1.1 What is Key Learning Area (KLA)?

A Key Learning Area (KLA) is an important part of the school curriculum. It is founded on **fundamental and connected concepts within major fields of knowledge** which should be acquired by all students. A KLA provides a context for the development and application of both generic skills[1] (e.g. creativity, communication, critical thinking and collaboration) and subject-specific skills, positive values and attitudes through appropriate use of learning/teaching activities and strategies (see Figure 1). It also serves as a context for the construction of new knowledge and the development of understanding. The studies offered in each KLA may have an academic, social or practical orientation or a combination of these, depending on their purpose(s). They can be organized into subjects, modules, units, tasks or other modes of learning.

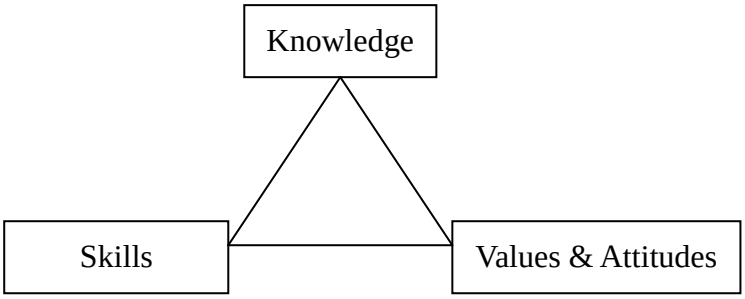

Figure 1

1.2 Position of Mathematics Education KLA in the School Curriculum

Students require knowledge and skills that will help them live a full life in the society of the 21st century, which is an information age. Knowledge of Mathematics is a necessity for every individual if they are to contribute towards the prosperity of Hong Kong. Mathematics pervades all aspects of life. It is not possible to live in the modern world without making some use of mathematics. Many of the developments and decisions made in industry and commerce, the provision of social and community services as well as government policy and planning etc., rely to some extent on the use of mathematics.

[1] The 9 essential generic skills are collaboration skills, communication skills, creativity, critical thinking skills, information technology skills, numeracy skills, problem-solving skills, self-management skills and study skills (see Section 2.2.2 for details).

Mathematics is essential in the school curriculum of Hong Kong, as it is:

(a) a powerful means of communication – It can be used to present information in many ways like figures, tables, charts, graphs and symbols, which can be processed to generate further information.

(b) a tool for studying other disciplines – It helps students enhance their understanding of the world and provides a basis as well as a foundation to study other disciplines.

(c) an intellectual endeavour and a mode of thinking – It is a creative activity in which students can be fully involved and through which they can demonstrate their imagination, initiative and flexibility of mind.

(d) a discipline, through which students can develop their ability to appreciate the beauty of nature, think logically and make sound judgments – Mathematical experiences acquired in school enable students to become mathematically literate citizens and contribute towards social prosperity.

Mathematics is valuable to help students develop necessary skills for lifelong learning. It is an integral part of general education and hence an important KLA in the Hong Kong school curriculum. The time allocation for Mathematics occupies roughly 13% of the total teaching time in schools.

1.3 Rationale and Direction for Development

According to two research studies[2], which were conducted in 1998 in support of a holistic review[3] of the Hong Kong mathematics curriculum, although the mathematics curriculum is well supported by various stakeholders, there are problems which need to be addressed if improvements are to be made. At basic education level (i.e. primary and junior secondary levels) among other problems: (a) the school mathematics curriculum is generally content-oriented, rather packed and difficult; (b) the mathematics curriculum at S1 repeats some of the materials at P5 and 6; (c) teaching at the upper primary level is examination-driven; and (d) over-drilling is common. (Summaries of the findings are listed in Appendix 1 and the reports can be found in the web site *http://cd.ed.gov.hk*.)

[2] The two research studies were *Comparative Studies of the Mathematics Curricula of Major Asian and Western Countries* and *An Analysis of the Views of Various Sectors on the Mathematics Curriculum*. The former was conducted by The University of Hong Kong and the latter by The Chinese University of Hong Kong. The two research studies were completed with reports compiled in mid-1999.

[3] The holistic review was carried out by the Ad hoc Committee on Holistic Review of the Mathematics Curriculum, which was set up in July 1997 by the former CDC. The chairman was Dr Wong King-keung who was a member of the Hong Kong Airport Authority. The final report of the Ad hoc Committee was issued to schools in June 2000 and can be found in the web site *http://cd.ed.gov.hk*.

The Ad hoc Committee on Holistic Review of the Mathematics Curriculum indicated in its final report (January 2000) that the mathematics curriculum should be designed according to a set of content-based learning dimensions so that learning objectives and students' progress can be structured and represented systematically from primary through secondary levels. The content in the mathematics curriculum should be arranged that students get adequate prior experience through manipulating concrete objects before being introduced to formal mathematical concepts. Abstract concepts should also be backed up by an abundance of mathematical and non-mathematical examples. Thinking skills should be developed through mathematical activities and incorporated into the content-based learning dimensions when designing the future mathematics curriculum.

Taking into consideration the research results and the views of the Ad hoc Committee, the CDC Committee on Mathematics Education recommends the following for the development of the Hong Kong mathematics curriculum:

(a) The appropriate use of information technology (IT) in mathematics learning should be emphasized. High technology items like computers and calculators have profoundly changed the world of mathematics education. Students need to master IT to adapt to the dynamically changing environment. With the help of IT tools, meaningless drilling and obsolete topics are no longer essential and relevant in mathematics learning.

(b) It is important for our students to acquire the foundations of knowledge and skill, to develop the capabilities for learning how to learn, to think logically, creatively and critically, to develop and use knowledge, to analyze and solve problems, to access and process information, to make sound judgements and communicate with others effectively.

(c) Students should be enabled to build up confidence and positive attitudes towards mathematics learning, to value mathematics and to appreciate the beauty of mathematics.

1.4 Strategies for Development

Both the primary and secondary mathematics curricula which together form the main framework of the mathematics curriculum of Hong Kong were revised along the above lines. Rote procedures and meaningless drilling are discouraged. Instead, the

development of students' thinking abilities, catering for the different needs and abilities of students and the strengthening of their learning are emphasized. In terms of content, the primary and secondary mathematics curricula have been trimmed down by over 10% in the review. However, schools/teachers, if necessary, can further adapt the curricula to create more space for:

- using IT in mathematics learning/teaching;
- conducting project learning;
- doing exploratory work; and
- organizing consolidation/enrichment activities, etc.

Tryouts of some selected topics (see Appendix 2 for the list of tryout topics/teaching strategies) have been conducted in some schools since 1997. The results of the tryouts and the comments and suggestions from the schools concerned, teachers' opinions from related surveys and seminars, and the recommendations of the Ad hoc Committee on Holistic Review of Mathematics Curriculum were all considered before the finalization of the revised curricula. The revised secondary mathematics curriculum[4] (referred as Secondary Mathematics Curriculum (1999)[5] below) was implemented in S1 in September 2001 and the revised primary mathematics curriculum[6] (referred as Primary Mathematics Curriculum (2000)[7] below) will be implemented in P1 in September 2002. Relevant in-service teacher training programmes will be organized whenever required to familarize teachers with the focuses of the revised curricula. Multi-media materials including exemplars, on-line learning and teaching packages and CD ROMs will also be produced to support the learning and teaching of mathematics in schools.

1.4.1 Short-term (2001 – 2005) and Medium-term (2006 – 2011) Targets

Schools and teachers should

- discourage students to do meaningless drilling;
- adapt the mathematics curriculum to cater for student diversities and flexibly use curriculum space created for activities like projects, exploratory activities, consolidation/enrichment activities, etc.;

[4] The curriculum document "Syllabuses for Secondary Schools: Mathematics (Secondary 1-5) (1999)" was issued to secondary schools in March 2000.
[5] The curriculum was endorsed by the former CDC Mathematics Subject Committee (Secondary) in 1999.
[6] The curriculum document "Mathematics Education Key Learning Area – Mathematics Curriculum Guide (P1 – P6)" was issued to primary schools in July 2001.
[7] The curriculum was endorsed by the CDC Committee on Mathematics Education in 2000.

- encourage more teacher/student interactions in class to enhance students' thinking and communication skills;
- help students develop a positive attitude towards mathematics learning;
- use diversified learning activities and tools (including project learning and using IT) to arouse students' interest in learning mathematics and to foster high-order thinking skills (HOTS);
- use diversified assessments (including routine assessment like paper-and-pencil tests as well as non-routine assessment like classroom observation, questioning and projects) for improving learning and teaching; and
- provide opportunities for students to extend their mathematics learning experiences beyond the classroom by participating in mathematics-related activities outside school to broaden perspectives.

1.4.2 Long-term (Beyond 2011) Targets

- Schools and teachers continue to work on the focuses listed in the short-term and medium-term phases.
- Pending the review of the new senior secondary academic structure, the mathematics curriculum at the basic education level may need some re-adjustment to cope with the new situation, to ensure better continuity in the mathematics curricula between the basic education level and the new senior secondary level, and to suit the diversified needs of students.
- Teachers are encouraged to gradually develop their curriculum ownership.

1.5 Building on Strengths

The principle of developing the mathematics framework is built on existing strengths of schools and teachers and hence promote/facilitate quality mathematics learning and teaching. The following table summarizes the existing strengths, current effective learning/teaching practices and experiences that should be continued, and the new emphases of the framework.

Existing Strengths	New Emphases
• There are sufficient emphasis on the learning and teaching of basic computational skills and contents.	• There should be a balance between process abilities and basic computational skills and contents. • Mathematics education should address a wider objective. HOTS and conceptual understanding should be emphasized. • Teaching should provoke students to think.
• Students' performance in computation and solving routine problems is good.	• There should be more emphasis on developing students' ability in solving exploratory problems and in solving problems that required some hands-on activities.
• Both students and parents show high regard for mathematics. • Both students and parents find mathematics important.	• Value and attitude towards learning mathematics should be reinforced. • Students' interest in learning mathematics should be enhanced.
• Most teachers are professionally trained and their general teaching skill is good.	• Teachers should have better understanding of the subject and have more comprehensive knowledge of the development of the curriculum. • Teachers teaching at various levels should have a better understanding of the curriculum at other levels.

• There are exchanges and sharing of experience in the learning and teaching of mathematics among teachers.	• There should be exchanges and sharing of experience in the learning and teaching of mathematics among teachers, school administrators, curriculum developers and academics. In particular, communication between primary school teachers and secondary school teachers should be reinforced.
• Teachers show high regard for assessing students' ability through formative and summative assessment – *assessment of learning.*	• Mode of assessment should be diversified. Apart from paper-and-pencil assessment, different assessment activities should be adopted to assess students' various abilities. • Assessment should be considered as an integral component of the learning and teaching cycle and aim at promoting and enhancing quality mathematics education – *assessment for learning*.
• Remedial classes for students weak in mathematics are organized in most schools. • There is flexibility in the curriculum. "Spare time" is available in the design of the mathematics curriculum.	• Student diversities is a key issue in quality mathematics learning. Supporting measures for both ends of the student population are equally essential. • School-based curriculum is encouraged. The curriculum should be adjusted and adapted to meet the needs of less able students and the needs of more able students. • "Spare time" should be properly utilized to provide support and enrichment programs for students of different abilities. • Diversified teaching methods and teaching approaches should be adopted.

• Most teachers have been trained and attained basic level on using IT.	• There should be more emphasis on the application of IT in the learning and teaching of mathematics.
• Teachers hold positive view on curriculum development.	• Teachers should be encouraged to take more active role in research and development activities, action research and seed projects. • Both curriculum ownership and curriculum leadership of teachers are essential factors for realizing the spirit of the mathematics curriculum in class.