Board of Secondary Education
New South Wales, Australia

MATHEMATICS SYLLABUS

YEARS 7 AND 8

1988
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Mathematics K-12

Statement of Principles

This Statement of Principles is a joint publication of the NSW Department of Education and the Board of Secondary Education.
Preface

This K-12 Statement of Principles describes the general principles which underlie all ideas in this syllabus.

The nature of mathematics

Mathematics is the study of number and space

More particularly it is:

- a search for patterns and relationships. This search, utilising acquired knowledge and skills, leads to the development of concepts and generalisations which can be applied in finding solutions to problems, improving our understanding of the world around us and meeting the specific needs of people.

- a way of thinking characterised by processes such as exploring, manipulating, discovering, ordering, classifying, generalising, abstracting, estimating, calculating, predicting, describing, deducing, drawing and measuring.

- a powerful, precise and concise means of communication used to represent, to interpret, to explain and to predict.

- a creative activity. Accordingly, it involves invention, intuition and discovery.

Rationale for mathematics in the curriculum

Mathematics is useful

- Mathematics is essential for living. Some aspects of mathematics are required by individuals in order to function adequately as members of society. These aspects include strategies, skills and techniques involved in number facts, computation, mathematical problem solving and reasoning.

- Mathematics is important and useful in many fields of endeavour. These fields include the sciences, medicine, economics, commerce, industry, engineering, business and the arts.

- Mathematics provides a means of oral and written communication. Mathematics can be used to present and convey information in many ways. Some of these include explanations, figures, letters, tables, charts, diagrams, graphs and drawings.

- Mathematics provides opportunities for development of reasoning abilities.

Mathematics is part of our culture

- Mathematics has been part of human activity since the earliest times. It has made, and continues to make, a significant contribution to human culture. Mathematics allows children to appreciate their cultural heritage more fully by providing insights into many of the creative achievements of the human race.

Mathematics can be part of our leisure

- Mathematics is a source of interesting and appealing puzzles and problems. When mathematics is enjoyable it encourages curiosity, exploration, discovery and invention.
Aims of mathematics education

The aims of mathematics education will be achieved in different levels in the K-12 range according to the stages of development of the students at these levels. These aims are to develop in students confidence and enjoyment in doing mathematical activities; knowledge, skills and understandings in certain specified areas; and awareness of the place of mathematics in solving problems of everyday life and in contributing to the development of our society.

Confidence and enjoyment in doing mathematical activities

- confidence in their ability to do mathematics.
- a positive attitude to mathematics as an interesting, enjoyable and challenging subject.
- an appreciation of mathematics as a creative activity with aesthetic appeal.

Knowledge, skills and understandings in certain specified areas

- thinking which is logical, flexible, fluent and original.
- skills in computation and problem solving in all areas of mathematics.
- appropriate language for the effective communication of mathematical ideas and experiences.
- an ability to recognise mathematical patterns and relationships.
- a variety of methods for calculations and problem solving.
- an awareness of the basic structure of mathematics by an appreciation of the nature and inter-relationship of the various strands of mathematics.

Awareness of the place of mathematics in solving problems of everyday life and in contributing to the development of our society

- an ability to apply mathematical ideas, rules and procedures to particular situations and problems.
- an awareness that the learning of mathematics includes the processes of inquiry, discovery and verification.
- an awareness of the uses of mathematics both in and beyond the classroom.
- an appreciation of mathematics as a relevant and useful activity.
- an appreciation of appropriate uses of technology, including calculators and computers.
The nature of mathematics learning

Students learn best when motivated

- Mathematics learning is more effective when it is interesting, enjoyable and challenging.

*Implications*

Learning activities should provoke curiosity, should be appropriate to students’ stages of development, and should be related to everyday life experiences.

The actual experiences of students should be used as the source of many learning activities.

Students should be encouraged to become aware of the relevance of mathematics to their lives.

Students should often experience success in mathematical activities. A positive attitude towards mathematics and towards oneself will be promoted by emphasising the students’ achievements.

Students learn mathematics through interacting

- Mathematics learning should involve interaction with the physical and social environment, leading to the abstraction of particular mathematics ideas encountered.

*Implications*

The understanding of mathematical ideas is promoted by interaction with people and manipulation of materials in a wide variety of learning situations.

Co-operative learning in small groups provides excellent opportunities for interaction.

- Mathematics learning is promoted by the appropriate use of a variety of materials, equipment and personnel.

*Implications*

Materials and equipment should be used in imaginative ways to explore, discover and develop mathematical ideas.

The availability of technological equipment, such as calculators and computers, does not reduce the need for mathematical understanding or the need for competence.

Some concepts and skills will need to receive greater emphasis with the introduction of calculators and computers, eg place value and decimal concepts; skills of approximation and estimation.

Students learn mathematics through investigating

- Mathematics learning should involve the investigation of mathematical patterns, relationships, processes and problems.

*Implications*

Students should be given opportunities to discover and create patterns, and to describe and record relationships contained in those patterns.

Opportunities to use mathematical processes and to compose and solve problems should be provided in all strands of mathematics.

Students learn mathematics through language

- Mathematics learning is promoted by the appropriate use of language. Language, including symbols and diagrams, plays an important part in the formulation and expression of mathematical ideas and serves as a bridge between concrete and abstract representation.
Implications

Mathematical activities should be regarded as opportunities for teachers and students to use and develop appropriate language.

It is important that teachers be familiar with the language patterns appropriate to the different mathematical processes.

Students should be encouraged to use oral and written language appropriate to their particular stage of development to gain meaning from their mathematical learning experiences.

When developing teaching strategies and learning activities in mathematics, teachers should give consideration to the diverse cultural and linguistic backgrounds of students.

Students learn mathematics as individuals but in the context of intellectual, physical and social growth

- Mathematics learning is promoted when individual differences of students are taken into account.

Implications

Students vary in the way and the rate in which they learn mathematics.

Learning experiences should be appropriate to the students’ stage of development.

Teachers should take into account the students’ knowledge gained formally and informally outside the school, including the home.

Recognition should be given that the whole of society has mathematical ability.

Maximum participation and extension of all students, regardless of sex, is appropriate.

- Mathematics learning should be appropriate to each student’s current stage of development and should build upon previous experiences and achievement.

Implications

To cater for the variety of developmental levels that may exist among a group of students, teachers should provide a flexible learning situation where there is a variety of opportunities for involvement.

Whilst the student’s readiness to proceed to new work will depend on previous knowledge and understanding, this does not mean that there is an absolute order in which mathematics learning should proceed for all students. There are many paths to understanding.

Teachers should respond to emergent opportunities to capitalise on the student’s interests and needs and vary the intended sequence of mathematical experiences.

As each new mathematical concept is encountered, learning should proceed, where possible, from the concrete to the abstract. Concepts should be continually developed and consolidated through a wide variety of learning experiences.

The development of understanding should, as a general principle, precede a requirement for both automatic recall of factual information and speed and accuracy in performing mathematical computations. Skills should be maintained through meaningful practice and enjoyable drill.

Assessment and Evaluation

In implementing any syllabus based on this Statement of Principles, schools must be careful to evaluate the program offered by the school and to assess the progress of individuals within that program.
The aims are set out in two columns - the left-hand column outlining aims which are desirable in the development of all students and the right-hand column relating to a more systematic study by those whose levels of cognitive development and interest encourage a more formal approach. This may appear to imply that students can only be categorised in two ways whereas in reality this is not so. It should be realised that these columns represent extremes and that the aims and objectives suited to a given student probably lie somewhere in between. Also, the profile for a given pupil need not necessarily be uniform; s/he may be closer to one extreme in respect to some objectives than in others.

To develop competence and confidence to participate in society, each student should:

**BASIC ABILITIES**

1. Knowledge

- acquire a background of mathematical knowledge and terminology;

2. Operational Facility

- develop facility in operational skills;

**COMPREHENSION ABILITIES**

3. Relevance

- develop an appreciation of relevance of mathematics in use by the pupil;

4. Communication

- develop skills in communication of mathematical information and ideas of use in everyday life;

- acquire a background of mathematical concepts and symbolic representation;

- develop facility in formal operational techniques;

- develop an understanding of how
  (a) given mathematics may be applied to situations;
  (b) situations may be taken and analysed into the essential mathematical features, leading in turn to the solution of existing problems;

- develop the ability to communicate and interpret within mathematical systems;
HIGHER ORDER ABILITIES

5. Application

- apply mathematical knowledge and skills to familiar problems, games and puzzles;
- develop creative skills and planning abilities in concrete situations.

6. Creativity

- develop thinking strategies to problem solving in unfamiliar situations;
- develop a creative and imaginative approach to mathematical situations.

Attitudes

In the achievement of the aims stated above, students should be encouraged to develop:

(a) self-confidence in handling mathematics;
(b) an awareness and appreciation of its value in society.
A Rationale for the Approach Taken in this Syllabus
A. Mathematics

Mathematics is sometimes regarded as a body of collected knowledge and skills concerning patterns and relationships in number, algebra, geometry, etc that is needed in many areas of study and in everyday life. People who take this view refer only to the mathematics content of concepts and skills.

Another, more dynamic, process oriented definition of mathematics is presented in the section on the Nature of Mathematics in the Mathematics K-12 Statement of Principles (p ii).

Mathematics is:

- a search for patterns and relationships. This search, utilizing acquired knowledge and skills, leads to the development of concepts and generalisations which can be applied in finding solutions to problems, improving our understanding of the world around us and meeting the specific needs of people.
- a way of thinking characterised by processes such as exploring, manipulating, discovering, ordering, classifying, generalising, abstracting, estimating, calculating, predicting, describing, deducing, drawing and measuring.
- a powerful, precise and concise means of communication used to represent, to interpret, to explain and to predict.
- a creative activity. Therefore it may involve invention, intuition and discovery.

This syllabus presents a proper balance of these two views, but in a way that takes account of the nature and needs of the student, the role of the teacher and the nature of the learning process.

B. Mathematics and this Syllabus

The processes of mathematics and the content of mathematics are both emphasised in this syllabus. Students are to be actively involved in learning, doing and using mathematics to solve problems. This will require opportunities for students to explore, manipulate, estimate, calculate, draw, measure, abstract, describe and deduce in the search for patterns and relationships leading to the development of concepts and generalisations.

Problem solving and the applications of mathematics in the world are key elements of this syllabus. The relevance and the history of mathematics should be made apparent wherever possible. It should be stressed that mathematics is a human endeavour.

C. The Syllabus

This syllabus recognises the importance of:

- students talking to each other about mathematics using their own words.
- students writing about mathematics using their own language patterns.
- teachers listening to students in order to determine their level of understanding.

Students' mathematical language patterns should be refined gradually. The desirable endpoint for most students is formal mathematical language and symbolism.

This syllabus recognises the importance of the use of concrete materials as many students in Years 7 and 8 have not yet reached a level of abstract thinking in mathematics. Students benefit from practical experiences and activities involving the manipulation and investigation of everyday objects.
It is important to realise that manipulative materials are an aid to understanding. As understanding increases the need for manipulative materials may decrease.

The use of calculators which are now readily accessible to all students has been included in this syllabus. Calculators allow for new approaches to the learning of mathematics, improve students' confidence in doing mathematics and allow for the investigation of realistic situations. They should be used in imaginative ways for exploring, discovering and developing mathematical concepts. It is stressed that calculators in no way reduce the need to understand mathematical processes and that despite the availability of calculators, teachers must ensure that mental strategies and written computations are not neglected.

This syllabus has been organised as a single basic course for students in Years 7 and 8 leading to the Advanced, Intermediate and General courses in Years 9 and 10.

It is presented in six strands:

- Problem Solving
- Geometry
- Measurement
- Statistics
- Number
- Algebra.

Although Problem Solving is presented as a separate strand in this document, all strands will include problem solving.

The starting point for each strand for a student or a group will need to be decided by the classroom teacher after considering the knowledge and skills possessed by the students. It should not be assumed that each student is competent in all sections of the primary curriculum.

In implementing the syllabus, schools should note that all students must meet each strand and each school will need to interweave the six strands to provide a balanced program to meet the needs, interests and abilities of their students. The course has been designed to enable students to reach a level suitable for commencing the Year 9/10 courses, thus the depth of treatment for various student groups will need to be determined by each school in order to achieve this objective at an appropriate level.
The material in each strand has been presented in a double page format, arranged under the headings of Guidelines followed by Content and Skills Objectives, Applications and Implications and Considerations.

Guidelines

This section suggests activities that will promote the active involvement of students in learning, doing and using mathematics to solve problems.

The Guidelines support the methodology for mathematics of exploring, manipulating, abstracting, estimating, calculating, describing, drawing, measuring and deducing. Ways of investigating and searching for patterns and relationships that contribute to the development of concepts and generalisations are described. Related mathematical explorations and problems for students are indicated here.

It is not intended that all the activities suggested should be undertaken. Teachers will need to choose from, and add to, the activities listed to best meet the needs of their students.
<table>
<thead>
<tr>
<th>Content and Skills Objectives</th>
<th>Applications</th>
<th>Implications and Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>This section refers to the mathematical knowledge and understandings from which the specific skills listed below are developed.</td>
<td>This section highlights the relevance of mathematics. The applications listed throughout the syllabus are suggestions only. Schools will need to expand on these in order to extend the more able. Students should be aware of the mathematics in:</td>
<td>This section raises issues related to the teaching and learning of the concepts and skills in this topic. The issues may relate to:</td>
</tr>
<tr>
<td><strong>To be able to:</strong></td>
<td>• everyday situations</td>
<td>• the Syllabus Aims</td>
</tr>
<tr>
<td></td>
<td>• vocational areas</td>
<td>• relevant research</td>
</tr>
<tr>
<td>This section lists the skills which students need to be able to apply.</td>
<td>• other subjects</td>
<td>• possibilities for integration with other strands and subjects</td>
</tr>
<tr>
<td></td>
<td>• industry and technology</td>
<td>• across the curriculum perspectives</td>
</tr>
<tr>
<td></td>
<td>• recreational activities.</td>
<td>• language development</td>
</tr>
</tbody>
</table>
<pre><code>                                                                                                                                              |                                                                                      | • an appreciation of mathematics                               |
</code></pre>
<p>|                                                                                                                                                  |                                                                                      | • the Mathematics K-12 Statement of Principles.                  |</p>

Mathematics Syllabus Years 7-8
Assessment and Evaluation
A. Assessment refers to those processes by which teachers respond to and consider the extent of a student's achievements in all facets of mathematics.

B. Evaluation refers to the reviewing, judging (and subsequent modification) of programs, organisations, teaching strategies, assessment procedures, resource usage and other aspects of implementation of the mathematics syllabus.

**A. Assessment**

Assessment forms an integral and continuous part of any teaching program.

The purposes of assessments include:

- the identification of students' needs
- the measurement of students' achievements
- the measurement of the result of a course of action.

It is often inappropriate to use measures taken for one purpose for another, eg a diagnostic test should not be used to rank students.

The content areas and aims of this syllabus lend themselves to different depths of treatment. This should be reflected in the assessment procedures and testing criteria adopted by teachers.

Assessment of student achievement in relation to the aims of the syllabus should incorporate measures of:

- knowledge
- operational facility
- comprehension
- communication

...application in realistic situations

...analysis of situations leading to the solution of problems.

Generally each skill should be assessed at a level consistent with the level of presentation. If the school requires assessment across diverse groups, some form of moderation is desirable.

The relative weighting of both aims and skills is the school's responsibility, but should reflect the relative importance the school has placed on those areas. Schools should distinguish assessment measures taken as part of an evaluation of the syllabus implementation from those which have consequences for the student (eg remediation, extension, class placement, progression). Students indicate their level of understanding and skill development in what they do, what they say, and what they write and draw. Consequently there are a variety of ways of gathering information for assessment purposes. No one way alone is adequate, but each makes a valuable contribution to the overall assessment process. Possible sources of information are:

- pen and paper tests
- observation of student activity
- interviews and questioning
- teacher-pupil discussion
- listening to students' use of language
- student explanation and demonstration to others
- samples of students' work
- practical investigations and projects
- students' written and/or verbal reports.
B. Evaluation

Evaluation is concerned with reviews and judgements concerning the effectiveness, quality and need for modification of all aspects of the mathematics curriculum.

The evaluation should encompass:

- programs (the continuity, order, balance and depth of coverage of topics)
- organisation
- teaching strategies
- classroom management
- assessment procedures
- resource usage
- parent and community reaction
- development of students' ability to apply mathematical knowledge and skills in everyday situations and in problem solving
- development of students' language skills in mathematics
- student attitudes (interest, curiosity, enthusiasm, perseverance, co-operation, enjoyment, initiative, etc).

This will involve qualitative and quantitative measures.

Schools should gauge the effectiveness and quality of their mathematics curriculum against criteria contained in:

- the Rationale of the Mathematics Syllabus
- the Aims of the Mathematics Syllabus
- across-the-curriculum policies endorsed by the Board of Secondary Education (or the Secondary Schools Board prior to August 1987)
- the Mathematics K-12 Statement of Principles.

Informal evaluation is a continuous process in which the teachers monitor and react to the needs of their students in the teaching/learning environment.

Informal evaluations should be complemented by formal monitoring to enable schools to co-ordinate and plan more effective mathematics programs.
Problem Solving
Guidelines P1

Problem solving will involve at various times direct instruction, guided discovery, open ended inquiries, small group discussion and individual work.

Problems can be derived from the immediate class, school or home environment of the students.

- Determine the cost of carpeting all the floors in the mathematics classrooms.
- Determine the amount each student in the class would have to pay to cover all the costs incurred in holding a class picnic.

Students are often intrigued by large numbers in unusual question settings.

- Ring-pull can fasteners are clipped together to form a chain. How long would a chain be if it is made of 10 000 ring-pull tabs?
- How many footprints would you leave in the sand on a walk of 1 kilometre along a beach?
- How many days have you lived? Minutes? Seconds? Are you younger or older than 1 000 000 minutes?

Students also find crazy questions like the following fun to investigate.

- Do big feet run faster than small feet?
- Approximately how many times do your eyes blink in 1 day?
- How many Year 7 students would be needed to balance (equal) the mass of one elephant?

Many problems can be found that consolidate mathematical understandings and skills.

- Find 2 two digit numbers whose product is:
  (a) smaller than 1000
  (b) close to 4000
  (A possible strategy would be to guess, check and refine estimate).

- A manufacturer wishes to produce a box that will hold 100 cubes. If the cubes have sides of 1 cm, how many different boxes can be made that will exactly hold 100 cubes? Which of these boxes will use the least cardboard in manufacture?
  (Possible strategies include guess and check, and model making.)

The abilities to visualise and to manipulate various geometric shapes are needed for a wide range of problem solving activities and occupations, eg parking a car, following a knitting pattern, dressmaking, carpentry, architecture, surgery, art.

Students need to develop the ability to:

- perceive and hold an appropriate image of a figure or arrangement as a whole
- visualise imagined manipulations on all or part of the configuration
- understand two dimensional representations of three dimensional figures
- extract information from a diagram
- match diagram to written descriptions.

These skills may be developed through activities such as:

- model building
- maze puzzles
- symmetry exercises
- jigsaw puzzles
- origami
- tangrams
- soma puzzles
- match stick puzzles

- matching solids to diagrams on isometric grid paper and vice versa
- strategy games such as noughts and crosses, draughts, chess, boxes, hex, nim.
<table>
<thead>
<tr>
<th>Content and Skills Objectives</th>
<th>Applications</th>
<th>Implications and Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P1.1 Problem Interpretation</strong></td>
<td>- Problem solving can be and is applied in:</td>
<td>- Problem solving should be integrated into the total program and be incorporated into the teaching and learning of other topics continuously throughout the two years. It should not be taught as a single topic at one time only.</td>
</tr>
<tr>
<td>To be able to:</td>
<td>mathematics</td>
<td>- Opportunities should be provided for:</td>
</tr>
<tr>
<td>- read and interpret a problem</td>
<td>other subjects</td>
<td>teaching for problem solving where the focus is on the acquisition of concepts and skills useful for solving problems</td>
</tr>
<tr>
<td>- visualise an object or situation from its drawing or description</td>
<td>the physical world</td>
<td>teaching about problem solving where the focus is on learning strategies and processes of problem solving</td>
</tr>
<tr>
<td>- identify what is wanted, what is given, what information is needed and what information is not needed</td>
<td>the commercial world</td>
<td>teaching through problem solving where problem solving is the methodology adopted.</td>
</tr>
<tr>
<td>- restate the problem in different words.</td>
<td>everyday living.</td>
<td>- Problem solving should encompass a wide variety of problem types including open investigations, traditional word problems (applied arithmetic and algebra) and applications of other content areas in physical and commercial situations.</td>
</tr>
<tr>
<td><strong>P1.2 Problem Solving</strong></td>
<td></td>
<td>- The extension of a pattern/rule/relationship is discussed further in Algebra A1.</td>
</tr>
<tr>
<td>To be able to:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- plan to solve the problem by choosing one or more strategies to try</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- solve problems using a variety of processes including:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>guessing, checking and refining the estimates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>eliminating possibilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>making and using diagram or model</td>
<td></td>
<td></td>
</tr>
<tr>
<td>acting it out</td>
<td></td>
<td></td>
</tr>
<tr>
<td>making and using systematic lists, tables and graphs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>simplifying the problem into an easier one that can be solved and then applying the same process to the original problem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>working backwards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>extending a pattern/rule/relationship.</td>
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<td></td>
</tr>
</tbody>
</table>
Guidelines P1 (Cont.)

A good problem is one that is accessible to a wide range of ability levels. Problems that can be attempted and solved by the less able and yet at the same time provide a challenge for the talented are the most suitable for problem solving activities. Such problems usually lend themselves to a variety of strategies for solving. The following problem illustrates this point.

Problem

There are 7 people at a party. If each person shakes hands with the other guests, how many handshakes will there be?
(Extension: How many handshakes would there be for 10 people? 20 people? 'n' people?)

Possible Strategies

- 7 students act out the problem keeping count of the number of handshakes.
- Draw a diagram to illustrate by placing 7 points in a rough circle and using lines to represent handshakes.

A

+ Assign a name to each of the seven guests and make a list of the people each person shakes hands with:

<table>
<thead>
<tr>
<th>Ana</th>
<th>Betty</th>
<th>Carol</th>
<th>Didi</th>
<th>Effy</th>
<th>Fay</th>
<th>Glen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Betty</td>
<td>Carol</td>
<td>Didi</td>
<td>Effy</td>
<td>Fay</td>
<td>Glen</td>
<td></td>
</tr>
<tr>
<td>Carol</td>
<td>Didi</td>
<td>Effy</td>
<td>Fay</td>
<td>Glen</td>
<td></td>
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<tr>
<td>Didi</td>
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<td>Glen</td>
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<tr>
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<td>Fay</td>
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<tr>
<td>Fay</td>
<td>Glen</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Glen</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

- Simplify the problem to consider the number of handshakes if there were only 2 guests, 3 guests, ... and apply one of the above methods.

- Tabulate the results of the previous approach and look for a pattern.

<table>
<thead>
<tr>
<th>Number of Guests</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6 ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Handshakes</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Many open ended investigations can be derived from geometry:

- Which shapes (triangles, squares, parallelograms, ...) tessellate?
- Draw a triangle on a piece of paper. Fold each side of the triangle exactly in half. What happens? Does this always occur? Why?
- Draw a large quadrilateral with all sides of different length. Find the midpoint of each side. Join the midpoints as shown in the diagram. Cut out the large quadrilateral. Put the triangle pieces together like a jigsaw so that they exactly fit over section E. Experiment with other quadrilaterals. Can you work out what happens and why?
<table>
<thead>
<tr>
<th>Content and Skills Objectives</th>
<th>Applications</th>
<th>Implications and Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1.3 Solutions to Problems</td>
<td></td>
<td>• The open ended nature of many problem solving tasks may generate frustration and anxiety. This can be minimised by adopting a co-operative rather than a competitive teaching style. Students should be encouraged to share ideas and solutions by discussing and working in pairs or small groups.</td>
</tr>
<tr>
<td>To be able to:</td>
<td></td>
<td>• The use of calculators in problem solving enables students to focus on the problem solving processes and to tackle real-world problems involving realistic numbers and measurements.</td>
</tr>
<tr>
<td>• explain how a problem was solved</td>
<td></td>
<td>• The editing of rough first attempts and subsequent drafts is an approach to be encouraged.</td>
</tr>
<tr>
<td>• check a solution including calculations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• make a rough draft of solution possibilities and/or attempts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• refine a written solution by editing the first draft</td>
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<td>• compare different solutions to the same problem</td>
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<td>• discuss the adequacy and completeness of a problem solution</td>
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<td>• vary or extend the problem to a new one</td>
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<td>• generalise a problem solution so as to include other solutions.</td>
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