guide	The Commonwealth Bank Home Equity Guide calculates an estimate of the equity you have in your home, based on what you know about your property and our knowledge of fluctuations of the property market in your area.
Commonwealth Bank Property Value Guide	Property Value Guide is a free, comprehensive, up-to-date insight into what the property market is doing from month to month.
Home loan calculator	Use the home loan calculator to find out what your monthly loan repayments might be, or how many years it could take to repay your Home Loan. Calculate your loan amount, your repayments, your loan term and your frequency of repayments to establish the right product for you.
Home loan selector	How do you find a home loan that's a perfect fit financially? Choose the home loan that suits your financial needs by using the home loan selector to find the perfect home loan in an instant.
How much can I borrow?	Estimate how much you can borrow based on your income and expenditure. Use this calculator to estimate how much you can borrow for your new home or investment property and how much your repayments will be.
Total home-buying costs calculator	This calculator will estimate the cost to purchase a property based on the property purchase price and the loan amount you plan to borrow.
Personal loans	
Personal Loan Calculator (Java enabled) Personal Loan Calculator (HTML version)	There are two personal loan calculators available, designed to help you with your application and to manage your finances. • Calculate my repayments — helps you establish the most affordable repayment schedule based on weekly, fortnightly or monthly repayments. • How much can I borrow? — provides you with an idea of how much money you may be able to borrow.
Home, contents or investment home insurance	
Home insurance calculator	An interactive calculator to help you calculate the value of your home or investment property for insurance purposes.

Contents insurance calculator	Use this calculator to estimate the value of your home contents for insurance purposes.

The following website is useful for topic 2 (Mathematics for interpreting society: data), http://www.shodor.org/interactivate/elementary/index.html. 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. It is also a very good teaching tool.

Histogram	Students can 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.
Pie chart	Students can 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.
Bar graph	Enter data to create a bar graph, then manipulate the graph's maximum and minimum values.
Circle graph	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.
Plot it	Allow students to graph their information using a simple bar graph and investigate mean and median. Parameters: range for observations.
Measures	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.

Appendix 1: Examples of courses of study

Introduction

Three different course overviews are provided to illustrate ways courses of study may be organised. These courses have been developed from course overviews included in the study area specification *Prevocational Mathematics*, to show the close links that can be made between *Functional Mathematics* and *Prevocational Mathematics*.

Overview 1 is designed around themes lasting a whole semester — each theme deals with several of the five topics. Overview 2 has been designed around a number of large and small projects. Overview 3 is designed around many short units that are not connected by a theme.

In all cases, the assessment package requires students to use a variety of response modes to allow students to show their abilities in the best possible light. Once students have experienced each form of assessment, they may be allowed to negotiate the response mode they wish to use for a particular assessment task.

Course overview 1

Semester	Unit description	Topics	Time	Suggested assessment
1	*Becoming employed* • identifying job • rates of pay • applying • being interviewed • moving or living at home • budgeting • managing money • mobile phones • pitfalls	1,3,4,5	17 weeks	Oral presentation Folio of worksheets Poster display *(Formative)*
2	*Self-employed — developing a market garden* • planning • designing • marketing the produce • using the profits	1,2,3,4,5	16 weeks	Checklist Poster display Oral presentation *(Formative)*
3	*Taking care of yourself* • food and nutrition • comparative shopping • planning a party • public transport • planning a day trip	1,2,3,4,5	16 weeks	Folio of worksheets End of term lunch Prepare a trip *(Summative)*
4	*Taking a break (schoolies)* • planning a destination • costs • procedures • precautions • budgeting • spending	1,2,3,4,5	15 weeks	Oral presentation Folio of worksheets Prepare a budget *(Summative)*

Course overview 2

Term	Project description	Assessment
Term 1, Year 11	*Planning a grandparent's surprise birthday party* (2 weeks) With relatives from Perth and Christchurch	Poster display (party details); budget; accommodation arrangements for at least 1 relative from Perth and 1 relative from Christchurch
	Mobile telephones: A necessity for teenagers (3 weeks)	Poster comparison of various plans
	Practical activities (4 weeks) • Location and Time • Finance (basic calculations associated with purchasing).	Classroom quizzes — students can access their textbooks and class notes. Teacher assistance freely available.
Term 2, Year 11	*Computer games* (3 weeks) • Number facts • Calculator skills	Check-sheet for students to record progress.
	You and your money (6 weeks) Mini projects: • giving change • advantages and disadvantages of buying second-hand • finding the average return from Golden Casket and Lotto • the mathematics behind the chain letter; • what is the relationship between mathematics and alcohol?	Portfolio of worksheets completed in class relating to selected topics.
Term 3, Year 11	*How efficiently does the school fill in the morning and empty in the afternoon?* (5 weeks) Surveys of roads, footpaths, gates and parking arrangements.	Oral presentation to members of school administration — data to be displayed on charts; Group work
	Practical activities (5 weeks) • Data (skills required to read and interpret data) • Measurement (basic skills and applications)	Individual interviews with students (10 minutes): students given statistical information before the interview; interview questions relate to ability to read and interpret graphs, examining the student's ability to carry out basic measurement tasks and interpret simple problems. Calculations are not part of this interview process.
Term 4, Year 11	Practical activities (4 weeks) • Measurement (volume and capacity) • Location and time (understanding maps)	Portfolio of selected worksheets completed in class that relates to selected topics.

Term	Project description	Assessment
Term 1, Year 12	*Day trip to the coast* (5 weeks) Short holiday using timetables and public transport.	Individual itinerary; peer assessment of itinerary; read maps and direct students during the excursion. Excursion using best itinerary.
	Exploration of online financial information (2 weeks)	Observation of selected tasks requiring students to use internet.
	Practical activities (3 weeks) • Finance associated with earning an income	Portfolio of selected worksheets completed in class.
Term 2, Year 12	*Does the school have sufficient shade areas?*(5 weeks)	Oral presentation to members of school administration — data to be displayed on charts; pair work
	Box making (2 weeks) • Investigate various boxes used commercially as packaging • Making boxes using prepared templates. • Designing and making own box for a particular purpose.	Construction of own box
	Practical activities (2 weeks) • Saving money	No assessment — this work is preparation for the next project.
Term 3, Year 12	*Finances: Next year* (5 weeks) Investigation of possible financial situations that students may encounter next year.	Individual work with some pair work. Students to prepare a poster suitable for use with other students; information must be accurate and relevant.
	Location! Location! Location! (2 weeks) Series of worksheets on given theme: • street directory and index pages • shopping centre site maps • large tourist attractions site maps (Dreamworld)	Individual interview with student (10 minutes) • students asked to perform various tasks that are similar to the activities undertaken during class lessons • verbal answers and activities that may require students to trace routes, etc.
	Practical activities (3 weeks) • Borrowing and repaying money	Individual interview with student (10 minutes) relating to work covered in class.
Term 4, Year 12	Practical activities (2 weeks) • Collecting and displaying data (work required for the project)	No assessment — the skills gained here will be used in the project that follows.
	Hopes for next year (4 weeks) • Conditions that affect data-gathering and data display • Comparison of data displays.	Individual work: • students to write comments on their findings in two areas • display of data in various forms • analysis of data.

Course overview 3

Semester	Unit description	Topics	Time (weeks)	Suggested assessment activities
1.	*Landscaping and designing*	1,3,4,5	4	Design a kitchen garden
	Tuckshop usage	1,2,4,5	3	Poster around a survey
(Formative)	*Planning a beach holiday*	1,3,4,5	4	Folio of worksheets
	Healthy bodies and nutrition	1,2,4,5	4	Prepare a lunch
	Keeping domestic pets	1,2,4,5	3	Oral presentation
2.	*Small business and budgeting*	1,2,5	4	Prepare weekly morning teas
	Finding your way	1,2,4	4	Practical travel activity
(Formative)	*Healthy bodies and exercise*	1,2,4,5	4	A day's menu
	Taking a chance	1,2,4,5	3	Oral presentation
	Catering for barbecues	1,2,4,5	3	End-of-year barbecue
3.	*Travelling*	1,2,4,5	4	Folio of worksheets
	Interior design	1,3,4,5	3	Decorate your room
(Summative)	*Housing*	1,3,4,5	4	Series of reports, one paragraph each
	The school grounds	1,2,3,4,5	3	Oral report
	Mobile telephones	1,5	4	Poster display
4.	*My favourite sport*	1,2,4,5	5	Oral report
(*Summative)*	*My first job*	1,2,5	3	Checklist of activities
	Personal budget	1,5	3	Prepare a budget
	Moving out (looking for a place to live)	3,5	4	Folio of worksheets

Appendix 2: Articulation with *Prevocational Mathematics*

The study area specification *Functional Mathematics* is designed to articulate with the study area specification *Prevocational Mathematics*. This articulation allows students to move between the two subjects and also helps schools choosing to offer the subjects in composite classes. The following table shows the approximate relationship between the two syllabuses.

Relationship between *Functional Mathematics* and *Prevocational Mathematics*

Features	Study area specification	
	Functional Mathematics	**Prevocational Mathematics**
NRS[13] level	2	3
Equivalent to Years 1 to 10 KLA syllabus level (or equivalent)	Aspects of 2 and some of 3	Aspects of 4 and 5 and, for the finance topic, a few aspects of 6
Entry level assumed knowledge of the student	From foundation to level 2 of the Years 1 to 10 KLA Mathematics syllabus or equivalent	At least level 3 of the Years 1 to 10 KLA Mathematics syllabus or equivalent
General objectives	Knowing, Applying, Communicating	Knowing, Applying, Explaining
Topics	• 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.	• 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.
Support needs	• Very highly scaffolded and supported • Consideration of teaching and assessment strategies to suit individual learning needs • May also have high literacy support needs	• Highly scaffolded and supported • Focus on building confidence and success through a range of teaching and assessment strategies

[13] National Reporting System

Appendix 3: Lessons for establishing a climate of trust

Students who experience severe difficulties with mathematics need substantial support in their learning. Teachers of *Functional Mathematics*, should be aware that positive attitudes and dispositions towards mathematics are developed over time and as a result of many lessons. A safe environment for thinking, exploring, risk-taking and communicating needs to be created and fostered. Group work, exploratory talk and decision making should be encouraged. Situations with more than one possible solution should be created, encouraging students to consider possibilities.

The following schedule of lessons and activities could be used early in the course and involves students working individually and in groups. Activities enable specific expectations to be taught and class rules to be developed. By using these processes again in subsequent lessons, expectations are reinforced and opportunities for corrective feedback are provided for students who require more support. The specific activities undertaken with students can be a valuable source of data about their preferred learning styles and pre-existing knowledge and skills.

Goals

- Establish a climate of trust between students, and students and the teacher.
- Identify preferred learning styles of the students (kinaesthetic, auditory or visual).
- Start gathering data about the knowledge and skill levels of individual students.

Objectives

- Students and teacher complete a 'collage' presentation telling or showing something about them.
- Students work co-operatively with each other.
- Students negotiate with each other to use preferred materials.
- SMART[14] goals are negotiated between the teacher and each student for the first half of the term.
- Students have fun.

Schedule

Lesson 1: Students and teacher(s) begin their 'collage' for presentation

Lesson 2: 'Collages' completed

Lesson 3: 'Collage' presentations and completion of fact-finding sheets

Lesson 4: Maths games and student interviews to establish SMART goals

[14] The SMART acronym refers to goals that are Specific, Measurable, Achievable, Realistic and Time-based.

Lesson One: Preparing for 'collage'	Time	Equipment (example only)	Organisation
Teacher provides range of materials and explains/demonstrates that everyone will create a 'collage' presentation to share something about themselves with the class, e.g. where they live, how many people in their family & where they fit in the family. Jointly establish rules about negotiating for materials, e.g. whether there will be a time limit, how time limits are managed, how to ask for something. Record ideas, and then establish no more than 2 rules to record for future reference. Jointly identify the stages of planning to complete the task — record these for future reference. Record the stages for planning, whether the planning phase includes teacher conferencing — and if so, what this will look like. Students then work on their collage with adult support as negotiated or identified. Clean up and regroup — let them know they will continue this work next lesson. Presentations will be in Lesson 3.	Approx 5 min Approx 7 min Approx 7 min	Water colour paints Felt tip pens Crayons Paper — various colours and sizes Scissors Glue CD player Computer with internet access + PowerPoint Data projector	Students seated around central area for discussion — near white board or area to record information. (Re-use this space if you need to recall the full group for further discussions.) Arrange equipment on a central table in the classroom. Adults in the room to constantly circulate, and also prepare own collages to share with the group.

Lesson Two: Making the 'collage'			
Review rules and planning process Students to work on their collage with adult support as negotiated or identified. Students are encouraged to speak with each other and share information. Some students will like to practice their presentation. Teacher to discretely ensure that all students are comfortable with the presentation to the group. Clean up and regroup — determine group rules for the presentations. Record these for future reference. For example, listen quietly during the presentation, specify when you can ask questions etc. No more than 3 rules.	Approx 5 min Approx 7 min	Water colour paints Felt tip pens Crayons Paper — various colours and sizes Scissors Glue CD player Computer with internet access + PowerPoint Data projector	Students seated around central area for discussion — near white board or area to record information. (Re-use this space if you need to recall the full group for further discussions.) Arrange equipment on a central table in the classroom. Adults in the room to constantly circulate, and also prepare own collage to share with the group.

Lesson Three: 'Collage' presentation	Time	Equipment (example only)	Organisation
Review rules for presentations. Decide the order for presentations — random (pulling names out of hat etc). Each student to complete a fact sheet for each presentation. Regroup — debrief the task, what did you learn about someone else, tell me why you chose to present your collage using… Materials used for presentation and the style of presentation may be an indicator of preferred learning style. Teachers may wish to note this on the 'fact sheet'.	Approx 5 min Approx 7 min	Felt tip pens, crayons, paints Paper — various colours and sizes Scissors Glue CD player Computer with internet access + PowerPoint Data projector Fact sheet	Students seated around central area for discussion — near white board or area to record information. This may become a useful way of creating an area for talking through the semester. Each student has a fact sheet to record information about the presentations. This can be used at a later stage as basis for a graphing activity.

Lesson Four: 'Maths games' + student interviews			
Review rules for working together — negotiating for materials. Explain that students will be working through maths rotations, but each student will meet for a few minutes with the teacher. Divide into approximately 3 groups of no more than 6 people, number the group and assign the rotation on which they will begin. Commence rotations — divide remaining time in 3 and that is time allowed for each rotation. Teacher meets individually with student to complete the SMART goals. Regroup — debrief the task. Which rotations were the most fun?	Approx 5 min Approx 7 min	Timer SMART goal sheet 3 games + equipment for each game (see below). Any 3 activities can be used for the rotation — but should be practical and able to be done with minimum adult assistance.	Students seated around central area for discussion — near white board or area to record information. (Re-use this space if you need to recall the full group for further discussions.) Maths rotations set up around the room, seating for up to 6 students at each rotation. Teacher located in the middle of room — able to assist at any time. Other adults circulate through rotations providing assistance.

Working successfully without adult assistance will need to be a graduated process for many of these students.

Game 1: Maths Race

A fun maths race reinforces maths facts in a very visual way.

Objectives

Students will:

- reinforce maths-facts knowledge and understanding
- contribute to a team effort
- carefully observe the actions of all team members.

Keywords

maths facts, race, game, addition, subtraction, multiplication, addition facts, subtraction facts, multiplication facts, times tables, multiplication tables

Materials needed

- chart paper
- markers or crayons

Lesson plan

Before the lesson

Create on the board, or on chart paper, a grid numbered 1 to 9 across and 1 to 9 down. The grid's squares should be large enough for students to write a readable number in.

The race

Arrange the class into two or more teams and provide each team with a grid sheet. Decide whether students will practice addition, subtraction, or multiplication facts in this game of speed. When the chart is set, say "Go!" One person on each team races to the board and fills in any square on the math facts grid. For example, if reinforcing addition facts, the student writes the number 6 in the square at which the ‘4’ column and the ‘2’ row meet (4 + 2 = 6).

Emphasise that it is important for all members of a team to watch what their team-mates write. If a student on either team sees a mistake made by a team-mate during the game, they can use their turn to correct that error.

The first team to fill in all the squares on their grid is the winning team *if* all the answers on their chart are correct.

Extend the lesson

Use the completed charts to reinforce the concepts being taught. For example, if the game is used to reinforce multiplication facts, emphasise how the charts show the pattern made by the 5 tables or 7 tables.

Assessment

The first team to fill in all the squares on their grid wins — *if* every answer on their chart is correct.

Game 2: Maths War

Objectives

Students will

- follow the rules of the game
- play fairly
- compute math facts accurately and quickly.

Keywords

math facts, game, addition facts, multiplication facts, times tables, subtraction facts, war, cards, card game, addition, subtraction, multiplication, multiplication tables

Materials needed

- a deck of cards for each pair of students

Lesson plan

About the game

Arrange students into pairs. Each pair has a deck of cards. The game is played in much the same way the traditional card game "War" is played. Players add (or subtract or multiply) the cards they reveal.

A random method to arrange students into pairs:

- Write a simple problem an index card (e.g. 5 x 7) and write the answer to that problem (35) on a second card. Continue until the number of cards matches the number of students. *Note: Ensure all solution cards have different numbers on them, so that only one problem card will match each solution card.*
- Pass out the cards to students. Put a card *face down* on each student's desk.
- On "Go", each student reads their card and locates the student with the matching card.

Before playing

- Choose the operation (addition, subtraction, or multiplication) students are to practice. Each pip (number) card is worth its face value (e.g. the 7 of clubs has a value of 7). Decide on the value of cards such as aces and picture cards (e.g. ace = 1, king = 10)

Rules for play

- Shuffle the deck of cards and place it face down.
- Each student draws a card from the top of the deck and reveals the card. Cards can be revealed one at a time or at the same time.
- When both cards are revealed, students must perform the assigned operation on the cards. For example, if one student reveals a 5 of hearts and the other reveals a 9 of spades, then the students add in their heads the value of those two cards. 5 + 9 = 14. The first student to call out "14" wins those two cards.
- Play continues in this manner until the end of a predetermined time or until one student has all the cards. If time runs out, the student with the most cards wins.

Game 3: Just the Facts

Brief description

This fast-paced team game is a fun way to practise maths facts.

Objectives

Students will:

- play fairly as a member of a team
- practise maths facts.

Keywords

bell, math facts, game, addition facts, multiplication facts, times tables, subtraction facts, addition, subtraction, multiplication, multiplication tables

Materials needed

- a bell or noisemaker for each team
- maths fact flash cards.

Lesson plan

Arrange students into two or more teams. Two teams might be the most manageable arrangement; but the more teams you have for this game, the more practice students get.

You might appoint a scorekeeper to record points as they are awarded. You also might appoint a flash-card handler, especially if students have played before and you have modelled the role of the flash-card handler.

Have each team line up facing you. At the head of each line, position a desk with the bell on it.

To start the game, have the one member of each team move to the desk, ready to ring the bell. Show them the next maths-fact flash card in the stack. As soon as a student knows the answer, he or she rings the bell. The first student to ring the bell gets to call out the answer. If the student who rings the bell calls out the correct solution without delay, he or she earns a point for his or her team. If the bell-ringer delays a response or calls out the wrong answer, the opposing team earns the point. After that round, the first two students run to the back of their respective team's line and the next two players step forward and prepare to answer a question.

The game moves quickly. The more quickly it moves, the more chances for maths fact practice each student gets. At the end of the game, the team with the most points wins.

Assessment

Did students follow the rules? Did they play fairly and compete in a sporting manner? Did the losers congratulate the winners on their victory? Did the winners accept their congratulations appropriately?

Student fact sheet

Name	Topic	Type of presentation	Interesting fact
Mary	Living on a dairy farm	PowerPoint + music	Mary gets up early to milk the cows before she comes to school

Student interview sheet

Student name:	**Date:**
SMART goals are: **Specific** **Measurable** **Achievable** **Replicable** **Time-based**	**No more than 2 goals for the first half of the term** **Goal 1:** **Goal 2:**
Student signature:	**Teacher signature:**

Appendix 4: Examples of contextualised tasks

Context 1: Space paper chase

You are about to begin a series of six group investigations where your group is required to follow instructions and complete a task in a given time. Your group will earn points as you complete the tasks.

After each group activity you will be required to complete an **individual task sheet** about the activity.

Investigation 1 — Spaced out

Task: to make a variety of shapes to demonstrate your understanding of area and perimeter.

Materials: plenty of newspaper, ruler, scissors, glue, sticky tape and stapler.

Time: 1 hour. You will need to cooperate well to complete these tasks in **one hour**.

Your work group is required to make:

- a square with an area of 1 square metre
- three different rectangles, each with an area of 1 square metre
- two different triangles with an area of 1 square metre
- any other shape with an area of 1 square metre.

When you have finished and tidied your workspace, complete the individual task sheet. Make sure you keep your shapes undamaged, as you will need them for your individual task.

Individual task sheet

Shape	Describe how you made this	Area	Perimeter
Square			
Rectangle 1			
Rectangle 2			
Rectangle 3			
Triangle 1			
Triangle 2			
Other			

Write a paragraph about what you have discovered.

Investigation 2: Which space?

Task: To find out how many regular polygons can you draw with a perimeter of 24cm.

Materials: 1 sheet of cm squared paper, ruler, coloured pencils.

Time: 1 hour

Using your squared paper:

- Draw as many regular polygons as possible that have a perimeter of 24cm.
- Colour and calculate the area of each shape.
- Number each shape and complete the individual task sheet.

Individual task sheet

Complete the following table:

Number	*Name of Shape*	*Perimeter*	*Dimensions*	*Area*

Write a paragraph about what you have discovered.

Can you design a rule for the:

- perimeter of a shape?

- area of a shape?

Investigation 3: Money and space (extension)

Task 1: To find out how much of an average newspaper is advertising.

Task 2*:* Calculate costs to place different types of advertisements in the "Weekend Shopper" section. *Materials* : 1 *Courier Mail* newspaper

Time: 1 hour for both tasks

Discuss the questions below as a group, and then answer the questions individually.

Individual task sheet

Task 1

1. Does a double page of newspaper have an area of more than or less than a square metre? _____
2. How many square centimetres are there in a square metre? _____
3. Calculate the area of a double-page spread of the newspaper.
   _____
4. Select 3 different-sized advertisements on the page and calculate each of their areas.
   1._____ 2._____ 3._____
5. Calculate the area of ALL the advertisements on one double-page spread (NOT a whole page of Advertisements). **An approximate area will do.**
   _____
6. Express this as a percentage of the area of the whole page. _____
7. Choose another double page from your newspaper (NOT the front or back page) and calculate the area of advertisements on this page. _____
8. Express this as a percentage of the area of the whole page. _____
9. Compare the two pages and be prepared to contribute your data to the class discussion later today. _____
10. How many full pages of advertisements are in your complete newspaper?
    _____
11. Estimate how much of your newspaper is story/article and how much advertising as a percentage. story/article _____ advertising
    _____

Task 2

Read the Weekend Shopper section and calculate the cost of placing an advertisement for a refrigerator you are selling for $500.00 or a used car selling for $4500.00. Include the "Shout About It" package. Design the wording of your advertisement and the logo in the box below. Are you prepaying or not? How can you get a free advertisement?

Investigation 4: Mass and space

Task*:* As dispatcher at the Courier Mail you need to send 1000 newspapers to a school in Rockhampton. With "Movers and Shakers" freight is charged at $100.00 per tonne. With "Mammoth Movers" the price is $100.00 per cubic metre. Investigate which is the better option.

Materials: Several newspapers, ruler or tape measure, pencil.

Time: 1 hour

With your group, work out ways you could solve this problem. Which is the better option and why?

Write a short explanation about how your group solved the problem. Include information about what your group found difficult about the problem.

Which do you think is the better option and why do you think this?

Investigation 5: Circles in space

Task*:* Investigate the relationship between the diameter and the circumference of a circle. What is the relationship between a circle and the square it neatly fits into?

Materials: squared paper, compasses, pencils and a length of string.

Time: 1 hour

1. Draw several circles on squared paper and, using only the materials provided, work out the relationship between the diameter and the circumference.
2. Draw a circle, and then draw a square that just touches the circle in four places. Can you work out the areas of both the square and the circle?
3. Do at least four of these and see what you discover about the relationship about the area of a square and the circle that sits inside it.

Draw a circle with a diameter of 5 centimetres in the box.

What is…….

The ***radius*** of this circle?

The ***circumference*** of this circle?

The ***area*** of this circle?

Write a few sentences to explain how you calculated these answers

Major investigation 6: Lost in space[15]

Investigate what would happen to a box of Smarties if they were carried in a space shuttle.

In your computer lesson, you can log onto the NASA website to find out interesting facts about the space shuttle.

Your teacher will give each group a box of smarties for the following activity:

Activity 1

1. **Examine** the Smarties package. How does the packaging compare with the contents of the box? Is it too small, too large or just right for the contents of the box?
2. **Measure** the length, width, depth, mass, volume and surface area of the Smarties box and identify how the weightlessness in space might affect the box.
3. **Consider** an individual Smartie. Is it likely to change shape, weight, mass or size whilst in space?

Activity 2

To celebrate being the first in space, Smarties have decided to release another product that holds exactly twice the mass of the box carried into space. **Design** this new package.

Activity 3

To encourage people to buy this pack of Smarties the manufacturers intend to cover the box with brightly coloured foil paper. **Calculate** how much foil it will take to cover your design.

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[15] This photograph is copyright-free, accessed from *Classroom Clipart's website* http://classroomclipart.com/cgi-bin/kids/imageFolio.cgi?action=view&link=Space/Space_Shuttle&image=10063759.jpg&img=9&tt= on 05.08.05

Activity 4

The package looks so great that the manufacturers decide to market an ice cream in the same pack. **Calculate** how much ice cream it will hold. (Hint:Ice-cream is measured in litres or millilitres)

Extension activity

Important factors in designing packaging are size and cost.

1. Is there a "best" design of Smarties package that will use the least foil-wrap and therefore cost less to make?
2. Is this the most appealing package? Explain.
3. What other factors might be important in deciding types of packing?

Do NOT attempt this task until you have made the box and completed the group activity sheet. Complete a table that compares the original package with your new package. Consider the length, width, depth, mass, shape, volume and surface area of the new package with the old package.

Explain why your package would help to sell the correct mass of Smarties.

Length	Width	Depth	Mass	Shape	Volume	Surface Area
First Box						
My Box						

Explanation:

Context 2: Frog mathematics

Origami frogs

Build the origami frog that can jump the farthest.

Objectives

- Analyse and create new shapes (space, shape and measurement)
- Measure, including: identifying type of measurement required, selecting appropriate tools and units of measurement, and measuring accurately
- Generate and describe more than one method to solve problems (number sense)
- Conduct experiments (chance and data handling)
- Describe patterns or relationships in data displayed in graphs, tables or charts (chance and data handling)

Assessment

Were students able to construct, test and graphically compare the jumps made by the three frogs? Were students able to predict how far a fourth frog would jump based on their graph? Were students able to successfully identify and test variables that affected frog jumping ability?

Materials needed

- Paper (various sizes)
- Scissors
- Meter sticks
- Calculators
- Graph paper
- Art supplies to decorate frogs (to be used if time permits at the end of the lesson)

Directions to students

Show the students a pre-constructed frog and how to make it jump.
Give them time to make the same-sized frog using the guide given, and experiment with making it jump. (Depending on ability, students may need to follow step-by-step directions given by teacher.)
Show two different-sized frogs and give them time to make the same another two frogs of these sizes.
Before they begin experimenting with making their frog family jump, ask them to predict how far each frog will jump.

Group work

Divide students into groups and have them test their frogs for distance jumping abilities. Using meter sticks, record three good jumps per frog. Calculate the average jump distance for each of the three frogs. Then graph the three averages (frog size on the x-axis and jump distance on the y-axis)

Whole group presentations

Each group should present their findings to the rest of the large group. The teacher should create a large class graph showing the different group averages so that the students can compare their distances with that of the others.

As a class, predict how far a fourth frog that is even larger could jump. Have each group build the fourth-sized frog and measure its jumping distance.

FROG OLYMPICS

My name_____

Frog's name_____

Recording my data

Make your frog jump.

Measure how far it jumped in millimetres.

How many centimeters is this?

Record your result in the table below.

Do this 3 times.

Find the average distance your frog can jump.

	Distance (mm)	Distance (cm)
First jump		
Second jump		
Third jump		
Total		
Average		

Measure out a metre.

How many jumps does it take for your frog to jump one metre?

Have a guess first.

Write your results here. Guess_____ Actual_____

With a friend, time how long it takes for your frog to jump 1 metre. Have a guess first.

Write your results here. Guess_____ Actual_____

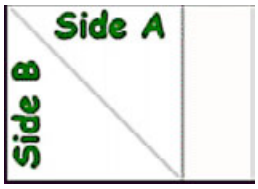
Can you measure anything else your frog can do?

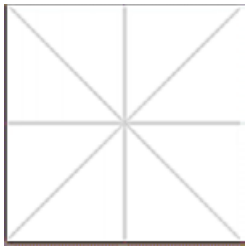
How to make an Origami Jumping Frog

In just 20 simple steps you can make your very own Origami Jumping Frog. The only tools that you will need are your hands and maybe a pair of scissors. The only material you will need is a piece of paper no smaller than 21cm x 21cm. If the paper is any smaller than this it tends to get a bit difficult to fold.

1. To make your very own Origami Jumping Frog, start out with a square piece of paper. You can find square paper made especially for Origami at art supply stores, or you can be even more creative and make your own.

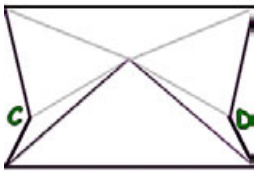
2. To make your own square paper, take a sheet of A4 and fold it diagonally, so that side A meets side B. You can either cut along the heavy line with a pair of scissors or you can fold the paper backwards and forwards to create a sharp crease and then carefully tear section 1 off.

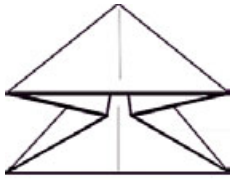


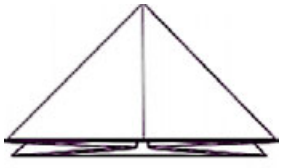


3. Now you should have a perfect square piece of paper. The next thing you need to do is fold it so that the creases match this diagram. Fold the paper diagonally and then in half. Then unfold it and it should match the diagram.

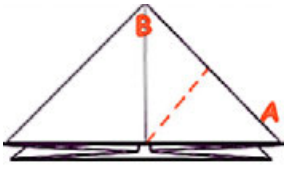
4. Start to push on points C and D, at the same time folding the top edge of the paper down until it meets the bottom edge of the paper. You want your completed fold to end up as a triangle.

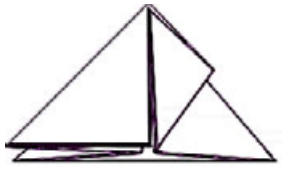




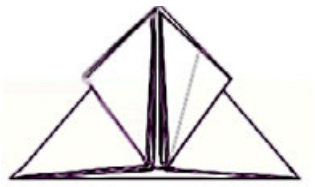


5. Take the paper at point A (which is only the top layer of the paper, don't fold the bottom corner yet), and fold along the dotted line so that point A meets point B. It should now look like the next diagram below.



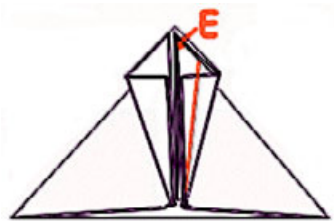


6. Do the same thing on the opposite corner (remember to fold the top layer only). Now you should have something that resembles this diagram….

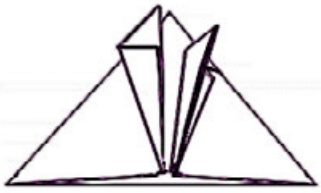


7. Fold along the grey line in the above diagram, so that your paper looks like the diagram below….

8. Do exactly the same for the other side so that your paper now matches the next diagram….



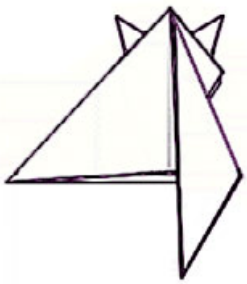
9. Now fold the top corner, marked E, outwards so that it looks like this….



10. Do the same on the left side to that your paper looks like this….

11. Turn your piece of paper over so that the other side now faces you like the diagram below….

12. Fold along the diagonal crease so that it looks like this….

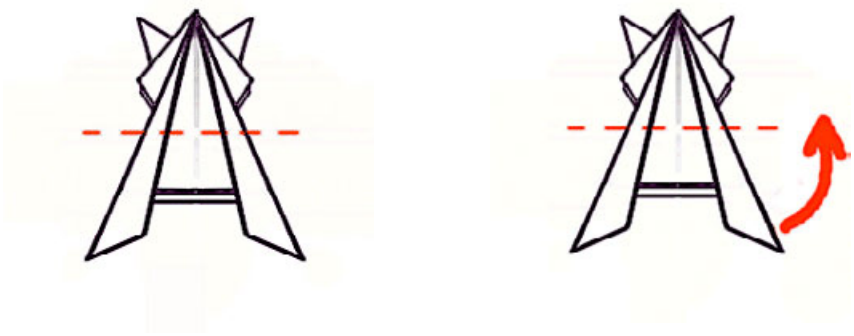


13. Do the same thing on the left side. Your paper should now look like this diagram….

14. Now fold it outwards along the grey line so that your right side looks like this….

15. Do the same thing on the left side. Your frog is now very close to being completed!

16. The next folds that you are going to do are the ones that make your frog able to jump. Fold your frog in half along the dotted line like the diagram below…



so it ends up like this…

17. Turn your frog over so that the other side is facing you and it looks like this…

18. Now fold what are going to be the frog's back legs, down along the dotted line…

19. You have now completed your frog and it looks like the picture below.

20. To make your frog jump, lay it on a flat surface like a table, and push down near the end of it, where the cross is on the diagram below. You must make sure that the legs of the frog are folded underneath before you push, otherwise it will just sit there.

Now you are ready to play with your very own Origami Jumping Frog. You can even get your friends to make one and have a race together, or see who can get theirs to jump the highest. Use your imagination….

Have fun!

With acknowledgments to Petar Nikolic