OUTLINE OF COURSE OF STUDY

Functions, Grade 11, University Preparation (MCR3U)

Course title	Functions
Ministry course code	MCR3U
Grade	Grade 11
Course type	University Preparation
Credit value	1.0
Prerequisite	Principles of Mathematics, Grade 10, Academic (MPM2D)
Department	Mathematics
Curriculum policy document	The Ontario Curriculum, Grades 11 and 12: Mathematics, 2007 (revised)
Course development date	August 2026
Course revision	November 2026, by the Principal, Daniel Martinez (updated for the 2026–27 assessment and evaluation policy)
Teacher	Samiul Hoque
Course delivery	Fully online; school year September 1, 2026 – August 31, 2027
Total hours	110

1. Course Description / Rationale

As stated in The Ontario Curriculum, Grades 11 and 12: Mathematics, 2007 (revised):

> This course introduces the mathematical concept of the function by extending students' experiences with linear and quadratic relations. Students will investigate properties of discrete and continuous functions, including trigonometric and exponential functions; represent functions numerically, algebraically, and graphically; solve problems involving applications of functions; investigate inverse functions; and develop facility in determining equivalent algebraic expressions. Students will reason mathematically and communicate their thinking as they solve multi-step problems.

Overall curriculum expectations

By the end of this course, students will:

A. Characteristics of Functions

- **A1** demonstrate an understanding of functions, their representations, and their inverses, and make Functions connections between the algebraic and graphical representations of functions using transformations;
- **A2** determine the zeros and the maximum or minimum of a quadratic function, and solve problems involving quadratic functions, including problems arising from real-world applications;
- **A3** demonstrate an understanding of equivalence as it relates to simplifying polynomial, radical, and rational expressions.

B. Exponential Functions

- **B1** evaluate powers with rational exponents, simplify expressions containing exponents, and describe properties of exponential functions represented in a variety of ways;
- **B2** make connections between the numeric, graphical, and algebraic representations of exponential functions;
- **B3** identify and represent exponential functions, and solve problems involving exponential functions, including problems arising from real-world applications.

C. Discrete Functions

- **C1** demonstrate an understanding of recursive sequences, represent recursive sequences in a variety of ways, and make connections to Pascal's triangle;
- **C2** demonstrate an understanding of the relationships involved in arithmetic and geometric sequences and series, and solve related problems;
- **C3** make connections between sequences, series, and financial applications, and solve problems involving compound interest and ordinary annuities.

D. Trigonometric Functions

- **D1** determine the values of the trigonometric ratios for angles less than 360º; prove simple trigonometric identities; and solve problems using the primary trigonometric ratios, the sine law, and the cosine law;
- **D2** demonstrate an understanding of periodic relationships and sinusoidal functions, and make connections between the numeric, graphical, and algebraic representations of sinusoidal functions;
- **D3** identify and represent sinusoidal functions, and solve problems involving sinusoidal functions, including problems arising from real-world applications.

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2. Outline of Course Content

Units are delivered in the sequence shown. Total scheduled time is 110 hours, including the final evaluation.

Unit	Title	Hours
1	Characteristics of Functions — relations and functions; function notation; domain and range; inverses from tables, graphs and equations; transformations of the parent functions x, x^2, $\sqrt{x}$ and 1/x	18.5
2	Quadratic Functions and Equivalent Expressions — polynomial, radical and rational expressions with restrictions; maximum and minimum values; the number of zeros; families of quadratics; quadratic problems; linear–quadratic systems	22
3	Exponential Functions — zero, negative and rational exponents; graphs and properties of exponential functions; transformations; equivalent forms with different bases; modelling growth and decay	17
4	Discrete Functions and Financial Applications — recursive sequences; Pascal's triangle and binomial expansion; arithmetic and geometric sequences and series; simple and compound interest; annuities and loans	18.5
5	Trigonometric Functions — special angles and angles to 360°; reciprocal ratios and identities; the sine and cosine laws in two and three dimensions; periodic and sinusoidal functions; transformations and sinusoidal models	20
6	Course Review — consolidation of all units in preparation for the culminating task and final examination	7
7	Culminating Task — take-home modelling task drawing on at least three units (term work)	5
—	**Final Evaluation — proctored written final examination**	2
	Total	**110**

This outline reflects 110 hours of scheduled instructional time as required for credit. Units' mastery-based platform lets students progress at their own pace; scheduled hours represent the planned program, and course completion requires demonstrating all expectations regardless of pace.

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3. Teaching and Learning Strategies

Instruction is delivered through the school's online learning platform and is designed for a range of learners preparing for university-level mathematics. Strategies include:

- **Interactive online lessons** — requiring active response at every step: worked examples, immediate feedback on practice questions, and guided investigation, rather than passive video watching.
- **Investigation with technology** — students use the Desmos graphing calculator embedded in lessons to investigate properties of functions, transformations, and sinusoidal models before

formalizing results algebraically.

- **Modelled, guided, and independent practice** — each skill is introduced with modelled solutions, practised with scaffolded hints, and consolidated through independent multi-step problem solving.
- **Project-based application** — each unit ends with an applied project (a function-transformation logo, a product pricing brief, a growth or decay data brief, a first-purchase savings and loan plan, a periodic model) that produces something a student can publish or show.
- **Teacher conferencing** — scheduled one-on-one conferences (video call or written conference) on project work and on diagnosed areas of difficulty, including oral explanation of solutions.
- **Synchronous support sessions** — regularly scheduled live problem-solving sessions; recordings and follow-up materials provided for students unable to attend.
- **Communication of mathematical thinking** — students explain reasoning orally and in writing using precise mathematical vocabulary and appropriate representations (numeric, graphical, algebraic).
- **Differentiated instruction** — flexible pacing within unit deadlines, tiered practice sets, optional extension problems, and multiple entry points to accommodate the range of learner needs, readiness, and interests in an online setting.

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4. Strategies for Assessment and Evaluation of Student Performance

Assessment and evaluation follow Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools, 2010, and the ministry's 2026–27 assessment and evaluation policy.

Component	Weight
Term work (assessment of learning across all units)	65%
Final evaluation — Written final examination (two hours, covering every unit and all four achievement categories), taken in a lockdown browser and supervised by a human proctor arranged with the student once they are eligible to write. It is assessed by the teacher against the published marking scheme. Term work (65%) is made up of five unit tests (35%), the take-home culminating task (12%), five unit quizzes (11%) and five unit assignments (7%); attendance and participation is the remaining 10%.	25%
Attendance and participation — Determined by the ministry's level rubric: Level 4 (80–100%) for 0–2.5% of classes missed without excuse and consistent participation; Level 3 (70–79%) for 2.5–5%; Level 2 (60–69%) for 5–7.5%; Level 1 (50–59%) for 7.5–10%; below 50% for more than 10% missed. Excused absences never count against the student.	10%

Each unit has one assignment, one quiz and one test. Students write each quiz and test in a lockdown browser; assignments are completed at home, so they carry the least weight. Students show their full working by hand, and every question is marked against a written answer key and marking scheme across the four achievement categories.

The culminating task is a take-home modelling task that draws on at least three units. It is assessed with a rubric for each of Knowledge and Understanding, Thinking, Communication and Application, and the teacher may ask the student to explain their model and choices in a conference.

An optional mark booster follows Unit 5: three lessons on complex numbers and polynomial division with one assignment. It is enrichment beyond the MCR3U expectations, outside the 110 scheduled hours, and is not on the culminating task or the final examination. Its mark can only raise the final mark: the booster mark × 2%, capped at 100.

Late and missed assignments, resubmission opportunities, and determination of the report card grade follow the school's assessment policy, with the grade reflecting the student's most consistent level of achievement, with special consideration given to more recent evidence.

Achievement chart categories

Category	Approximate weight
Knowledge and Understanding	30%
Thinking	25%
Communication	20%
Application	25%

Learning skills and work habits are assessed and reported separately from achievement of curriculum expectations.

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5. Considerations for Program Planning

- **Students with special education needs** — accommodations in a student's Individual Education Plan (IEP), such as extended time, text-to-speech, breaks and alternative ways to show learning, are applied to lessons and to every assessment, including timed quizzes, tests and the final examination.
- **English language learners** — lessons state their learning goal and success criteria in plain language, key vocabulary is defined in context, and students can work at their own pace, revisit lessons and ask the teacher for clarification.
- **Environmental education** — where it fits the expectations, examples and projects draw on environmental contexts and data.
- **Equity and inclusive education** — materials reflect a range of perspectives, cultures and experiences; students have flexible pacing and multiple ways to show learning, following the ministry's equity and inclusive education strategy.
- **Financial literacy** — where it fits the expectations, problems use real financial contexts (budgets, interest, prices and costs).

- **First Nations, Métis and Inuit education** — First Nations, Métis and Inuit perspectives, histories and contributions are included where they connect to the course expectations.
- **Information and communications technology** — the course is delivered online; students use the learning platform, graphing and productivity tools, and learn to use online sources and AI tools responsibly and to cite them.
- **Career education** — unit projects connect the course to real careers and to the university and college programs that require it, and students build work they can show to others.
- **Cooperative education and experiential learning** — students may connect course learning to cooperative education and other experiential learning, as described in the course calendar.
- **Health and safety** — students follow the school's guidance on safe and responsible online conduct, digital privacy and healthy screen time; the course has no physical lab or workplace hazards.

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6. Resources

- Units online learning platform (units.school) — interactive lessons, stepped practice with feedback, submission and feedback workflows for all strands.
- Desmos graphing calculator — embedded in lessons for investigation of functions, transformations, exponential models, and sinusoidal models.
- Spreadsheet software (Google Sheets) — financial applications: compound interest, annuities, and the first-purchase savings and loan plan.
- Practice and assessment banks authored to the MCR3U specific expectations, delivered through the platform.
- Curriculum and policy documents: The Ontario Curriculum, Grades 11 and 12: Mathematics, 2007 (revised); Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools, 2010.
- Public library access: students are directed to Ontario public library digital collections for supplementary mathematics reference materials.

Prepared by the Units curriculum team under the direction of the Principal, August 2026.