

Overview of the Mathematics K–6 Syllabus

Mathematics K–10



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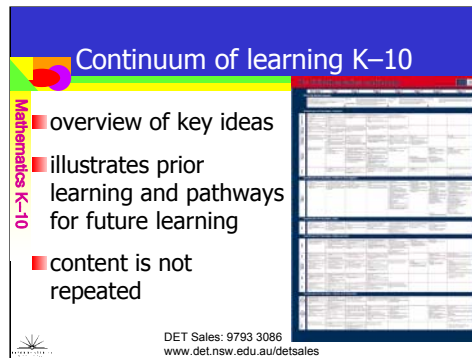
Implementation	
Mathematics K-10	■ K-6 Syllabus: determined by systems
	■ Years 7-10 Syllabus: 2004 – Years 7 and 8 2005 – Years 7 to 9 2006 – Years 7 to 10

NOTE: The timelines for implementation of K-6 Syllabuses are matters for education systems and schools. It is up to individual systems as to how/when they implement the *Mathematics K-6 Syllabus*.

- For Department of Education (DET) schools implementation of the *Mathematics K-6 Syllabus* is as follows:
 - **by end of 2004:** it is expected that schools will use a teaching sequence for the following strands based on the Stage outcomes for these strands and the related *Working Mathematically* outcomes:
 - Data
 - Measurement
 - Patterns and Algebra
 - **by end of 2005:** it is expected that schools will use a teaching sequence for the following strands based on the Stage outcomes for these strands and the related *Working Mathematically* outcomes:
 - Number
 - Space and Geometry

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- For Catholic Education Commission (CEC) schools, the decision is up to each individual diocese.
- For independent schools, it is up to each school.



K–10 Mathematics continuum:

1. Overview of key ideas:

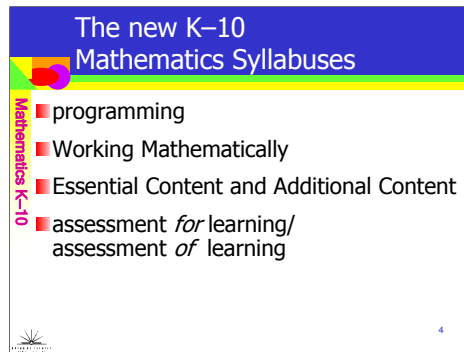
- **Scope and Continuum** (*K–6 Syllabus* pp 27–37; *Years 7–10 Syllabus* pp 29–39)
- is an overview of *key ideas* in each of the strands (Number, Patterns and Algebra, Data, Measurement, Space and Geometry)
- K–10 continuum provides *overview of sequence of learning*. It provides support for teachers when planning learning activities that take into account prior learning to build on what students know and what they can do. The essence of the K–10 continuum is in the support that it provides teachers to *find out where students are on the continuum and to then take them to the next level*.

2. Illustrates prior learning and pathways for future learning

3. Content is not repeated

DET Poster : K–10 Mathematics Continuum

<i>DET Sales</i>	<i>Telephone: 9793 3086</i>	<i>FAX: 9793 3242</i>
<i>www.det.nsw.edu.au/detsales</i>		
Cost: approximately \$25 (pack of 5 posters)		



1. Programming:

- teachers need to determine the progress of learning in previous Stages before planning new teaching and learning experiences
- K-6: programming advice included in Phase 2 *Sample Units of Work* (released May 2003 – 156 pages)

2. Working Mathematically: centre of the K-6 and Years 7-10 Syllabuses

3. **Essential Content:** consists of Knowledge and Skills ('Students learn *about*') and Working Mathematically ('Students learn *to*'). Teachers need to address *all the Essential Content* which means that teachers must ensure they cover the five Working Mathematically processes.

Additional Content: *K-6 Syllabus* p 10

4. Assessment *for* learning/assessment *of* learning:

K-6 Syllabus pp 138-141, *K-6 Sample Units of Work* pp 5-6

- The Board's revised syllabuses advocate assessment *for* learning, not just assessment for accountability (ie not just assessment *of* learning)
- Assessment for learning is designed to enhance teaching and improve learning
- Assessment for learning helps teachers and students to know if current understanding is a suitable platform for future learning
- Assessment for learning involves teachers in deciding how and when to assess student achievement, as they plan the work students will do, using a range of appropriate assessment strategies including self-assessment and peer assessment
- Assessment occurs as a regular part of teaching and learning. Assessment for learning involves using assessment activities to clarify student understanding of concepts and to plan ways to remedy misconceptions and support the development of deeper understanding.

K-10:
Essential Content in six strands

Mathematics K-10

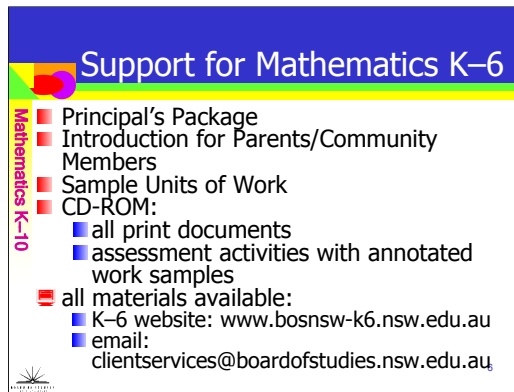
- *process strand* :
Working Mathematically
- *content strands* :
Number, Patterns and Algebra *,
Data *, Measurement,
Space and Geometry

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The *Mathematics K-6 Syllabus* now has the same six strands as the *Mathematics Years 7-10 Syllabus*. Asterisk (*) on slide denotes the 'new' strands:

- Patterns and Algebra: previously in K-6 syllabus in Number and Space strands
- Data: previously in K-6 syllabus in Space strand (substrand Graphs).

Note: *Mathematics K-6 Syllabus* has Early Stage 1 through to Stage 4 outcomes and content.
Mathematics Years 7-10 Syllabus has Stage 2 through to Stage 5 outcomes and content.



Office of the Board of Studies (OBOS) support for the new syllabuses consists of three Phases. Support for the *Mathematics K-6 Syllabus* includes :

- Phase 1 (released with Syllabus)

1. **Principal's Package** – released November 2002

2. **Introducing the Mathematics K – 6 Syllabus to Parents and School Community Members** – released November 2002

- Phase 2 (released May 2003)

3. **Sample units of work** (156 pages):

- advice on programming
- sample units of work that can be incorporated into teaching and learning programs
- sample units for each Stage from Early Stage 1 to Stage 3

- Phase 3 (released December 2003)

4. **CD-ROM:** contains all print documents, as well as assessment activities with annotated work samples.

(See slide numbers 7-10.)

5. **Note that the *Mathematics K-6 Syllabus* and all the support materials are available through:**

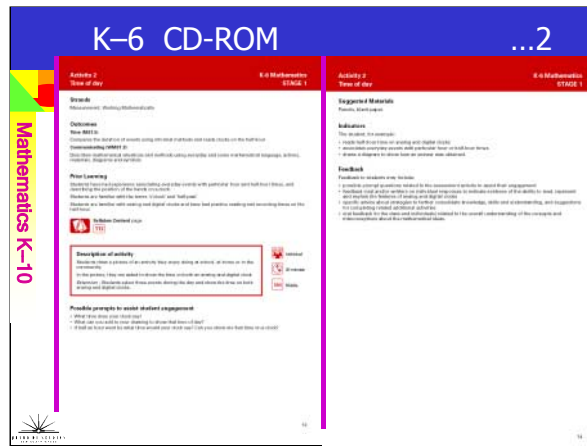
- BOS website: www.boardofstudies.nsw.edu.au
- K-6 website: www.bosnsw.k-6.nsw.edu.au

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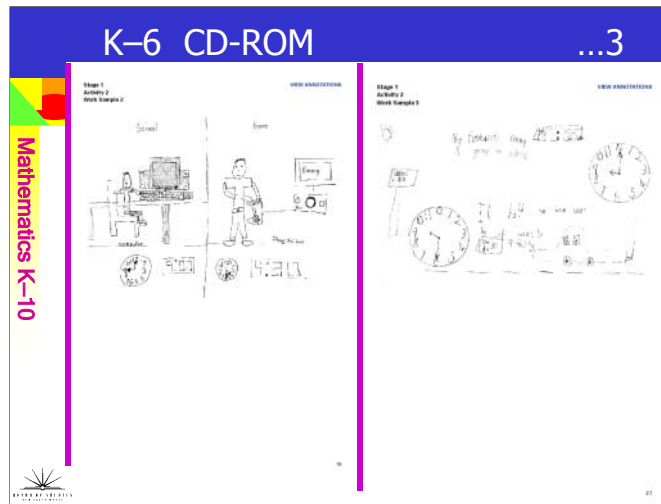


K-6 CD-ROM

Example activity shown: *Stage 1 Activity 2 Time of Day*

Each activity on the CD-ROM consists of the following sections:

1. **Syllabus Strands**
2. **Syllabus Outcomes:** a list of the outcomes that the activity addresses, including the relevant Working Mathematically outcomes
3. **Prior Learning:** this section outlines relevant learning experiences leading up to the activity, and explains the context of the task within the unit of work
4. **Syllabus Content page(s):** each assessment activity contains a page reference and a link to the relevant content of the syllabus
5. **Description of Activity** (each activity is ‘open-ended’ to allow students to demonstrate working towards the achievement of more than one syllabus outcome)
6. **Possible Prompts to assist student engagement:** a list of possible prompts is included which could be used to assist students, where necessary, in accessing the activity or in determining different solutions
7. **Suggested Materials:** suggested materials required for the completion of the activity
8. **Indicators:** indicators show what students might display as they work towards the achievement of the relevant syllabus outcomes. The indicators shown in the assessment activities are those listed in the syllabus, but do not represent the only ways that students can demonstrate what they know and can do. Indicators are a good basis for providing feedback to students.
9. **Feedback:** provides ways to assist students during and following completion of the assessment activity. Feedback enables students to recognise their strengths, and to plan with their teacher the next steps in their learning. The prompts are also a helpful feedback tool for both student and teacher. The feedback is modelled here in detail, although in a classroom situation it might be given orally to individual students or as a summary to the whole class.



Each activity contains three work samples:

- each work sample: work sample *without* annotations + work sample *with* annotations

(This slide shows two student work samples *without* annotations.)

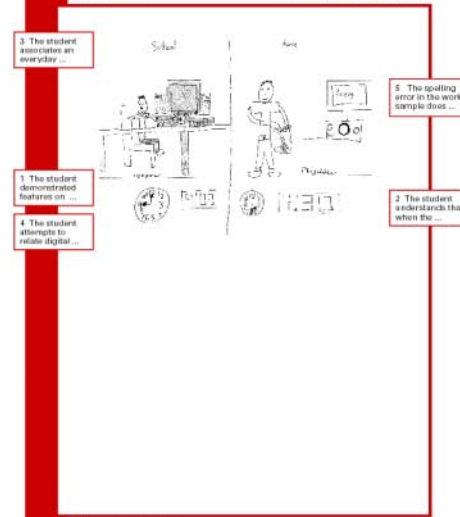
Mathematics K-10

Activity 2 – Work Sample 2

Time of day

K-6 Mathematics
STAGE 1

LINK TO ACTIVITY
LINK TO PRINTABLE ANNOTATIONS



3. The student associates an everyday ...

5. The spelling error in the work sample does ...

1. The student demonstrated features on ...

2. The student understands that when the ...

4. The student attempts to relate digital ...

Where to from here?
Get the student to list activities that occur on the half-hour, then match these activities to analog and digital clocks. Discuss and demonstrate to the student how the minute hand points to the 6 when it is half-past the hour and how the hour hand has also moved to half-way between two numbers.

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Activity 2 – Work Sample 2

Time of day

K-6 Mathematics
STAGE 1

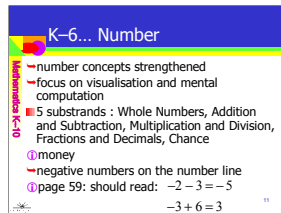
LINK TO ACTIVITY
LINK TO ANNOTATED WORKSAMPLE
VIEW SAMPLE

Annotations

1. The student demonstrated features on analog and digital clocks.
2. The student understands that when the minute hand points to 6, the hour hand has moved to half-way between two numbers.
3. The student associates an everyday event with the time that it occurs.
4. The student attempts to relate digital and analog time.
5. The spelling error in the work sample does not affect its mathematical quality.

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- a work sample with annotations is shown above. By moving the mouse over an annotation, the full annotation will drop down
- there are links to printable annotations (that include references to relevant syllabus outcomes)
- **Where to from here?:** advice to assist the student in their future learning



Note symbols: → NEW IN TERMS OF THIS STAGE OF LEARNING ⓘ FOR YOUR INFORMATION

- Focus on visualisation and mental computation :
 - examples of strategies –
 - NS1.2 pp 47–48 (see ‘Students learn about’ statements and ‘Background information’): split strategy, jump strategy
 - NS2.2 pp 49–50 (see ‘Students learn about’ statements and ‘Background information’): jump strategy, split strategy, compensation strategy, using patterns to extend number facts, bridging the decades, changing the order of addends to form multiples of 10 (ie *commutative property* – eg $16+8+4 = \mathbf{16+4} +8$)
 - from **Early Stage 1** there is an emphasis on the development of number sense, and confidence and competence in using mental strategies. Formal written algorithms are introduced after students have gained a firm understanding of basic concepts including place value.
 - for addition and subtraction, formal written algorithms are introduced in **Stage 2**
 - for multiplication and division, formal written algorithms are introduced in **Stage 3**
 - prior to the introduction of written algorithms, students should develop informal methods to record their thinking related to calculation.
- Number strand divided into five substrands :
 - **Whole Numbers, Addition and Subtraction, Multiplication and Division** (paired to emphasise the importance of developing awareness of inverse relationships; however, showing the relationships between all four operations is also important), **Fractions and Decimals** (students introduced to the *concept of a fraction* through everyday experiences and modelling the division of a whole and a collection of objects into equal parts. This leads to equivalence relationships and simple operations including *addition and subtraction of fractions where one denominator is a multiple of the other* and *multiplication of fractions by whole numbers*. Students also develop an understanding of decimals, perform calculations with decimals up to 3-decimal places and interpret percentages in everyday contexts.)
 - **Chance:** has been included from Stage 1 to enable the development of understanding of chance concepts from an early age. The use of *informal language* associated with chance is introduced, followed by simple experiments to produce data. Students can then make comparisons of the likelihood of events occurring and begin to order chance expressions on a scale from zero to one.
- Money: no longer a substrand of Number – integrated into other substrands in the Number strand.
- New in Stage 3: NS3.1 p 45 (‘Students learn about’ statement): recognising the location of negative numbers in relation to zero and locating them on a number line
- NS4.2 p 59 ‘Background Information’ should read:
 - $-2 - 3 = -5$ NOT $2 - 3 = -5$
 - $-3 + 6 = 3$ NOT $3 + 6 = 3$

K–6... Patterns and Algebra

Mathematics K–10

- pre-algebra concepts developed from Early Stage 1
- importance of early number learning in the development of algebraic thinking
- emphasises number patterns and number relationships
- ➔ completing a table of values

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- New in Stage 3: PAS3.1a p 76 (‘Students learn about’ statements): completing a table of values for a geometric pattern, completing a table of values for a number pattern (see p 80 of syllabus for the full text and the two examples given).

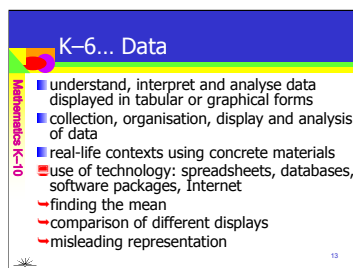
Example shown on p 76:

- eg building a simple geometric pattern using materials :

▲, ▲▲, ▲▲▲, ▲▲▲▲,

Number of triangles	1	2	3	4	5	6
Number of sides	3	6	9	12	–	–

- describing the number pattern in a variety of ways and recording descriptions using words eg ‘It looks like the three times tables’.
- determining the rule to describe the pattern from the table eg ‘You multiply the top number by three to get to the bottom number’.
- using the rule to calculate the corresponding value for the larger number
- links to Stage 4: PAS4.1 p 78 (‘Outcome’ statement): uses letters to represent numbers and translates between words and algebraic symbols.



- **Data:** includes work on graphs that was previously included in the Space strand.
- **Use of technology:**
 - DS1.1 p 86 ('Students learn to' statement): use simple graphics software to create picture graphs
 - DS2.1 p 87 ('Students learn to' statements):
 - create a table to organise collected data, using a computer program eg spreadsheets
 - use simple graphing software to enter data and create a graph
 - interpret graphs found on the Internet, in media and in factual texts
 - DS3.1 p 88 ('Students learn to' statement):
 - collect, represent and evaluate a set of data as part of an investigation, including data collected from the Internet
 - use a computer database to organise information collected from a survey
 - use a spreadsheet program to tabulate and graph collected data
- **Finding the mean:**
 - DS3.1 p 88 ('Students learn about' statements):
 - using the term 'mean' for average
 - calculating the mean for a small set of data
- **Comparison of different displays:**
 - DS2.1 p 87 ('Students learn to' statements):
 - discuss the advantages and disadvantages of different representations of the same data
 - compare tables and graphs constructed from the same data to determine which is the most appropriate method of display
 - DS3.1 p 88 ('Students learn to' statements):
 - determine which type of graph is the best one to display a set of data
 - discuss the advantages and disadvantages of different representations of the same data
- **Misleading representation:**
 - DS1.1 p 86 ('Students learn to' statement):
 - identify misleading representations of data eg where the symbols are not the same size
 - DS3.1 p 88 ('Students learn to' statement):
 - identify misleading representations of data in the media

K-6... Measurement

Mathematics K-10

- compare and order objects
- approximation and estimation
- use of appropriate unit and device in measuring a particular attribute
- 5 substrands: Length, Area, Volume and Capacity, Mass, Time
- ❗ temperature *not* a substrand
- ➔ surface area of a rectangular prism

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- The Measurement strand is divided into 5 substrands:
 1. Length
 2. Area
 3. Volume and Capacity
 4. Mass
 5. Time

- **Temperature:** no longer a substrand of Measurement. Instead, temperature is used (in Stages 2 and 3) to provide an everyday context/application of using number (in the Number strand: whole numbers or negative numbers) or data (in the Data strand: drawing line graphs). Temperature covered in Science, HSIE, PDHPE.

- **Surface area of a rectangular prism:** MS3.2 p 99 ('Students learn about' statement): finding the surface area of rectangular prisms by using a square centimetre grid overlay or by counting unit squares
 - this links to Stage 4: MS4.2 p 107 ('Outcome' statements): calculates surface area of rectangular and triangular prisms and volume of right prisms and cylinders

K-6... Space and Geometry

Mathematics K-10

- representation of shape, pattern, position and movement of objects
- develop angle concepts
- 3 strands: Three-dimensional Space, Two-dimensional Space, Position
 - ➔ identify and name parts of a circle
 - ➔ determine the *order* of rotational symmetry

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- The Space and Geometry strand is organised into three strands :
 1. Three-dimensional Space
 2. Two-dimensional Space
 3. Position
- New in Stage 3: parts of a circle – SGS3.2a p 128 (‘Students learn about’ statement): identifying and naming parts of a circle, including the centre, radius, diameter, circumference, sector, semi-circle and quadrant
- New in Stage 3: SGS3.2a p 128 (‘Students learn about’ statement): identifying shapes that have rotational symmetry, determining the **order** of rotational symmetry
 - K-6 Syllabus Glossary (p 197) – definition of ‘order of rotational symmetry’:
*The number of times a figure coincides with its original position in turning through one full rotation eg an **equilateral triangle** has rotational symmetry of **order 3** and a **square** has rotational symmetry of **order 4**.*

Stage 4: Number

Mathematics K-10

- recognises the properties of special groups of whole numbers and applies a range of strategies to aid computation
- compares, orders and calculates with integers
- operates with fractions, decimals, percentages, ratios and rates
- solves probability problems involving simple experiments

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‘Outcome’ statements for Stage 4:

1. **NS4.1** pp 57–58: recognises the properties of special groups of whole numbers and applies a range of strategies to aid computation
2. **NS4.2** p 59: compares, orders and calculates with integers
3. **NS4.3** pp 66–67: operates with fractions, decimals, percentages, ratios and rates
4. **NS4.4** p 71: solves probability problems involving simple experiments

Stage 4: Patterns and Algebra

Mathematics K-10

- uses letters to represent numbers and translates between words and algebraic symbols
- creates, records, analyses and generalises number patterns using words and algebraic symbols in a variety of ways
- uses the algebraic symbol system to simplify, expand and factorise simple algebraic expressions
- uses algebraic techniques to solve linear equations and simple inequalities
- graphs and interprets linear relationships on the number plane

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‘Outcome’ statements for Stage 4:

1. **PAS4.1** p 78: uses letters to represent numbers and translates between words and algebraic symbols
2. **PAS4.2** pp 79–80: creates, records, analyses and generalises number patterns using words and algebraic symbols in a variety of ways
3. **PAS4.3** p 81: uses the algebraic symbol system to simplify, expand and factorise simple algebraic expressions
4. **PAS4.4** p 82: uses algebraic techniques to solve linear equations and simple inequalities
5. **PAS4.5** p 83: graphs and interprets linear relationships on the number plane

Stage 4: Data

Mathematics K-10

- constructs, reads and interprets graphs, tables, charts and statistical information
- collects statistical data using either a census or a sample, and analyses data using measures of location and range



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‘Outcome’ statements for Stage 4:

1. **DS4.1** p 89: constructs, reads and interprets graphs, tables, charts and statistical information
2. **DS4.2** p 90: collects statistical data using either a census or a sample, and analyses data using measures of location and range

Stage 4: Measurement

Mathematics K-10

- uses formulae and Pythagoras' theorem in calculating perimeter and area of circles and figures composed of rectangles and triangles
- calculates surface area of rectangular and triangular prisms and volume of right prisms and cylinders
- performs calculations of time that involve mixed units



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'Outcome' statements for Stage 4:

1. **MS4.1** pp 100–101: uses formulae and Pythagoras' theorem in calculating perimeter and area of circles and figures composed of rectangles and triangles
2. **MS4.2** p 107: calculates surface area of rectangular and triangular prisms and volume of right prisms and cylinders
3. **MS4.3** p 116: performs calculations of time that involve mixed units

Stage 4: Space and Geometry

Mathematics K-10

- describes and sketches three-dimensional solids including polyhedra, and classifies them in terms of their properties
- identifies and names angles formed by the intersection of straight lines, including those related to transversals on sets of parallel lines, and makes use of the relationships between them
- classifies, constructs, and determines the properties of triangles and quadrilaterals
- identifies congruent and similar two-dimensional figures stating the relevant conditions

20

‘Outcome’ statements for Stage 4:

1. **SGS4.1** pp 122–123: describes and sketches three-dimensional solids including polyhedra, and classifies them in terms of their properties
2. **SGS4.2** p 130: identifies and names angles formed by the intersection of straight lines, including those related to transversals on sets of parallel lines, and makes use of the relationships between them
3. **SGS4.3** pp 131–132: classifies, constructs, and determines the properties of triangles and quadrilaterals
4. **SGS4.4** p 133: identifies congruent and similar two-dimensional figures stating the relevant conditions