A Comparison of Expectations in OAC Algebra and Geometry and Grade 12 Geometry and Discrete Mathematics

Items related to expected use of technology appear in bold italics.

Content Area	OAC Algebra and Geometry	Geometry and Discrete Mathematics
Operating with Geometric and Cartesian Vectors	Similar content as the new course with the following exception: - linear combinations of vectors (dependence and independence) not part of the new course	• represent vectors as directed line segments; • perform the operations of addition, subtraction, and scalar multiplication on geometric vectors; • determine the components of a geometric vector and the projection of a geometric vector; • model and solve problems involving velocity and force; • determine and interpret the dot product and cross product of geometric vectors; • represent Cartesian vectors in two-space and in three-space as ordered pairs or ordered triples; • perform the operations of addition, subtraction, scalar multiplication, dot product, and cross product on Cartesian vectors.
Determining Intersections of Lines and Planes in Three-Space	Similar content as the new course with the following exception: - row reduction of matrices is stressed over elimination to solve a system of equations	• determine the vector and parametric equations of lines in two-space and the vector, parametric, and symmetric equations of lines in three-space; • determine the intersections of lines in three-space; • determine the vector, parametric, and scalar equations of planes; • determine the intersection of a line and a plane in three-space; • ***solve systems of linear equations involving up to three unknowns, using row reduction of matrices, with and without the aid of technology;*** • interpret row reduction of matrices as the creation of a new linear system equivalent to the original; • determine the intersection of two or three planes by setting up and solving a system of linear equations in three unknowns;

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Determining Intersections of Lines and Planes in Three-Space continued …		• interpret a system of two linear equations in two unknowns and a system of three linear equations in three unknowns geometrically, and relate the geometrical properties to the type of solution set the system of equations possesses; • solve problems involving the intersections of lines and planes, and present the solutions with clarity and justification**.**
Proving Properties of Plane Figures by Deductive, Algebraic, and Vector Methods	Proof was introduced in earlier grades. Students entered Algebra and Geometry with some understanding of proof techniques. This is the first exposure to the notion of proof for students coming through the new grade 9 –11 courses.	• demonstrate an understanding of the principles of deductive proof (e.g., the role of axioms; the use of “if . . . then” statements; the use of “if and only if” statements and the necessity to prove them in both directions; the fact that the converse of a proposition differs from the proposition) and of the relationship of deductive proof to inductive reasoning; • prove some properties of plane figures (e.g., circles, parallel lines, congruent triangles, right triangles), using deduction; • prove some properties of plane figures (e.g., the midpoints of the sides of a quadrilateral are the vertices of a parallelogram; the line segment joining the midpoints of two sides of a triangle is parallel to the third side) algebraically, using analytic geometry; • prove some properties of plane figures, using vector methods; • prove some properties of plane figures, using indirect methods; • ***demonstrate an understanding of the relationship between formal proof and the illustration of properties that is carried out by using dynamic geometry software.***

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Using a Variety of Strategies to Solve Problems	Not dealt with directly in Algebra and Geometry. Assumption made that students entered the course familiar with many of these techniques.	• solve problems by effectively combining a variety of problem-solving strategies (e.g., brainstorming, considering cases, choosing algebraic/geometric/vector or direct/indirect approaches, working backwards, visualizing by using concrete materials or diagrams or software, iterating, varying parameters, creating a model, introducing a coordinate system); • generate multiple solutions to the same problem; • ***use technology effectively in making and testing conjectures;*** • solve complex problems and present the solutions with clarity and justification.
Completing Significant Problem-Solving Tasks Independently	Not dealt with directly in Algebra and Geometry.	• solve problems of significance, working independently, as individuals and in small groups; • solve problems requiring effort over extended periods of time; • demonstrate significant learning and the effective use of skills in tasks such as solving challenging problems, researching problems, applying mathematics, creating proofs, ***using technology effectively***, and presenting course topics or extensions of course topics.

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Using Counting Techniques	NOT IN THE COURSE – dealt with in OAC FINITE	• solve problems, using the additive and multiplicative counting principles; • express the answers to permutation and combination problems, using standard combinatorial symbols [e.g., , P(*n*, *r*)]; • evaluate expressions involving factorial notation, using appropriate methods (e.g., evaluate mentally, by hand, by using a calculator); • solve problems involving permutations and combinations, including problems that require the consideration of cases; • explain solutions to counting problems with clarity and precision; • describe the connections between Pascal's triangle, values of , and values for the binomial coefficients; • solve problems, using the binomial theorem to determine terms in the expansion of a binomial
Using Mathematical Induction to Prove Results	Similar content as the new course. Students entered OAC Algebra and Geometry familiar with the use of sigma notation.	• demonstrate an understanding of the principle of mathematical induction; • use sigma notation to represent a series or the sum of a series; • prove the formulas for the sums of series, using mathematical induction; • prove the binomial theorem, using mathematical induction; • prove relationships between the coefficients in Pascal's triangle, by mathematical induction and directly.

Content Area	OAC Algebra and Geometry	Geometry and Discrete Mathematics
Transformations and Matrices	• Determining the images and equations under translation of relations defined by $x^2 + y^2 = r^2$, $y^2 = ax$, $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, • Determining the translation that will eliminate the first-degree terms in equations of the form $x^2 + y^2 + 2gx + 2fy + c = 0$, $ax^2 + by^2 + 2gx + 2fy + c + 0$, for $ab > 0$ and for $ab < 0$. • Defining a column vector as a 2 x 1 matrix. • Representing reflections, dilatations, two-way stretches, shears, projections, and rotations by matrices. • Interpreting the product of a matrix and a vector as a transformation of the vector. • Interpreting the products of 2 x 2 matrices as the composition of transformations. • Illustrating the non-commutativity of matrix multiplication • Defining the transpose of a matrix, X^t. • Relating equations of the form $X^tAX = K$, $A = \begin{pmatrix} a & h \\ h & b \end{pmatrix}$, $X = \begin{pmatrix} x \\ y \end{pmatrix}$ with conic sections.	NOT IN THE COURSE

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Content Area	OAC Algebra and Geometry	Geometry and Discrete Mathematics
Transformations and Matrices continued…	• Determining matrix equations of conic sections under rotation. • Determining the rotation that will eliminate the xy term in equations of the form $ax^2 + 2hxy + by^2 = k$, for $ab > 0$ and for $ab < 0$	NOT IN THE COURSE
Complex Numbers	• Expressing a complex number as an ordered pair and in the form $a + bi$, $i^2 = -1$. • Adding, subtracting, multiplying and dividing complex numbers. • Relating complex numbers to the solution of quadratic equations. • Illustrating complex numbers geometrically: defining modulus, argument, and complex conjugates: writing complex numbers in polar form and in exponential form $re^{i\theta}$ • Illustrating geometrically complex conjugates and expressions such as $z + w$, $\frac{1}{z}$ and zw • Generalizing the product of complex numbers to De Moivre's theorem. • Determining the *n*th roots of complex numbers; illustrating these graphically	NOT IN THE COURSE – some of this content is now in the Grade 11 U course MCR3U