



EDER ACADEMY OF CANADA

EDER ACADEMY OF CANADA CALCULUS AND VECTORS, GRADE 12

MCV4U Course Outline

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| School | Eder Academy of Canada |
| Department | Mathematics |
| Course Title/Grade/Type | Grade 12, University Preparation |
| Course Code | MCV4U |
| Course Developer | Navdeep Kaur |
| Reviser/IT | Updated by Principal |
| Course Development Date | August 2021 |
| Credit Value | 1.0 |
| Length | 110 hours |
| Prerequisite | MHF 4U must be taken prior to or concurrently with Calculus and Vectors (MCV 4U) |



OVERVIEW & COURSE DESCRIPTION

COURSE DESCRIPTION

This course builds on students' previous experience with functions and their developing understanding of rates of change. Students will solve problems involving geometric and algebraic representations of vectors and representations of lines and planes in three-dimensional space; broaden their understanding of rates of change to include the derivatives of polynomial, sinusoidal, exponential, rational, and radical functions; and apply these concepts and skills to the modelling of real-world relationships. Students will also refine their use of the mathematical processes necessary for success in senior mathematics. This course is intended for students who choose to pursue careers in fields such as science, engineering, economics, and some areas of business, including those students who will be required to take a university-level calculus, linear algebra, or physics course.

For further information about this course or any Ontario Secondary Curriculum Guidelines. Please go to www.edu.gov.on.ca/eng/curriculum/secondary/math1112currb.pdf

UNITS

A. RATE OF CHANGE

OVERALL EXPECTATIONS

1. demonstrate an understanding of rate of change by making connections between average rate of change over an interval and instantaneous rate of change at a point, using the slopes of secants and tangents and the concept of the limit;
2. graph the derivatives of polynomial, sinusoidal, and exponential functions, and make connections between the numeric, graphical, and algebraic representations of a function and its derivative;



3. verify graphically and algebraically the rules for determining derivatives; apply these rules to determine the derivatives of polynomial, sinusoidal, exponential, rational, and radical functions, and simple combinations of functions; and solve related problems.

B. DERIVATIVES AND THEIR APPLICATIONS

OVERALL EXPECTATIONS

1. make connections, graphically and algebraically, between the key features of a function and its first and second derivatives, and use the connections in curve sketching;
2. solve problems, including optimization problems, that require the use of the concepts and procedures associated with the derivative, including problems arising from real-world applications and involving the development of mathematical models.

C. GEOMETRY AND ALGEBRA OF VECTORS

OVERALL EXPECTATIONS

1. demonstrate an understanding of vectors in two-space and three-space by representing them algebraically and geometrically and by recognizing their applications;
2. perform operations on vectors in two-space and three-space, and use the properties of these operations to solve problems, including those arising from real-world applications;
3. distinguish between the geometric representations of a single linear equation or a system of two linear equations in two-space and three-space, and determine different geometric configurations of lines and planes in three-space;
4. represent lines and planes using scalar, vector, and parametric equations, and solve problems involving distances and intersections.



| Units | Hours | Topics |
|------------------------------------|-------|---|
| RATE OF CHANGE | 37 | <ul style="list-style-type: none">- Investigating Instantaneous Rate of Change at a Point- Investigating the Concept of the Derivative Function- Investigating the Properties of Derivatives |
| DERIVATIVES AND THEIR APPLICATIONS | 30 | <ul style="list-style-type: none">- Connecting Graphs and Equations of Functions and Their Derivatives- Solving Problems Using Mathematical Models and Derivatives |
| GEOMETRY AND ALGEBRA OF VECTORS | 41 | <ul style="list-style-type: none">- Representing Vectors Geometrically and Algebraically- Operating With Vectors- Describing Lines and Planes Using Linear Equations- Describing Lines and Planes Using Scalar, Vector, and Parametric Equations |
| FINAL EXAM | 2 | |



TEACHING/LEARNING STRATEGIES

Program Planning Consideration

Exceptional Students: Additional time will be allowed for tests. Additional accommodation will be provided in consultation with the guidance, special education and ESL departments.

Technology: Graphing Calculators and computers will be utilized for technology related applications

Career Education: Links to related fields will be established throughout the course

Mathematics Anxiety: Attention will be addresses according to the following:

- ❖ Cultural perspectives
- ❖ Positive reinforcements
- ❖ Variety of assessment techniques
- ❖ Group structures
- ❖ Consideration of learning styles

Assessment of Learning Skills

Assessment of learning skills will be done on an ongoing basis throughout the academic year by observation of the student work, checklists and interviews. This will include:

- ❖ Classwork/ homework (work habits. Homework and organization)
- ❖ Completed work and seeking assistance (Organization and initiative)
- ❖ Persistence and independence at tasks (Working independently and initiative)
- ❖ Extension of task (Organization and initiative)
- ❖ Achievement of group goals (Team Work)

Assessment Strategies



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A variety of teaching/ assessment strategies to address student's needs will be used during the school year. Formative assessments will be ongoing throughout the academic year. These may include:

- ❖ Diagnostic Assessment
- ❖ Formative Assessment
- ❖ Performative Assessment
- ❖ Portfolio Assessment
- ❖ Rubrics
- ❖ Checklists

Term Summative Evaluations (70% Term Work)

- ❖ Tests, Quizzes, tasks and other forms of term summative evaluations will occur throughout the academic year at the end of units of work as outlined in the accompanying course outline
- ❖ Students will be provided with reasonable opportunities to master skills relating to the achievement of the curriculum expectations before assessment or evaluation occurs.
- ❖ Major evaluations will be announced at least 5 days in advance.
- ❖ Absence on the day of an evaluation must be documented.
 - A student is expected to see the teacher before the absence to arrange an alternative date to make up the evaluation
 - In case of illness/ unexpected absence, present a not to the teacher signed by parent or guardian, immediately upon their return to explain the absence.
- ❖ Cheating will not be tolerated in any form and will be dealt with appropriately.

Materials

Students must bring the following items to each class: pen/pencil, lined paper, three ringed binder, text and any other items as requested by the teacher



Late or Missed Assignments

Submitted course work on time is an important aspect of student learning and time management. As such, “late assignments” will be reported on as part of the learning skills on the report card or progress reports and a variety of strategies will be used for dealing with “late assignments” (counselling, contracts, mark deductions). However, missed assignments do impact on marks and a mark of zero will be assigned after an appropriate time has been allowed and marked assignments have been returned to the class

Missed Tests

If a student is absent on the day of a test, the student is expected to bring a note from a guardian explaining the test day absence of their return to school. The missed test will be written on the first day of return to school.

Final Mark Calculation

Calculation of the term mark will be based upon the categories of the achievement chart. This chart is meant to assist teachers in planning instruction and learning activities for the achievement of the curriculum expectations. It is also used in designing assessment and evaluation tools and in providing feedback to students. Each mathematical topic will contain each category in the chart due to the integrated nature of the discipline in mathematics. Final Marks will be calculated as follows

Team Work **70%**

Knowledge and Understanding: 35%

Application: 35%

Thinking and Inquiry: 15%

Communication: 15%

Final Summative Evaluation 30%



REPORTING

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| Final Report |
| 70% Term Work + 30% Final Summative Evaluation (Cumulative) |

ACHIEVEMENT CHART

The following table provides a summary description of achievement in each percentage grade range and corresponding level of achievement.

| Percentage Grade Range | Achievement Level | Summary Description |
|---------------------------|--|---|
| 80-100% | Level 4 | A very high to outstanding level of achievement. Achievement is above the provincial standard. |
| 70-79% | Level 3 | A high level of achievement. Achievement is at the provincial standard. |
| 60-69% | Level 2 | A moderate level of achievement. Achievement is below, but approaching the provincial standard. |
| 50-59% | Level 1 | A passable level of achievement. Achievement is below the provincial standard. |
| Below 50% | Insufficient achievement of curriculum expectations. A credit will not be granted. | |

ASSESSMENT & EVALUATION OF STUDENT PERFORMANCE

Using a variety of instructional strategies, the teacher will provide numerous opportunities for students to develop skills of inquiry, problem solving and communication as they investigate and learn fundamental concepts.

- Homework
- Note Making
- Problem Posing
- Peer Teaching
- Reflection
- Discussion
- Inquiry process



STRATEGIES FOR ASSESSMENT AND EVALUATION OF STUDENT PERFORMANCE

There are three forms of assessment that will be used throughout this course.

Assessment for learning: Assessment for learning will directly influence student learning by reinforcing the connections between assessment and instruction, and provide ongoing feedback to the student. Assessment for learning occurs as part of the daily teaching process and helps teachers form a clear picture of the needs of the students because students are encouraged to be more active in their learning and associated assessment. Teachers gather this information to shape their classroom teaching.

Assessment for learning is:

- Ongoing
- Is tied to learning outcomes
- Provides information that structures the teachers planning and instruction
- Allows teachers to provide immediate and descriptive feedback that will guide student learning

The purpose of assessment for learning is to create self-regulated and lifelong learners

Assessment as learning: Will occur frequently and in an ongoing manner during instruction, to enable students to monitor their own progress towards achieving their learning goals (self – assessment).

Assessment of learning: Will occur at or near the end of a period of learning, this summary is used to make judgments about the quality of student learning using established criteria, to assign a value to represent that quality and to communicate information about achievement to students and parents.

Evidence of student achievement for evaluation is collected over time from three different sources – *observations*, *conversations*, and *student products*. Using multiple sources of evidence increases the reliability and validity of the evaluation of student learning.

| Assessment as Learning | Assessment for Learning | Assessment of Learning |
|---|---|---|
| <p>Student Product</p> <ul style="list-style-type: none"> <input type="checkbox"/> Journals/Letters/Emails (checklist) <input type="checkbox"/> Learning Logs (anecdotal) <input type="checkbox"/> Entrance Tickets <input type="checkbox"/> Exit Tickets (Lesson Self-Assessment) <input checked="" type="checkbox"/> Test Reflections | <p>Student Product</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Assignment <input type="checkbox"/> Journals/Letters/Emails (Checklist) <input type="checkbox"/> Pre-tests (checklist/scale/rubric) <input checked="" type="checkbox"/> Quizzes (scale/rubric) <input type="checkbox"/> Rough drafts (rubric) <input type="checkbox"/> Posters (rubric/scale) <input type="checkbox"/> Graphic organizer <input type="checkbox"/> Peer feedback (anecdotal/checklist) <input type="checkbox"/> Reports (rubric) <input type="checkbox"/> Essays (rubric) | <p>Student Product</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Assignment (scale) <input checked="" type="checkbox"/> Quizzes (scale) <input type="checkbox"/> Journals/Letters/Emails (checklist) <input checked="" type="checkbox"/> Test (scale/rubric) <input checked="" type="checkbox"/> Exam <input type="checkbox"/> Rough drafts (rubric) <input type="checkbox"/> Poster (rubric/scale) <input type="checkbox"/> Graphic organizer (scale) <input type="checkbox"/> Reports (rubric) <input type="checkbox"/> Essays (rubric) |



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| | <input type="checkbox"/> Webbing/Mapping (rubric/scale) <input checked="" type="checkbox"/> Entrance ticket <input checked="" type="checkbox"/> Exit Tickets <input type="checkbox"/> Vocabulary notebooks (anecdotal) <input type="checkbox"/> Visual Thinking Networks (rubric) <input checked="" type="checkbox"/> Test Corrections | |
| Observation <input checked="" type="checkbox"/> Whole class discussion (anecdotal) <input type="checkbox"/> Self-proofreading (checklist) <input type="checkbox"/> Peer and Self Evaluations | Observation <input checked="" type="checkbox"/> Class discussions (anecdotal) <input type="checkbox"/> Debate (rubric) <input type="checkbox"/> PowerPoint presentations (rubric) <input type="checkbox"/> Performance tasks (anecdotal/scale) | Observation <input type="checkbox"/> Debate (rubric) <input type="checkbox"/> PowerPoint presentation (rubric) <input type="checkbox"/> Performance Task (rubric) <input checked="" type="checkbox"/> Oral Presentation – Solution Presentati (rubric) |
| Conversation <input checked="" type="checkbox"/> Student teacher conferences (checkli <input type="checkbox"/> Small Group Discussions (checklist) <input checked="" type="checkbox"/> Pair work (checklist) <input type="checkbox"/> Debate (rubric) | Conversation <input checked="" type="checkbox"/> Student teacher conferences (checkli <input type="checkbox"/> Small group discussions (checklist) <input type="checkbox"/> Pair work (anecdotal) <input type="checkbox"/> Peer-feedback (anecdotal) <input type="checkbox"/> Peer editing (anecdotal) <input type="checkbox"/> Oral pre-test (scale/rubric) <input type="checkbox"/> Oral quizzes (scale/rubric) | Conversation <input type="checkbox"/> Student teacher conference (rubric) <input checked="" type="checkbox"/> Questions and Answer Session (checklist) <input checked="" type="checkbox"/> Oral Presentation with Question and Answer Session (rubric) |



SOME CONSIDERATIONS FOR PROGRAM PLANNING IN MATHEMATICS

Teachers who are planning a program in mathematics must take into account considerations in a number of important areas, including those discussed below.

INSTRUCTIONAL APPROACHES

To make new learning more accessible to students, teachers build new learning upon the knowledge and skills students have acquired in previous years – in other words, they help activate prior knowledge. It is important to assess where students are in their mathematical growth and to bring them forward in their learning.

In order to apply their knowledge effectively and to continue to learn, students must have a solid conceptual foundation in mathematics. Successful classroom practices engage students in activities that require higher-order thinking, with an emphasis on problem solving.⁶ Learning experienced in the primary, junior, and intermediate divisions should have provided students with a good grounding in the investigative approach to learning new mathematical concepts, including inquiry models of problem solving, and this approach continues to be important in the senior mathematics program.

Students in a mathematics class typically demonstrate diversity in the ways they learn best. It is important, therefore, that students have opportunities to learn in a variety of ways – individually, cooperatively, independently, with teacher direction, through investigation involving hands-on experience, and through examples followed by practice. In mathematics, students are required to learn concepts, acquire procedures and skills, and apply processes with the aid of the instructional and learning strategies best suited to the particular type of learning.



6. See the resource document Targeted Implementation & Planning Supports for Revised Mathematics (TIPS4RM): Grade 7, 8, 9 Applied and 10 Applied (Toronto: Queen's Printer for Ontario, 2005) for helpful information about problem solving.

The approaches and strategies used in the classroom to help students meet the expectations of this curriculum will vary according to the object of the learning and the needs of the students. For example, even at the secondary level, manipulatives can be important tools for supporting the effective learning of mathematics. These concrete learning tools, such as connecting cubes, measurement tools, algebra tiles, and number cubes, invite students to explore and represent abstract mathematical ideas in varied, concrete, tactile, and visually rich ways.⁷ Other representations, including graphical and algebraic representations, are also a valuable aid to teachers. By analysing students' representations of mathematical concepts and listening carefully to their reasoning, teachers can gain useful insights into students' thinking and provide supports to help enhance their thinking.

All learning, especially new learning, should be embedded in well-chosen contexts for learning – that is, contexts that are broad enough to allow students to investigate initial understandings, identify and develop relevant supporting skills, and gain experience with varied and interesting applications of the new knowledge. Such rich contexts for learning open the door for students to see the "big ideas" of mathematics – that is, the major underlying principles or relationships that will enable and encourage students to reason mathematically throughout their lives.

Promoting Positive Attitudes Towards Learning Mathematics

Students' attitudes have a significant effect on how students approach problem solving and how well they succeed in mathematics. Students who enjoy mathematics tend to perform well in their mathematics course work and are more likely to enrol in the more advanced mathematics courses.



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Students develop positive attitudes when they are engaged in making mathematical conjectures, when they experience breakthroughs as they solve problems, when they see connections between important ideas, and when they observe an enthusiasm for mathematics on the part of their teachers.⁸ With a positive attitude towards mathematics, students are able to make more sense of the mathematics they are working on, and to view themselves as effective learners of mathematics. They are also more likely to perceive mathematics as both useful and worthwhile, and to develop the belief that steady effort in learning mathematics pays off.

It is common for people to feel inadequate or anxious when they cannot solve problems quickly and easily, or in the right way. To gain confidence, students need to recognize that, for some mathematics problems, there may be several ways to arrive at a solution. They also need to understand that problem solving of almost any kind often requires a considerable expenditure of time and energy and a good deal of perseverance. To counteract the frustration they may feel when they are not making progress towards solving a problem, they need to believe that they are capable of finding solutions. Teachers can encourage students to develop a willingness to persist, to investigate, to reason, to explore alternative solutions, to view challenges as opportunities to extend their learning, and to take the risks necessary to become successful problem solvers. They can help students develop confidence and reduce anxiety and frustration by providing them with problems that are challenging but not beyond their ability to solve. Problems at a developmentally appropriate level help students to learn while establishing a norm of perseverance for successful problem solving.

7. A list of manipulatives appropriate for use in intermediate and senior mathematics classrooms is provided in *Leading Math Success*, pp. 48–49.

8. *Leading Math Success*, p. 42

Collaborative learning enhances students' understanding of mathematics. Working cooperatively in groups reduces isolation and provides students with opportunities to share



ideas and communicate their thinking in a supportive environment as they work together towards a common goal. Communication and the connections among ideas that emerge as students interact with one another enhance the quality of student learning.⁹

PLANNING MATHEMATICS PROGRAMS FOR STUDENTS WITH SPECIAL EDUCATION NEEDS

Classroom teachers are the key educators of students who have special education needs. They have a responsibility to help all students learn, and they work collaboratively with special education teachers, where appropriate, to achieve this goal. Special Education Transformation: The Report of the Co-Chairs with the Recommendations of the Working Table on Special Education, 2006 endorses a set of beliefs that should guide program planning for students with special education needs in all disciplines. Those beliefs are as follows:

- ❖ All students can succeed.
- ❖ Universal design and differentiated instruction are effective and interconnected means of meeting the learning or productivity needs of any group of students.
- ❖ Successful instructional practices are founded on evidence-based research, tempered by experience.
- ❖ Classroom teachers are key educators for a student's literacy and numeracy development.
- ❖ Each student has his or her own unique patterns of learning.
- ❖ Classroom teachers need the support of the larger community to create a learning environment that supports students with special education needs.
- ❖ Fairness is not sameness.

In any given classroom, students may demonstrate a wide range of learning styles and needs. Teachers plan programs that recognize this diversity and give students performance tasks that respect their particular abilities so that all students can derive the greatest possible benefit



from the teaching and learning process. The use of flexible groupings for instruction and the provision of ongoing assessment are important elements of programs that accommodate a diversity of learning needs.

PROGRAM CONSIDERATIONS FOR ENGLISH LANGUAGE LEARNERS

Young people whose first language is not English enter Ontario secondary schools with diverse linguistic and cultural backgrounds. Some English language learners may have experience of highly sophisticated educational systems, while others may have come from regions where access to formal schooling was limited. All of these students bring a rich array of background knowledge and experience to the classroom, and all teachers must share in the responsibility for their English-language development.

Teachers of mathematics must incorporate appropriate adaptations and strategies for instruction and assessment to facilitate the success of the English language learners in their classrooms. These adaptations and strategies include:

- ❖ modification of some or all of the course expectations so that they are challenging but attainable for the learner at his or her present level of English proficiency, given the necessary support from the teacher;
- ❖ use of a variety of instructional strategies (e.g., extensive use of visual cues, scaffolding, manipulatives, pictures, diagrams, graphic organizers; attention to clarity of instructions);
- ❖ modelling of preferred ways of working in mathematics; previewing of textbooks;
- ❖ pre-teaching of key vocabulary; peer tutoring; strategic use of students' first languages);
- ❖ use of a variety of learning resources (e.g., visual material, simplified text, bilingual dictionaries, materials that reflect cultural diversity);



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- ❖ use of assessment accommodations (e.g., granting of extra time; simplification of language used in problems and instructions; use of oral interviews, learning logs, portfolios, demonstrations, visual representations, and tasks requiring completion of graphic organizers or close sentences instead of tasks that depend heavily on proficiency in English).

When learning expectations in any course are modified for English language learners (whether or not the students are enrolled in an ESL or ELD course), this must be clearly indicated on the student's report card.

Although the degree of program adaptation required will decrease over time, students who are no longer receiving ESL or ELD support may still need some program adaptations to be successful.

For further information on supporting English language learners, refer to *The Ontario Curriculum, Grades 9 to 12: English As a Second Language and English Literacy Development, 2007* and the resource guide *Many Roots Many Voices: Supporting English Language Learners in Every Classroom* (Ministry of Education, 2005).

ANTIDISCRIMINATION EDUCATION

To ensure that all students in the province have an equal opportunity to achieve their full potential, the curriculum must be free from bias, and all students must be provided with a safe and secure environment, characterized by respect for others, that allows them to participate fully and responsibly in the educational experience.

Learning activities and resources used to implement the curriculum should be inclusive in nature, reflecting the range of experiences of students with varying backgrounds, abilities, interests, and learning styles. They should enable students to become more sensitive to the diverse cultures and perceptions of others, including Aboriginal peoples. By discussing aspects



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of the history of mathematics, teachers can help make students aware of the various cultural groups that have contributed to the evolution of mathematics over the centuries. Finally, students need to recognize that ordinary people use mathematics in a variety of everyday contexts, both at work and in their daily lives.

Connecting mathematical ideas to real-world situations through learning activities can enhance students' appreciation of the role of mathematics in human affairs, in areas including health, science, and the environment. Students can be made aware of the use of mathematics in contexts such as sampling and surveying and the use of statistics to analyse trends. Recognizing the importance of mathematics in such areas helps motivate students to learn and also provides a foundation for informed, responsible citizenship.

Teachers should have high expectations for all students. To achieve their mathematical potential, however, different students may need different kinds of support. Some boys, for example, may need additional support in developing their literacy skills in order to complete mathematical tasks effectively. For some girls, additional encouragement to envision themselves in careers involving mathematics may be beneficial. For example, teachers might consider providing strong role models in the form of female guest speakers who are mathematicians or who use mathematics in their careers.

Students Requiring Accommodations Only

Some students are able, with certain accommodations, to participate in the regular course curriculum and to demonstrate learning independently. Accommodations allow access to the course without any changes to the knowledge and skills the student is expected to demonstrate. The accommodations required to facilitate the student's learning must be identified in his or her IEP (see IEP Standards, 2000, page 11). A student's IEP is likely to reflect the same accommodations for many, or all, subjects or courses.



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Providing accommodations to students with special education needs should be the first option considered in program planning. Instruction based on principles of universal design and differentiated instruction focuses on the provision of accommodations to meet the diverse needs of learners.

There are three types of accommodations:

- ❖ Instructional accommodations are changes in teaching strategies, including styles of presentation, methods of organization, or use of technology and multimedia.
- ❖ Environmental accommodations are changes that the student may require in the classroom and/or school environment, such as preferential seating or special lighting.
- ❖ Assessment accommodations are changes in assessment procedures that enable the student to demonstrate his or her learning, such as allowing additional time to complete tests or assignments or permitting oral responses to test questions (see page 29 of the IEP Resource Guide, 2004, for more examples).

If a student requires "accommodations only" in mathematics courses, assessment and evaluation of his or her achievement will be based on the appropriate course curriculum expectations and the achievement levels outlined in this document. The IEP box on the student's Provincial Report Card will not be checked, and no information on the provision of accommodations will be included.

STUDENTS REQUIRING MODIFIED EXPECTATIONS

Some students will require modified expectations, which differ from the regular course expectations. For most students, modified expectations will be based on the regular course curriculum, with changes in the number and/or complexity of the expectations. Modified expectations represent specific, realistic, observable, and measurable achievements and describe specific knowledge and/or skills that the student can demonstrate independently, given the appropriate assessment accommodations.



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It is important to monitor, and to reflect clearly in the student's IEP, the extent to which expectations have been modified. As noted in Section 7.12 of the ministry's policy document Ontario Secondary Schools, Grades 9 to 12: Program and Diploma Requirements, 1999, the principal will determine whether achievement of the modified expectations constitutes successful completion of the course, and will decide whether the student is eligible to receive a credit for the course. This decision must be communicated to the parents and the student.

When a student is expected to achieve most of the curriculum expectations for the course, the modified expectations should identify how the required knowledge and skills differ from those identified in the course expectations. When modifications are so extensive that achievement of the learning expectations (knowledge, skills, and performance tasks) is not likely to result in a credit, the expectations should specify the precise requirements or tasks on which the student's performance will be evaluated and which will be used to generate the course mark recorded on the Provincial Report Card.

Modified expectations indicate the knowledge and/or skills the student is expected to demonstrate and have assessed in each reporting period (IEP Standards, 2000, pages 10 and 11). The student's learning expectations must be reviewed in relation to the student's progress at least once every reporting period, and must be updated as necessary (IEP Standards, 2000, page 11).

If a student requires modified expectations in mathematics courses, assessment and evaluation of his or her achievement will be based on the learning expectations identified in the IEP and on the achievement levels outlined in this document. If some of the student's learning expectations for a course are modified but the student is working towards a credit for the course, it is sufficient simply to check the IEP box on the Provincial Report Card. If, however, the student's learning expectations are modified to such an extent that the principal deems that a credit will not be granted for the course, the IEP box must be checked and the appropriate



statement from the Guide to the Provincial Report Card, Grades 9–12, 1999 (page 8) must be inserted. The teacher's comments should include relevant information on the student's demonstrated learning of the modified expectations, as well as next steps for the student's learning in the course.

LITERACY AND INQUIRY/RESEARCH SKILLS

Literacy skills can play an important role in student success in mathematics courses. Many of the activities and tasks students undertake in mathematics courses involve the use of written, oral, and visual communication skills. For example, students use language to record their observations, to explain their reasoning when solving problems, to describe their inquiries in both informal and formal contexts, and to justify their results in small-group conversations, oral presentations, and written reports. The language of mathematics includes special terminology. The study of mathematics consequently encourages students to use language with greater care and precision and enhances their ability to communicate effectively.

The Ministry of Education has facilitated the development of materials to support literacy instruction across the curriculum. Helpful advice for integrating literacy instruction in mathematics courses may be found in the following resource documents:

- Think Literacy: Cross-Curricular Approaches, Grades 7–12, 2003
- Think Literacy: Cross-Curricular Approaches, Grades 7–12 – Mathematics: Subject-Specific Examples, Grades 10–12, 2005

In all courses in mathematics, students will develop their ability to ask questions and to plan investigations to answer those questions and to solve related problems. Students need to learn a variety of research methods and inquiry approaches in order to carry out these investigations and to solve problems, and they need to be able to select the methods that are most appropriate for a particular inquiry. Students learn how to locate relevant information from a variety of sources, such as statistical databases, newspapers, and reports. As they advance through the grades, students will be expected to use such sources with increasing



sophistication. They will also be expected to distinguish between primary and secondary sources, to determine their validity and relevance, and to use them in appropriate ways.

THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN MATHEMATICS

Information and communication technologies (ICT) provide a range of tools that can significantly extend and enrich teachers' instructional strategies and support students' learning in mathematics. Teachers can use ICT tools and resources both for whole-class instruction and to design programs that meet diverse student needs. Technology can help to reduce the time spent on routine mathematical tasks, allowing students to devote more of their efforts to thinking and concept development. Useful ICT tools include simulations, multimedia resources, databases, sites that give access to large amounts of statistical data, and computer-assisted learning modules.

Applications such as databases, spreadsheets, dynamic geometry software, dynamic statistical software, graphing software, computer algebra systems (CAS), word-processing software, and presentation software can be used to support various methods of inquiry in mathematics. Technology also makes possible simulations of complex systems that can be useful for problem-solving purposes or when field studies on a particular topic are not feasible.

Information and communications technologies can be used in the classroom to connect students to other schools, at home and abroad, and to bring the global community into the local classroom.

Although the Internet is a powerful electronic learning tool, there are potential risks attached to its use. All students must be made aware of issues of Internet privacy, safety, and



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responsible use, as well as of the ways in which this technology is being abused – for example, when it is used to promote hatred.

Teachers, too, will find the various ICT tools useful in their teaching practice, both for whole class instruction and for the design of curriculum units that contain varied approaches to learning to meet diverse student needs.

CAREER EDUCATION IN MATHEMATICS

Teachers can promote students' awareness of careers involving mathematics by exploring applications of concepts and providing opportunities for career-related project work. Such activities allow students the opportunity to investigate mathematics-related careers compatible with their interests, aspirations, and abilities.

Students should be made aware that mathematical literacy and problem solving are valuable assets in an ever-widening range of jobs and careers in today's society. The knowledge and skills students acquire in mathematics courses are useful in fields such as science, business, engineering, and computer studies; in the hospitality, recreation, and tourism industries; and in the technical trades.

TEACHING RESOURCES

Calculus and Vectors: Nelson-Thomson Learning: 2009