



## Grade 11 Advanced Stream Scheme of Work, Term 1, Academic Year 2022-2023

### Purpose

- to define the **required** Advanced Stream Mathematics Student Learning Outcomes to be covered during the term for this grade;
- to **recommend** the pace at which the Student Learning Outcomes are to be covered. The term's content is broken down into eleven teaching weeks, allowing the coverage of topics within each week to be flexible.

### Assessment

- Assessment details for Term 1 will be communicated separately.

Teachers should incorporate the Standards for Mathematical Practice (SMPs) in their instruction when and where appropriate. The Standards for Mathematical Practice are

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

### Why are the Standards for Mathematical Practice important?

The Standards for Mathematical Practice set expectations for using mathematical language and representations to reason, solve problems, and model in preparation for careers and a wide range of college majors.

## Week 1: Aug. 29 – Sept. 2, 2022

This week can be used to get to know your students, establish classroom routines, and finalize class lists. It is also an opportunity to review prerequisite concepts and skills which students will need for Grade 11 and to administer teacher-created diagnostics.

## Week 2: Sept. 5 – 9, 2022

### Integrated III Module 5 – Exponential Functions

Lessons	Student Learning Outcomes	Common Core State Standards
M5L1 – Graphing Exponential Functions	<ul style="list-style-type: none"> <li>Graph exponential growth functions.</li> <li>Graph exponential decay functions.</li> </ul>	<p><b>F.IF.4</b> For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i></p> <p><b>F.IF.7</b> Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.</p> <p><b>F.IF.7e</b> Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.</p>
M5L2 – Solving Exponential Equations and Inequalities	<ul style="list-style-type: none"> <li>Solve exponential equations in one variable.</li> <li>Solve exponential inequalities in one variable.</li> </ul>	<p><b>A.CED.1</b> Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i></p> <p><b>A.REI.11</b> Explain why the <math>x</math>-coordinates of the points where the graphs of the equations <math>y = f(x)</math> and <math>y = g(x)</math> intersect are the solutions of the equation <math>f(x) = g(x)</math>; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where <math>f(x)</math> and/or <math>g(x)</math> are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.</p>

Week 3: Sept. 12 – 16, 2022		
Lessons	Student Learning Outcomes	Common Core State Standards
M5L3 – Special Exponential Functions	<ul style="list-style-type: none"> <li>Analyze expressions and functions involving the natural base <math>e</math>.</li> </ul>	<p><b>A.CED.2</b> Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</p> <p><b>F.IF.6</b> Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.</p>
M5L4 – Geometric Sequences and Series	<ul style="list-style-type: none"> <li>Generate geometric sequences.</li> <li>Find sums of geometric series.</li> </ul>	<p><b>A.SSE.4</b> Derive the formula for the sum of a geometric series (when the common ratio is not 1), and use the formula to solve problems.</p>

**Week 4: Sept. 19 – 23, 2022**

**Integrated III Module 6 – Logarithmic Functions**

<b>Lessons</b>	<b>Student Learning Outcomes</b>	<b>Common Core State Standards</b>
M6L1 – Logarithms and Logarithmic Functions	<ul style="list-style-type: none"> <li>Write logarithmic expressions in exponential form and write exponential expressions in logarithmic form.</li> <li>Graph and analyze logarithmic functions.</li> </ul>	<p><b>A.SSE.2</b> Use the structure of an expression to identify ways to rewrite it.</p> <p><b>F.IF.7</b> Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.</p> <p><b>F.IF.7e</b> Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.</p>
M6L2 – Properties of Logarithms	<ul style="list-style-type: none"> <li>Solve logarithmic equations using properties of equality.</li> <li>Simplify and evaluate expressions by using the properties of logarithms.</li> </ul>	<p><b>A.CED.1</b> Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i></p>
M6L3 – Common Logarithms	<ul style="list-style-type: none"> <li>Solve exponential equations by using common logarithms.</li> <li>Evaluate logarithmic expressions by using the Change of Base Formula.</li> </ul>	<p><b>A.REI.11</b> Explain why the <math>x</math>-coordinates of the points where the graphs of the equations <math>y = f(x)</math> and <math>y = g(x)</math> intersect are the solutions of the equation <math>f(x) = g(x)</math>; find the solutions approximately, e.g., using technology to graph the functions, make tables of values or find successive approximations. Include cases where <math>f(x)</math> and/or <math>g(x)</math> are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.</p> <p><b>F.LE.4</b> For exponential models, express as a logarithm the solution to <math>ab^{ct} = d</math> where <math>a</math>, <math>c</math> and <math>d</math> are numbers and the base <math>b</math> is 2, 10, or <math>e</math>; evaluate the logarithm using technology.</p>

**Week 5: Sept. 26 – 30, 2022**

<b>Lessons</b>	<b>Student Learning Outcomes</b>	<b>Common Core State Standards</b>
M6L4 – Natural Logarithms	<ul style="list-style-type: none"> <li>Simplify expressions with natural logarithms.</li> <li>Solve exponential equations by using natural logarithms.</li> </ul>	<p><b>A.SSE.2</b> Use the structure of an expression to identify ways to rewrite it.</p> <p><b>F.LE.4</b> For exponential models, express as a logarithm the solution to <math>ab^{ct} = d</math> where <math>a</math>, <math>c</math> and <math>d</math> are numbers and the base <math>b</math> is 2, 10, or <math>e</math>; evaluate the logarithm using technology.</p>
M6L5 – Using Exponential and Logarithmic Functions	<ul style="list-style-type: none"> <li>Write and solve exponential growth equations and inequalities.</li> <li>Write and solve exponential decay equations.</li> </ul>	<p><b>A.CED.1</b> Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i></p> <p><b>F.LE.4</b> For exponential models, express as a logarithm the solution to <math>ab^{ct} = d</math> where <math>a</math>, <math>c</math> and <math>d</math> are numbers and the base <math>b</math> is 2, 10, or <math>e</math>; evaluate the logarithm using technology.</p>

**Week 6: Oct. 3 – 7, 2022**

**Integrated III Module 7 – Rational Functions**

<b>Lessons</b>	<b>Student Learning Outcomes</b>	<b>Common Core State Standards</b>
M7L1 – Multiplying and Dividing Rational Expressions	<ul style="list-style-type: none"> <li>Simplify rational expressions.</li> <li>Simplify rational expressions by multiplying and dividing.</li> </ul>	<b>A.APR.7</b> Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.
M7L2 – Adding and Subtracting Rational Expressions	<ul style="list-style-type: none"> <li>Simplify rational expressions by adding and subtracting.</li> <li>Simplify complex fractions.</li> </ul>	<b>A.APR.7</b> Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.
M7L3 – Graphing Reciprocal Functions	<ul style="list-style-type: none"> <li>Graph reciprocal functions by making tables of values.</li> <li>Graph and write reciprocal functions by using transformations.</li> </ul>	<p><b>F.IF.5</b> Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.</p> <p><b>F.BF.3</b> Identify the effect on the graph of replacing <math>f(x)</math> by <math>f(x) + k</math>, <math>kf(x)</math>, <math>f(kx)</math>, and <math>f(x + k)</math> for specific values of <math>k</math> (both positive and negative); find the value of <math>k</math> given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i></p>

**Week 7: Oct. 10 – 14, 2022**

<b>Lessons</b>	<b>Student Learning Outcomes</b>	<b>Common Core State Standards</b>
M7L4 – Graphing Rational Functions	<ul style="list-style-type: none"> <li>Graph and analyze rational functions with vertical and horizontal asymptotes.</li> <li>Graph and analyze rational functions with oblique asymptotes.</li> </ul>	<p><b>F.IF.4</b> For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i></p> <p><b>F.IF.5</b> Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.</p>
M7L5 – Variation	<ul style="list-style-type: none"> <li>Recognize and solve direct and joint variation equations.</li> <li>Recognize and solve inverse and combined variation equations.</li> </ul>	<p><b>A.CED.1</b> Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i></p> <p><b>A.CED.2</b> Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</p>
M7L6 – Solving Rational Equations and Inequalities	<ul style="list-style-type: none"> <li>Solve rational equations in one variable.</li> <li>Solve rational inequalities in one variable.</li> </ul>	<p><b>A.CED.1</b> Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i></p> <p><b>A.REI.2</b> Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.</p> <p><b>A.REI.11</b> Explain why the <math>x</math>-coordinates of the points where the graphs of the equations <math>y = f(x)</math> and <math>y = g(x)</math> intersect are the solutions of the equation <math>f(x) = g(x)</math>; find the solutions approximately, e.g., using technology to graph the functions, make tables of values or find successive approximations. Include cases where <math>f(x)</math> and/or <math>g(x)</math> are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.</p>

**Week 8: Oct. 17 – 21, 2022**

**Integrated III Module 8 – Inferential Statistics**

<b>Lessons</b>	<b>Student Learning Outcomes</b>	<b>Common Core State Standards</b>
M8L1 – Random Sampling	<ul style="list-style-type: none"> <li>Classify sampling methods and identify bias in samples and survey questions.</li> <li>Distinguish among sample surveys, experiments, and observational studies.</li> </ul>	<p><b>S.IC.1</b> Understand statistics as a process for making inferences about population parameters based on a random sample from that population.</p> <p><b>S.IC.3</b> Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.</p>
M8L2 – Using Statistical Experiments	<ul style="list-style-type: none"> <li>Compare theoretical and experimental probabilities.</li> <li>Determine whether models are consistent with results from simulations of real-life situations.</li> </ul>	<p><b>S.IC.2</b> Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. <i>For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?</i></p> <p><b>S.IC.5</b> Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.</p>
M8L3 – Analyzing Population Data	<ul style="list-style-type: none"> <li>Describe distributions by finding their mean and standard deviation.</li> </ul>	<p><b>S.IC.4</b> Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.</p>



Week 9: Oct. 24 – 28, 2022		
Lessons	Student Learning Outcomes	Common Core State Standards
M8L4 – Normal Distributions	<ul style="list-style-type: none"> <li>Classify variables and analyze probability distributions to determine expected outcomes.</li> <li>Analyze normally distributed variables by using the Empirical Rule.</li> <li>Analyze standardized data and distributions by using z-values.</li> </ul>	<p><b>S.ID.4</b> Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.</p> <p><b>S.IC.6</b> Evaluate reports based on data.</p>
Integrated III Module 9 – Trigonometric Functions		
M9L1 – Angles and Angle Measure	<ul style="list-style-type: none"> <li>Draw angles in standard position and identify coterminal angles.</li> <li>Convert between degrees and radian measures and find arc lengths by using central angles.</li> </ul>	<p><b>F.TF.1</b> Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.</p>

**Week 10: Oct. 31 – Nov. 4, 2022**

<b>Lessons</b>	<b>Student Learning Outcomes</b>	<b>Common Core State Standards</b>
M9L2 – Trigonometric Functions of General Angles	<ul style="list-style-type: none"> <li>Find values of trigonometric functions for acute angles.</li> <li>Find values of trigonometric functions of general angles.</li> <li>Find values of trigonometric functions by using reference angles.</li> </ul>	<b>F.TF.3</b> Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$ , $\pi/4$ , and $\pi/6$ , and use the unit circle to express the values of sine, cosine, and tangent for $x$ , $\pi + x$ , and $2\pi - x$ in terms of their values for $x$ , where $x$ is any real number.
M9L3 – Circular and Periodic Functions	<ul style="list-style-type: none"> <li>Find values of trigonometric functions given a point on a unit circle or the measure of a special angle.</li> <li>Find values of trigonometric functions that model periodic events.</li> </ul>	<p><b>F.TF.2</b> Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.</p> <p><b>F.TF.5</b> Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.</p>

**Week 11: Nov. 7 – 11, 2022**

<b>Lessons</b>	<b>Student Learning Outcomes</b>	<b>Common Core State Standards</b>
M9L4 – Graphing Sine and Cosine Functions	<ul style="list-style-type: none"> <li>Graph and analyze sine and cosine functions.</li> <li>Model periodic real-world situations with sine and cosine functions.</li> </ul>	<p><b>F.IF.4</b> For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i></p>
M9L5 – Graphing Other Trigonometric Functions	<ul style="list-style-type: none"> <li>Graph and analyze tangent functions.</li> <li>Graph and analyze reciprocal trigonometric functions.</li> </ul>	<p><b>F.IF.7</b> Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.</p> <p><b>F.IF.7e</b> Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.</p>

Week 12: Nov. 14 – 18, 2022		
Lessons	Student Learning Outcomes	Common Core State Standards
M9L6 – Translations of Trigonometric Graphs	<ul style="list-style-type: none"> <li>Graph horizontal translations of trigonometric functions.</li> <li>Graph vertical translations of trigonometric functions.</li> </ul>	<p><b>F.IF.7</b> Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.</p> <p><b>F.IF.7e</b> Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.</p> <p><b>F.BF.3</b> Identify the effect on the graph of replacing <math>f(x)</math> by <math>f(x) + k</math>, <math>kf(x)</math>, <math>f(kx)</math>, and <math>f(x + k)</math> for specific values of <math>k</math> (both positive and negative); find the value of <math>k</math> given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i></p>
M9L7 – Inverse Trigonometric Functions	<ul style="list-style-type: none"> <li>Find values of angle measures by using inverse trigonometric functions.</li> </ul>	<p><b>F.TF.7</b> Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.</p>

<p><b>Week 13: Nov. 21 – 25, 2022</b></p> <p><b>Week 14: Nov. 28 – Dec. 2, 2022</b></p> <p><b>Week 15: Dec. 5 – 9, 2022</b></p>
<p><b>Term 1 Revision and End-of-Term Exam</b></p> <p><b>Exam date to be determined by the Assessment Directorate</b></p>