**MHF4U Course Outline 2012-2013**

This Course Outline is based upon the Ministry of Education and Training Ontario Curriculum for Grade 12 Mathematics as per the revised document of 2007.

***Board:*** Toronto District School Board

***School:*** East York Collegiate Institute

***Curriculum Leader:*** R.Singh

***Developing Teachers:*** P.Kianpour,G.Kyritsis, P. Wiles, R.Singh

***Date of Revision:*** June 2016

***Course Title:*** Advanced Functions, Grade 12, University Preparation

***Grade:*** 12

***Code:*** MHF4U

***Credit Value:*** 1.0

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

or Mathematics for College Technology, Grade 12, College Preparation (MCT4C)

***Textbook:*** Advanced Functions 12, McGraw-Hill Ryerson (2008)

***Resources:*** Advanced Functions 12, Nelson (2008)

Advanced Functions and Introductory Calculus, Harcourt (2002) Calculus and Advanced Functions, McGraw-Hill Ryerson (2002) OAME/OMCA Materials (2007)

Teacher-made Worksheets

Graphing Calculators & Computers

**Course Description**

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. Throughout the course, students will engage in the following processes: Problem Solving, Reasoning and Proving, Reflecting, Selecting Tools and Computational Strategies, Connecting, Representing and Communicating. 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.

**Strands**

Polynomial and Rational Functions 48 periods Trigonometric Functions 25 periods Exponential and Logarithmic Functions 18 periods Characteristics of Functions 11 periods

**Program Planning Considerations**

***Exceptional Students****:* Additional time will be allowed for tests. Additional accommodations 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. ***Co-operative Education****:* These will be provided in association with Guidance Department. ***Mathematics Anxiety****:* Attention will be addressed according to the following:

• Cultural perspectives

• Positive reinforcements

• Variety of assessment techniques

• Group structures

• Consideration for Learning Styles

**Learning Skills**

Assessment of the learning skills will be done on an ongoing basis throughout the academic year by observations of students at 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**

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

• Diagnostic assessment

• Formative assessment

• Performance 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 and evaluation occurs.

• Major evaluations will be announced at least one week in advance.

• Accommodations will be made for school activities, statutory holidays, religious days, cultural days, sports events and other occurrences that may impact on any scheduled evaluation. It is the student’s responsibility to notify teachers of such absences in advance and to make up missed work.

• Absence on the day of an evaluation must be documented. If a student must miss an evaluation, s/he is expected to:

a) see the teacher before the absence to arrange for an alternative date to make up the evaluation; or

b) in case of illness or unexpected absence, present a note to the teacher, signed by a parent or guardian, immediately upon their return to explain the absence. An alternate evaluation will then be scheduled at a mutually convenient time.

• The East York Late Policy applies to all assignments and evaluations. See your Agenda book.

• Cheating will not be tolerated in any form and will be dealt with appropriately.

**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:

|  |  |  |  |
| --- | --- | --- | --- |
| **Term Work:** |  | **70%** | ***Levels of Achievement:*** |
| Knowledge and Understanding: | 40% |  | Level 1: 50 - 59% |
| Application: | 30% |  | Level 2: 60 – 69% |
| Thinking and Inquiry: | 20% |  | Level 3: 70 – 79% |
| Communication: | 10% |  | Level 4: 80 - 100% |
| **Final Summative Evaluation:** |  | **30% Final** |  |

**Communication**

***Access to extra help and mark records***. Students are encouraged to consult their teachers on a regular basis for extra help and guidance as it relates to improving their academic performance. Students are also expected to discuss strategies for improving their grades with their teachers. Students are expected to view their report cards as an indication of their current achievement and discuss with teachers for clarification.

***Communication with Parents/Guardians***. Comments pertaining to academic achievement and learning skills are placed on the report cards are primarily to provide feedback for parents/guardians as well as students. Parent/guardian nights can be used for one to one discussion. At times it may be necessary to contact parents/guardians by telephone to discuss a student’s performance. Parents/guardians are also encouraged to contact teachers as and when the need arises.

**MHF4U Daily Course Outline 2016-2017**

**Textbook:** Advanced Functions 12, McGraw-Hill Ryerson (2008)

**Strand #1: POLYNOMIAL AND RATIONAL FUNCTIONS (48 periods)**

Overall Expectations:

• To identify and describe some key features of polynomial functions, and make connections between the numeric, graphical, and algebraic representations of polynomial functions;

• To identify and describe some key features of the graphs of rational functions, and represent rational functions graphically;

• To solve problems involving polynomial and simple rational equations graphically and algebraically;

• To demonstrate an understanding of solving polynomial and simple rational inequalities.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Per #** | **TOPIC** | **Section** | **ASSIGNMENT** | **Supplementary Resources** |
|  |  |  |  |  |
| **UNIT #1: POLYNOMIAL FUNCTIONS (18 periods)** | | | | |
| 1, 2 & 3 | Course Introduction  Power Functions: key features, end behaviour, interval notation | 1.1 | Investigation p. 5 p. 11, #1-17 | This unit is Investigation- based. TI-83s needed throughout. |
| 4, 5 & 6 | Characteristics of Polynomial Functions:  expanded form, odd vs even, finite differences | 1.2 | Investigations pp. 15-18 pp. 26, #1-18 | Investigation sheet  Regression Instructions Sheet |
| 7, 8 & 9 | Equations & Graphs of Polynomial Functions:  factored form, symmetry | 1.3 | Investigations pp. 30 & 36 pp. 39, #1-15 | Investigation sheets  Practice sheets |
| 10 | TEST #1 |  |  |  |
| 11 & 12 | Transformations | 1.4 | Investigation p. 42 p. 49, #1-16 |  |
| 13 & 14 | Slopes of Secants & Average Rate of Change | 1.5 | Investigation p. 54 p. 62, #1-12 |  |
| 15 & 16 | Slopes of Tangents & Instantaneous Rate of  Change | 1.6 | Investigation p. 65 p. 71, #1-12 |  |
| 17 | Review |  | pp. 74-79 |  |
| 18 | TEST #2 |  |  |  |
|  | | | | |
| **UNIT #2: POLYNOMIAL EQUATIONS & INEQUALITIES (19 periods)** | | | | |
| 1 & 2 | Factoring Review |  | p. 82, #4-7 | Factoring sheets |
| 3 | Division of Polynomials | 2.1 | p. 91, #1-6 |  |
| 4 | The Remainder Theorem | 2.1 | Investigation p. 87 p. 91, #7-22 |  |
| 5 & 6 | The Factor Theorem | 2.2 | Investigation p. 94 p. 102, #1-11 |  |
| 7 | Sum & Difference of Cubes | 2.2 | p. 103, #12-21 |  |
| 8, 9  &10 | TEST #3  Solving Polynomial Equations & Applications:  by hand & with TI-83+ | 2.3 | Investigation p. 104  p. 110, #1-9, 17, 18, 20, 22 | Polynomial sheets |
| 11 & 12 | Applications of Polynomial Equations | 2.3 | p. 111, #10-19, 21 |  |
| 13 | Families of Polynomial Functions | 2.4 | Investigation p. 114 p. 119, #1-22 |  |
| 14 & 15 | Solving Polynomial Inequalities using  Technology | 2.5 | Investigation p. 123 p. 129, #1-17 | Polynomial sheets |
| 16 & 17 | Solving Factorable Polynomial Inequalities  Algebraically | 2.6 | p. 138, #1-13 | Polynomial sheets |
| 18 | Review |  | pp. 140-143 | Review sheet |
| 19 | TEST #4 |  |  |  |
|  | | | | |
| **UNIT #3: RATIONAL FUNCTIONS (11 periods)** | | | | |
| 1 | Reciprocal of a Linear Function | 3.1 | Investigation p. 149 p. 153, #1-15 |  |
| 2 & 3 | Reciprocal of a Quadratic Function | 3.2 | Investigation p. 157 p. 164, #1-18 |  |
| 4 & 5 | Rational Functions of the Form (ax+b)/(cx+d) | 3.3 | Investigation p. 168 p. 174, #1-18 | Investigation sheet |
| 6, 7 & 8 | Solve Rational Equations & Inequalities:  by hand & TI-83 | 3.4 | p. 183, #1-20 |  |
| 9 | Make Connections with Rational Functions & Equations | 3.5 | p. 189, #1-15 |  |
| 10 | Review |  | pp. 192-195 | Review sheet |
| 11 | TEST #5 |  |  |  |

**Strand #2: TRIGONOMETRIC FUNCTIONS (25 periods)**

Overall Expectations:

• To demonstrate an understanding of the meaning of radian measure;

• To make connections between trigonometric ratios and the graphical and algebraic representations of the corresponding trigonometric functions and their reciprocals, and use these connections to solve problems;

• To solve problems involving trigonometric equations and prove trigonometric identities.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Per #** | **TOPIC** | **Section** | **ASSIGNMENT** | **Supplementary Resources** |
|  |  |  |  |  |
| **UNIT #4: TRIGONOMETRY (11 periods)** | | | | |
| 1 & 2 | Radian Measure & Angular Velocity | 4.1 | Investigation p. 202 p. 208, #1-25 | Radian sheets |
| 3 & 4 | Trigonometric Ratios & Special Angles | 4.2 | Investigations pp. 211 & 213 p. 216, #1-20 | Trig Ratio sheets |
| 5 | Equivalent Trigonometric Expressions | 4.3 | Investigations p. 220 & 221 p. 225, #1-23 | Simple Identities sheet |
| 6 & 7 | Compound & Double Angle Formulas | 4.4 | p. 232, #1-21 | Compound Angle sheets |
| 8 & 9 | Prove Trigonometric Identities | 4.5 | p. 240, #1-21 | Identity sheets |
| 10 | Review |  | pp. 244-247 |  |
| 11 | TEST #6 |  |  |  |
|  | | | | |
| **UNIT #5: TRIGONOMETRIC FUNCTIONS (14 periods)** | | | | |
| 1 & 2 | Graphs of Sine, Cosine & Tangent Functions | 5.1 | Investigation p. 252 | Investigation Sheets |
| 3 & 4 | Single Transformations of Sinusoidal Functions | 5.1 | p. 258, #1-15, 17-20 | Investigation Sheet |
| 5 & 6 | Multiple Transformations of Sinusoidal Functions | 5.3 | p. 275, #1-24 | Practice Sheets |
| 7 | Sinusoidal Regression |  | pp. 280-281 |  |
| 8 & 9 | Graphs of Reciprocal Trigonometric Functions | 5.2 | Investigation p. 261 p. 267, #1-18 | Investigation Sheets |
| 10 & 11 | Solve Trigonometric Equations: by hand & TI-83 | 5.4 | p. 287, #1-28 | Practice Sheets |
| 12 | Making Connections & Instantaneous Rates of  Change | 5.5 | p. 296, #1-7, 10, 11, 15 | Application Sheet |
| 13 | Review |  | pp. 300-303 |  |
| 14 | TEST #7 |  |  |  |

**Strand #3: EXPONENTIAL AND LOGARITHMIC FUNCTIONS (18 periods)**

Overall Expectations:

• To demonstrate an understanding of the relationship between exponential expressions and logarithmic expressions, evaluate logarithms, and apply the laws of logarithms to simplify numeric expressions;

• To identify and describe some key features of the graphs of logarithmic functions, make connections between numeric, graphical, and

algebraic representations of logarithmic functions, and solve related problems graphically;

• To solve exponential and simple logarithmic equations in one variable algebraically, including those arising from real-world applications.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UNIT #6: EXPONENTIAL & LOGARITHMIC FUNCTIONS (8 periods)** | | | | |
| 1 & 2 | The Exponential Function & Its Inverse | 6.1 | Investigations pp. 310 & 214 p. 318, #1-23 |  |
| 3 | Logarithms | 6.2 | p. 328, #1-16 |  |
| 4 | Transformations of Logarithmic Functions | 6.3 | Investigation p. 331 p. 338, #1-18 |  |
| 5 | Power Law of Logarithms | 6.4 | p. 347, #1-20 |  |
| 6 | Making Connections to Physical Sciences | 6.5 | p. 353, #1-15 | Application sheets |
| 7 | Review |  | PP. 356-359 |  |
| 8 | TEST #8 |  |  |  |
|  | | | | |
| **UNIT #7: TOOLS & STRATEGIES FOR SOLVING EXPONENTIAL & LOGARITHMIC EQUATIONS (10 periods)** | | | | |
| 1 | Equivalent Forms of Exponential Equations | 7.1 | p. 368, #1-16 |  |
| 2 & 3 | Techniques for Solving Exponential Equations | 7.2 | p. 375, #1-18 |  |
| 4 | Product & Quotient Laws of Logarithms | 7.3 | p. 384, #1-19 |  |
| 5 & 6 | Techniques for Solving Logarithmic Equations | 7.4 | p. 391, #1-13 |  |
| 7 & 8 | Making Connections: Algebraically &  using Regression | 7.5 | p. 404, #1-11 | Application sheets |
| 9 | Review |  | pp. 408-411 |  |
| 10 | TEST #9 |  |  |  |

**Strand #4: CHARACTERISTICS OF FUNCTIONS (11 periods)**

Overall Expectations:

• To 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;

• To compare the characteristics of functions, and solve problems by modeling and reasoning with functions, including problems with

solutions that are not accessible by standard algebraic techniques;

• To 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 an interval and the instantaneous rate of change of a function at a given point.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Per #** | **TOPIC** | **Section** | **ASSIGNMENT** | **Supplementary Resources** |
|  | | | | |
| **UNIT #8: COMBINING FUNCTIONS (11 periods)** | | | | |
| 1 & 2 | Sums & Differences of Functions | 8.1 | Investigation p. 416 p. 424, #1-19 | Investigation sheets |
| 3 & 4 | Products & Quotients of Functions | 8.2 | Investigation p. 429 p. 435, #1-19 | Investigation sheets |
| 5 | Inverse Functions |  | Nelson 1.5, pp. 38-45 |  |
| 6 | Composite Functions | 8.3 | p. 447, #1-20 | Applications sheets |
| 7 & 8 | Inequalities of Combined Functions:  by hand & TI-83 | 8.4 | p. 457, #1-17 |  |
| 9 | Making Connections: Modelling | 8.5 | p. 469, #1-14 |  |
| 10 | Review |  | pp. 472-475 | Review sheet |
| 11 | TEST #10 |  |  |  |
|  | | | | |
|  | **Cumulative Review (Units #1-8)** |  | **Un #1-3: p. 196**  **Un #4-5: p. 304**  **Un #6-8: p. 476**  **Course Review: p. 479** | **Course Review Sheets** |
|  | **FINAL SUMMATIVE EVALUATION (25%)** | | | |