

Canada Agile Preparatory Academy

Course outline

Ministry of Education Course Title: Advanced Functions, Grade 12, University Preparation

Ministry Course Code: MHF4U

Course Type: University Preparation

Grade: 12

Credit Value: 1.0

Prerequisite(s): MCR3U Functions, Grade 11, University Preparation

Or MCT4C Mathematics for College Technology, Grade 12, College Preparation

Department: Mathematics

Course developer: Canada Agile Preparatory Academy

Development Date: Feb 1, 2020

This course has been developed based on the following Ministry documents:

- The Ontario Curriculum, Grades 11 and 12: Mathematics, 2007 (revised)
- Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools (2010)

Revision Date: May 21st 2020

Course Description/Rationale

This course extends students' experience with functions. Students will investigate the properties of polynomial, rational, logarithmic, and trigonometric functions; develop techniques for combining functions; broaden their understanding of rates of change; and develop facility in applying these concepts and skills. Students will also refine their use of the mathematical processes necessary for success in senior mathematics. This course is intended both for students taking the Calculus and Vectors course as a prerequisite for a university program and for those wishing to consolidate their understanding of mathematics before proceeding to any one of a variety of university programs.

Overall Curriculum Expectations

Exponential and Logarithmic Functions

1. Demonstrate an understanding of the relationship between exponential expressions and logarithmic expressions, evaluate logarithms, and apply the laws of logarithms to simplify numeric expressions;
2. Identify and describe some key features of the graphs of logarithmic functions, make connections among the numeric, graphical, and algebraic representations of logarithmic functions, and solve related problems graphically;
3. Solve exponential and simple logarithmic equations in one variable algebraically, including those in problems arising from real-world applications.

Trigonometric Functions

1. Demonstrate an understanding of the meaning and application of radian measure;
2. Make connections between trigonometric ratios and the graphical and algebraic representations of the corresponding trigonometric functions and between trigonometric functions and their reciprocals, and use these connections to solve problems;
3. Solve problems involving trigonometric equations and prove trigonometric identities.

Polynomial and Rational Functions

1. Identify and describe some key features of polynomial functions, and make connections between the numeric, graphical, and algebraic representations of polynomial functions;
2. Identify and describe some key features of the graphs of rational functions, and represent rational functions graphically;
3. Solve problems involving polynomial and simple rational equations graphically and algebraically;
4. Demonstrate an understanding of solving polynomial and simple rational inequalities.

Characteristics of Functions

1. Demonstrate an understanding of average and instantaneous rate of change, and determine, numerically and graphically, and interpret the average rate of change of a function over a given interval and the instantaneous rate of change of a function at a given point;

2. Determine functions that result from the addition, subtraction, multiplication, and division of two functions and from the composition of two functions, describe some properties of the resulting functions, and solve related problems;
3. Compare the characteristics of functions, and solve problems by modelling and reasoning with functions, including problems with solutions that are not accessible by standard algebraic techniques

Major Units and Corresponding Hours

Unit 1 Characteristics of Functions	The basic characteristics of functions and the transformations of functions will be examined. The characteristics of polynomial, rational, logarithmic, and trigonometric functions will be compared. Average and instantaneous rates of change of a function will be determined.	24 Hours
Unit 2 Polynomial and Rational Functions	The key features of polynomial and rational functions will be examined, as well as relationships between the numeric, graphical, and algebraic representations of these functions.	28 Hours
Unit 3 Trigonometric Functions	The meaning and application of the radian measure will be demonstrated. Trigonometric ratios will be connected to graphical and algebraic representations of their corresponding functions and their reciprocal functions. Related trigonometric equations of one variable will be solved and trigonometric identities of one and two variables will be proven.	28 Hours
Unit 4 Exponential and Logarithmic Functions	The relationship between exponential and logarithmic expressions will be examined, as well as that of the corresponding functions. The laws of logarithms and exponents will be applied to solving exponential and logarithmic equations of one variable.	24 Hours
Culminating Activity		4 Hours
Final Exam		2 Hours
Total Hours		110 Hours

All course content is accessed online.

Teaching & Learning Strategies

The aim of the course is to help students deepen their understanding of mathematics. The course explains difficult concepts in a manner that is easy to understand.

There will be ample opportunities for students and the teacher to engage in 1 to 1 correspondence and discussion. Independent, self-regulated learning will also be required along with teacher facilitation.

Example exercises and problems will be included in worksheet format, also requiring individual research from external sources.

Strategies for Assessment & Evaluation of Student Performance

The assessment and evaluation strategies of our school follows the Ministry of Education's Growing Success document. Growing Success articulates the vision the Ministry has for the purpose and structure of assessment and evaluation techniques.

Assessments help to monitor student progression and provide reflection and feedback. Evaluation is the process of judging the quality of student work in relation to the achievement chart categories and criteria, and assigning a percentage grade to represent that quality. Evaluation is based on gathering evidence of student achievement through:

- Products
- Observations
- Conversations

The Final Grade

The evaluation for this course is based on the student's achievement of curriculum expectations and the demonstrated skills required for effective learning. The final percentage grade represents the quality of the student's overall achievement of the expectations for the course and reflects the corresponding level of achievement as described in the achievement chart for the discipline. A credit is granted and recorded for this course if the student's grade is 50% or higher. The final grade will be determined as follows:

70% of the grade will be based upon evaluations conducted throughout the course. This portion of the grade will reflect the student's most consistent level of achievement through the course. The balance of 30% of the grade will be based on final evaluations administered at the end of the course. The final assessment may be a final exam, a final project, or a combination of both an exam and a project.

Assessment Tools and Strategies

Assessments are broken down into three categories:

- *Assessments for learning:* Worksheets and quizzes to gauge student progression and provide feedback.
- *Assessments as learning:* Journals to record reflections on the course material and self-assessments.
- *Assessments of learning:* Tests and assignments given a final grade based on how well the learning goals are met towards the course expectations.

Considerations for Program Planning

For English language learners: Ontario schools have some of the most multilingual student populations in the world. The first language of approximately 20 percent of the students in Ontario's English language schools is a language other than English. Many English language learners were born in Canada and raised in families and communities in which languages other than English were spoken, or in which the variety of English spoken differed significantly from the English of Ontario classrooms. Other English language learners arrive in Ontario as newcomers from other countries; they may have experience of highly sophisticated educational systems, or they may have come from regions where access to formal schooling was limited. When they start school in Ontario, many of these students are entering a new linguistic and cultural environment.

Our teachers consider it to be his or her responsibility to help students develop their ability to use the English language properly. Appropriate accommodations affecting the teaching, learning, and evaluation strategies in this course may be made in order to help students gain proficiency in English, since students taking English as a second language at the secondary level have limited time in which to develop this proficiency.

For students with special educational needs: Our teachers are committed to ensuring that all students, especially those with special education needs, are provided with the learning opportunities and supports they require to gain the knowledge, skills, and confidence needed to succeed in a rapidly changing society.

Equity and inclusive education: Our teachers create an environment that will foster a sense of community where all students feel included and appreciated. Students see themselves reflected in the choices of issues, examples, materials, and resources selected by our teachers.

Literacy and Inquiry/Research Skills: The school emphasizes the importance of the following:

- using clear, concise communication in the classroom involving the use of diagrams, charts, tables, and graphs
- emphasizing students' ability to interpret and use graphic texts.
- acquiring the skills to locate relevant information from a variety of sources, such as books, newspapers, dictionaries, encyclopaedias, interviews, videos, and the Internet.

- learning that all sources of information have a particular point of view
- learning that the recipient of the information has a responsibility to evaluate it, determine its validity and relevance, and use it in appropriate ways.

The role of information and communications technology: Technological tools are first-class citizens at our online school and are used in many ways:

- Students use multimedia resources, databases, Internet websites, digital cameras, and word-processing programs.
- They use technology to collect, organize, and sort the data they gather and to write, edit, and present reports on their findings.
- Students are encouraged to use ICT to support and communicate their learning. For example, students working individually or in groups can use computer technology and/or Internet websites to gain access to museums and archives in Canada and around the world.
- Students use digital cameras, webcams, and screen recording software to design and present the results of their research.

Career Education: Students are given opportunities to develop career-related skills by:

- applying their skills to real-life situations
- exploring educational and career options
- developing research skills
- making oral presentations

Resources required by the student

- Internet access and a modern standards-compliant web browser
- A non-programmable, non-graphing, scientific calculator. Certain parts of the course require a graphing calculator, which can be accessed online for free at <http://www.opengraphingcalculator.com>
- A scanner, smart phone camera, or similar device to upload handwritten or hand-drawn work
- A front-facing camera such as a webcam to allow for remote proctoring over the internet
- Textbook: Advanced Functions (Nelson Education Ltd., 2008)