



## Grade 11 Advanced Stream Mathematics Scheme of Work, Term 2, 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 nine teaching weeks, allowing the coverage of topics within each week to be flexible.

### Assessment

- Assessment details for Term 2 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: Jan. 2 – 6, 2023**

**Chapter 5 – Systems of Equations and Matrices**

<b>Lessons</b>	<b>Student Learning Outcomes</b>	<b>Common Core State Standards</b>
<p>C5L2 – Matrix Multiplication, Inverses, and Determinants</p>	<ul style="list-style-type: none"> <li>• Multiply matrices.</li> <li>• Find determinants and inverses of <math>2 \times 2</math> and <math>3 \times 3</math> matrices.</li> </ul>	<p><b>N.VM.6</b> Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.</p> <p><b>N.VM.7</b> Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.</p> <p><b>N.VM.8</b> Add, subtract, and multiply matrices of appropriate dimensions.</p> <p><b>N.VM.9</b> Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.</p> <p><b>N.VM.10</b> Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.</p> <p><b>A.REI.8</b> Represent a system of linear equations as a single matrix equation in a vector variable.</p> <p><b>A.REI.9</b> Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension <math>3 \times 3</math> or greater).</p>

**Week 2: Jan. 9 – 13, 2023**

<b>Lessons</b>	<b>Student Learning Outcomes</b>	<b>Common Core State Standards</b>
C5L3 – Solving Linear Systems Using Inverses and Cramer’s Rule	<ul style="list-style-type: none"> <li>• Solve systems of linear equations using inverse matrices.</li> <li>• Solve systems of linear equations using Cramer’s Rule.</li> </ul>	<p><b>N.VM.6</b> Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.</p> <p><b>N.VM.7</b> Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.</p>
C5L5 – Linear Optimization	<ul style="list-style-type: none"> <li>• Use linear programming to solve applications.</li> <li>• Recognize situations in which there are multiple points at which a function is optimized.</li> </ul>	<p><b>N.VM.8</b> Add, subtract, and multiply matrices of appropriate dimensions.</p> <p><b>A.REI.8</b> Represent a system of linear equations as a single matrix equation in a vector variable.</p> <p><b>A.REI.9</b> Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension <math>3 \times 3</math> or greater).</p>

**Week 3: Jan. 16 – 20, 2023**

**Chapter 6 – Conic Sections and Parametric Equations**

<b>Lessons</b>	<b>Student Learning Outcomes</b>	<b>Common Core State Standards</b>
C6L1 – Parabolas	<ul style="list-style-type: none"> <li>• Write equations of parabolas in standard form.</li> <li>• Graph parabolas.</li> </ul>	<p><b>G.GPE.2</b> Derive the equation of a parabola given a focus and directrix.</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>
C6L2 – Circles	<ul style="list-style-type: none"> <li>• Write equations of circles.</li> <li>• Graph circles.</li> </ul>	<p><b>G.GPE.1</b> Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.</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>

**Week 4: Jan. 23 – 27, 2023**

<b>Lessons</b>	<b>Student Learning Outcomes</b>	<b>Common Core State Standards</b>
C6L3 – Ellipses	<ul style="list-style-type: none"> <li>• Write equations of ellipses.</li> <li>• Graph ellipses.</li> </ul>	<p><b>G.GPE.3</b> Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.</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>
C6L4 – Hyperbolas	<ul style="list-style-type: none"> <li>• Write equations of hyperbolas.</li> <li>• Graph hyperbolas.</li> </ul>	

**Week 5: Jan. 30 – Feb. 3, 2023**

Lessons	Student Learning Outcomes	Common Core State Standards
C6L6 – Solving Linear-Nonlinear Systems	<ul style="list-style-type: none"> <li>Solve systems of linear and nonlinear equations algebraically and graphically.</li> <li>Solve systems of linear and nonlinear inequalities graphically.</li> </ul>	<p><b>A.REI.7</b> Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line <math>y = -3x</math> and the circle <math>x^2 + y^2 = 3</math>.</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 6: Feb. 6 – 10, 2023**

Lessons	Student Learning Outcomes	Common Core State Standards
C6L8 – Parametric Equations	<ul style="list-style-type: none"> <li>Graph parametric equations.</li> <li>Solve problems related to the motion of projectiles.</li> </ul>	<p><b>F.IF.C.8</b> Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.</p> <p><b>F.IF.C.9</b> Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</p>

**Week 7: Feb. 13 – 17, 2023**

**Chapter 7 – Vectors**

Lessons	Student Learning Outcomes	Common Core State Standards
C7L1 – Introduction to Vectors	<ul style="list-style-type: none"> <li>• Represent and operate with vectors geometrically.</li> <li>• Solve vector problems and resolve vectors into their rectangular components.</li> </ul>	<p><b>N.VM.1</b> Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., <math>\vec{v}</math>, <math> \mathbf{v} </math>, <math>\ \mathbf{v}\ </math>, <math>\mathbf{v}</math>).</p> <p><b>N.VM.2</b> Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.</p> <p><b>N.VM.3</b> Solve problems involving velocity and other quantities that can be represented by vectors.</p>
C7L2 – Vectors in the Coordinate Plane	<ul style="list-style-type: none"> <li>• Represent and operate with vectors in the coordinate plane.</li> <li>• Write a vector as a linear combination of unit vectors.</li> </ul>	<p><b>N.VM.4</b> Add and subtract vectors.</p> <p><b>N.VM.4a.</b> Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.</p> <p><b>N.VM.4b.</b> Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.</p> <p><b>N.VM.4c.</b> Understand vector subtraction <math>\mathbf{v} - \mathbf{w}</math> as <math>\mathbf{v} + (-\mathbf{w})</math>, where <math>-\mathbf{w}</math> is the additive inverse of <math>\mathbf{w}</math>, with the same magnitude as <math>\mathbf{w}</math> and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.</p>

**Week 8: Feb. 20 – 24, 2023**

Lessons	Student Learning Outcomes	Common Core State Standards
C7L3 – Dot Products and Vector Projection	<ul style="list-style-type: none"> <li>• Find the dot product of two vectors and use the dot product to find the angle between them.</li> <li>• Find the projection of one vector onto another.</li> </ul>	<p><b>N.VM.5</b> Multiply a vector by a scalar.</p> <p><b>N.VM.5a.</b> Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as <math>c(v_x, v_y) = (cv_x, cv_y)</math>.</p> <p><b>N.VM.5b.</b> Compute the magnitude of a scalar multiple <math>cv</math> using <math>\ cv\  =  c v</math>. Compute the direction of <math>cv</math> knowing that when <math> c v \neq 0</math>, the direction of <math>cv</math> is either along <math>v</math> (for <math>c &gt; 0</math>) or against <math>v</math> (for <math>c &lt; 0</math>).</p> <p><b>N.VM.11</b> Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.</p>
C7L4 – Vectors in Three-Dimensional Space	<ul style="list-style-type: none"> <li>• Plot points and vectors in the three-dimensional coordinate system.</li> <li>• Express vectors algebraically and operate with vectors in space.</li> </ul>	<p><b>N.VM.1</b> Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., <math>\vec{v}</math>, <math> v </math>, <math>\ v\ </math>, <math>v</math>).</p> <p><b>N.VM.4</b> Add and subtract vectors.</p> <p><b>N.VM.4a.</b> Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.</p> <p><b>N.VM.5</b> Multiply a vector by a scalar.</p> <p><b>N.VM.5b.</b> Compute the magnitude of a scalar multiple <math>cv</math> using <math>\ cv\  =  c v</math>. Compute the direction of <math>cv</math> knowing that when <math> c v \neq 0</math>, the direction of <math>cv</math> is either along <math>v</math> (for <math>c &gt; 0</math>) or against <math>v</math> (for <math>c &lt; 0</math>).</p>

<b>Week 9: Feb. 27 – March 3, 2023</b>		
<b>Lessons</b>	<b>Student Learning Outcomes</b>	<b>Common Core State Standards</b>
C7L5 – Dot and Cross Products of Vectors in Space	<ul style="list-style-type: none"> <li>Find dot products of and angles between vectors in space.</li> <li>Find cross products of vectors in space, and use cross products to find area and volume.</li> </ul>	<p><b>N.VM.4</b> Add and subtract vectors.</p> <p><b>N.VM.4a.</b> Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.</p> <p><b>N.VM.11</b> Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.</p>

<p><b>Week 10: March 6 – 10, 2023</b></p> <p><b>Week 11: March 13 – 17, 2023</b></p> <p><b>Week 12: March 20 – 24, 2023</b></p>
<p><b>Term 2 Revision and End-of-Term Exam</b></p> <p><b>Exam date to be determined by the Assessment Directorate</b></p>