Board/Authority Authorized Course Framework Template

School District/Independent School Authority Name: School District 33	**School District/Independent School Authority Number (e.g. SD43, Authority #432):** SD33
Developed by: Derek Balsillie	**Date Developed:** May 2/2024
School Name: Sardis Secondary School	**Principal's Name:** Lynnet Schramm
Superintendent Approval Date (for School Districts only):	**Superintendent Signature (for School Districts only):**
Board/Authority Approval Date:	**Board/Authority Chair Signature:**
Course Name: University Prep Mathematics 12	**Grade Level of Course:** 12
Number of Course Credits: 4	**Number of Hours of Instruction:**

Board/Authority Prerequisite(s): Pre-Calculus 12

Special Training, Facilities or Equipment Required: N/A

Course Synopsis:

This course is designed to cover the concepts that are left out of the Pre-Calculus stream of Mathematics that are important prerequisites for many university level math courses. Although Pre-calculus goes into great detail in algebra it leaves out many branches of mathematics essential for success in programs like engineering. Concepts to be covered include geometry, logic and reasoning, combinatorics, probability, statistics, and linear algebra. This course is a high-level mathematics course designed for those who have completed Pre-Calculus 12 and/or are interested in attending Canadian and American universities. This course goes into great detail learning these concepts in a university classroom atmosphere in all of these conceptual areas making students who take this course feeling well prepared in secondary school mathematics for university.

Goals and Rationale:

-to prepare students mathematically for university who are interested in going into mathematical intensive programs in University by teaching all concepts of math that are at our disposal at the high school level.

-to provide students with an opportunity to visit various universities through field trips at UBC, UFV, etc.

-to help students understand the application process to programs and housing to local and American universities

-to provide students with a deeper understanding of the different academic and personal duties of being a university student and maintaining a healthy mindset throughout the application process and help them make a smooth transition from Secondary school to University.

Aboriginal Worldviews and Perspectives:

This course emphasizes experiential learning and embodies the many of the First Peoples principals of learning:

-Learning ultimately supports the well-being of the self, the family, and the community.

-Learning is holistic, reflexive, reflective, experiential, and relational.

-Learning involves recognizing the consequences of one's actions.

-Learning requires the exploration of one's identity.

Course Name: University Prep Mathematics 12 **Grade:12**

BIG IDEAS

Using **Diagrams** to investigate, communicate, and discover properties and relations in **geometry.**	Understanding the **proving process** beginning with conjecturing, looking for counter-examples, and refining the conjecture, and the process may end with a written proof.	**Probabilistic thinking** informs decision making in situations involving chance and uncertainty..	**Statistics** plays an integral role in research, decision making, and policy in society

Learning Standards

Curricular Competencies	Content
Students are expected to do the following: **Reasoning and modelling** • Develop **thinking strategies** to solve puzzles and play games • Engage in **spatial reasoning** in a dynamic environment • Explore, **analyze**, and apply mathematical ideas using **reason**, **technology**, and **other tools** • **Estimate reasonably** and demonstrate **fluent, flexible, and strategic thinking** about number • **Model** with mathematics in **situational contexts** • **Think creatively** and with **curiosity and wonder** when exploring problems **Understanding and solving** • Develop, demonstrate, and apply conceptual understanding of mathematical ideas through play, story, **inquiry**, and problem solving	*Students are expected to know the following:* **Unit 1: Geometry** • **Fundamentals of geometry** • **Circle properties** • **Geometry Proofs** **Unit 2: Set Theory** • **Venn Diagrams** • **Converse and Contrapositive reasoning** • **Unions and intersections** • **Deductive and Inductive reasoning** **Unit 3: Combinatorics** • **Permutations and Combinations** • **Simplifying Factoring** **Unit 4: Probability**

- **Visualize** to explore and illustrate geometric concepts and relationships
- Apply **flexible and strategic approaches** to **solve problems**
- Solve problems with **persistence and a positive disposition**
-

Engage in problem-solving experiences **connected** with place, story, cultural practices, and perspectives relevant to local First Peoples communities, the local community, and other cultures

Communicating and representing

- **Explain, justify,** and evaluate geometric ideas and **decisions** in **many ways**
- **Represent** mathematical ideas in concrete, pictorial, and symbolic forms
- Use geometric vocabulary and language to contribute to **discussions** in the classroom
- Take risks when offering ideas in classroom **discourse**

Connecting and reflecting

- **Reflect** on geometric thinking
- **Connect mathematical concepts** with each other, other areas, and personal interests
- Use **mistakes** as **opportunities to advance learning**

Incorporate First Peoples worldviews, perspectives, **knowledge**, and **practices** to make connections with computer science concepts

- **Independence vs. Dependence**
- **Mutually exclusive events**
- **Conditional Probability**
- **Binomial Theorem**

Unit 5: Statistics

- **Mean, Median, Mode, and Standard Deviation**
- **Normal Distribution**
- **Binomial Statistics**
- **Confidence Intervals**

Unit 6: Conic Sections

- **Parabolas**
- **Circles**
- **Ellipses**
- **Hyperbolas**

Big Ideas – Elaborations

- **Diagrams:**

  Sample questions to support inquiry with students:
  - How would we describe a specific geometric object to someone who cannot see it?
  - What properties can we infer from a diagram?
  - What behaviours can we infer from a dynamic diagram?
- **definitions:**
  - are seldom the starting point in geometry

  Sample questions to support inquiry with students:
  - How does variation help to refine our definitions of shapes?
  - How would we define a square (or a circle) in different ways? When would one definition be better to work with than another?
  - How can the definition of a shape be used in constructing the shape?
  - How can we modify a definition of a shape to define a new shape?
- **proving process:**

  Sample questions to support inquiry with students:
  - Can we make a conjecture about the diagonals of a polygon? Can we find a counter-example to our conjecture?
  - How can one conjecture about a *specific* shape lead to making another more *general* conjecture about a family of shapes?
  - How can we be sure that a proof is complete?
  - Can we find a counter-example to a conjecture?
  - How can different proofs bring out different understandings of a relationship?
- **Geometry:**
  - Geometry is more than a list of axioms and deductions. Non-Western and modern geometry is concerned with shape and space and is not always axiomatic. It is not always about producing a theorem; rather, it is about modelling mathematical and non-mathematical phenomena
    using geometric objects and relations. Today geometry is used in a multitude of disciplines, including animation, architecture, biology, carpentry, chemistry, medical imaging, and art.

  Sample questions to support inquiry with students:
  - Can we find geometric relationships in local First Peoples art or culture?
  - Can we make geometric connections to story, language, or past experiences?
  - What do we notice about and how would we construct common shapes found in local First Peoples art?
  - How has the notion of “proof” changed over time and in different cultures?

How are geometric ideas implemented in modern professions?

Curricular Competencies – Elaborations

- **thinking strategies:**
  - using reason to determine winning strategies
  - generalizing and extending
- **spatial reasoning:**
  - being able to think about shapes (real or imagined) and mentally transform them to notice relationships
- **analyze:**
  - examine the structure of and connections between geometric ideas (e.g., parallel and perpendicular lines, circle geometry, constructing tangents, transformations)
- **reason:**
  - inductive and deductive reasoning
  - predictions, generalizations, conclusions drawn from experiences (e.g., with puzzles, games, and coding)
- **technology:**
  - graphing technology, dynamic geometry, calculators, virtual manipulatives, concept-based apps
  - can be used for a wide variety of purposes, including:
    - exploring and demonstrating geometrical relationships
    - organizing and displaying data
    - generating and testing inductive conjectures
    - mathematical modelling
- **other tools:**
  - paper and scissors, straightedge and compass, ruler, and other concrete materials
- **Estimate reasonably:**
  - be able to defend the reasonableness of an estimated value or a solution to a problem or equation (e.g., congruencies, angles, lengths)
- **fluent, flexible, and strategic thinking:**
  - being able to generate a family of shapes and apply characteristics across the family
- **Model:**
  - use mathematical concepts and tools to solve problems and make decisions (e.g., in real-life and/or abstract scenarios)
  - take a complex, essentially non-mathematical scenario and figure out what mathematical concepts and tools are needed to make sense of it
- **situational contexts:**
  - including real-life scenarios and open-ended challenges that connect mathematics with everyday life

- **Think creatively:**
  - by being open to trying different strategies

  - refers to creative and innovative mathematical thinking rather than to representing math in a creative way, such as through art or music
- **curiosity and wonder:**
  - asking questions to further understanding or to open other avenues of investigation
- **inquiry:**
  - includes structured, guided, and open inquiry
  - noticing and wondering
  - determining what is needed to make sense of and solve problems
- **Visualize:**
  - create and use mental images to support understanding
  - Visualization can be supported using dynamic materials (e.g., graphical relationships and simulations), concrete materials, drawings, and diagrams.
- **flexible and strategic approaches:**
  - deciding which mathematical tools to use to solve a problem
  - choosing an effective strategy to solve a problem (e.g., guess and check, model, solve a simpler problem, use a chart, use diagrams, role-play)
- **solve problems:**
  - interpret a situation to identify a problem
  - apply mathematics to solve the problem
  - analyze and evaluate the solution in terms of the initial context
  - repeat this cycle until a solution makes sense
- **persistence and a positive disposition:**
  - not giving up when facing a challenge
  - problem solving with vigour and determination
- **connected:**
  - through daily activities, local and traditional practices, popular media and news events, cross-curricular integration
  - by posing and solving problems or asking questions about place, stories, and cultural practices
- **Explain and justify:**
  - use geometrical arguments to convince
  - includes anticipating consequences
- **decisions:**
  - Have students explore which of two scenarios they would choose and then defend their choice.

- **many ways:**
  - including oral, written, visual, gestures use of technology

- communicating effectively according to what is being communicated and to whom

- **Represent:**
  - concretely, diagrammatically, symbolically, including using models, tables, graphs, words, numbers, symbols
- **discussions:**
  - partner talks, small-group discussions, teacher-student conferences
- **discourse:**
  - is valuable for deepening understanding of concepts
  - can help clarify students' thinking, even if they are not sure about an idea or have misconceptions
- **Reflect**
  - share the geometric thinking of self and others, including evaluating strategies and solutions, finding counter-examples, extending, posing new problems and questions, proving results
- **Connect mathematical concepts:**
  - to develop a sense of how mathematics helps us understand ourselves and the world around us (e.g., daily activities, local and traditional practices, popular media and news events, social justice, cross-curricular integration)
- **mistakes:**
  - range from calculation errors to misconceptions
- **opportunities to advance learning:**
  - by:
    - analyzing errors to discover misunderstandings
    - making adjustments in further attempts
    - identifying not only mistakes but also parts of a solution that are correct
- **Incorporate:**
  - by:
    - collaborating with Elders and knowledge keepers among local First Peoples
    - exploring the First Peoples Principles of Learning (e.g., Learning is holistic, reflexive, reflective, experiential, and relational [focused on connectedness, on reciprocal relationships, and a sense of place]; Learning involves patience and time)
    - making explicit connections with learning mathematics
    - exploring cultural practices and knowledge of local First Peoples and identifying mathematical connections
- **knowledge:**
  - local knowledge and cultural practices that are appropriate to share and that are non-appropriated

Content – Elaborations

Unit 1: Geometry

- **constructions:**

Content – Elaborations

- angles, triangles, triangle centres, quadrilaterals

- **parallel and perpendicular:**
  - angle bisector, perpendicular bisector, transversal lines

- **circles as tools:**
  - constructing equal segments, midpoints

- **circle geometry:**
  - properties of chords, angles, and tangents to mobilize the proving process

- **constructing tangents:**
  - lines tangent to circles, circles tangent to circles, circles tangent to three objects

- **geometry proofs:**
  - prove geometry theorems using basic geometry and circle geometry

Unit 2: Logic and Reasoning

- **Venn Diagrams**
  -creating Venn diagrams to give a visual representation of subsets of a population

- **Converse and Contrapositive reasoning**
  -making a conditional statement and using logic and reasoning to prove or disprove statement through a counterexample

- **Unions and intersections**
  -investigating unions and intersections using “and” , “or’ formulas and representing through a Venn diagram

Unit 3: Combinatorics

- **Permutations and Combinations**
  -Use various systematic counting methods to calculate total number of combinations and permutations
  -Distinguish the difference between a permutation and a combination from the context of the question whether order is important or not

- **Simplifying Factorials**
  -Use algebraic skills dealing with the simplification of rational expressions and factoring to simplifying factorials

Unit 4: Probability

- **Independence vs. Dependence**
  -introduce definitions of an event, sample space, and experiment

Content – Elaborations

-use formula for independence to show independence or dependence mathematically

- **Mutually exclusive events**
  -investigating probabilities using “and” , “or’ formulas and calculating probabilities through a Venn diagram

- **Conditional Probability**
  -Using Bayes’ Theorem and tree diagrams to solve complex probabilities

- **Binomial Theorem**
  -calculating probabilities using the binomial theorem
  -calculating probabilities using the “binompdf and binomcdf” on the TI-83 plus graphing calculator

Unit 5: Statistics

- **Mean, Median, Mode, and standard deviation**
  -calculating mean. Median, and mode from a data set using algebra
  -calculating mean. Median, and mode from a data set using the TI-83 plus graphing calculator

- **Normal Distribution**
  -investigate normal distributions in the real world
  -calculate mean and z-scores for a data set
  -calculate probabilities of events occurring from a normal distribution
  -calculating probabilities from a normal distribution using the TI-83 plus graphing calculator
  -converting a Normal Distribution to a Standard Normal distribution by converting ”X-scores” to “Z-scores”

- **Binomial Statistics**
  -investigate binomial distributions in the real world
  -calculate mean and z-scores for a binomial distribution
  -calculate probabilities of events occurring from a binomial distribution
  -calculating probabilities from a binomial distribution using the TI-83 plus graphing calculator

- **Confidence Intervals**
  -estimate of the whole population by using information obtained from a sample, and the specific confidence level of the estimate.

Unit 6: Conic Sections

- **Parabolas**
  -investigate parabolas by looking at the cross section of a double-napped cone
  -solve real life engineering problems by representing data as a parabola
- **Circles**

Content – Elaborations

-investigate circles by looking at the cross section of a double-napped cone
-introduce the standard form of a circle centered at (h,k)
-convert from standard to general form

- **Ellipses**
  -investigate ellipses by looking at the cross section of a double-napped cone
  -introduce the standard form of an ellipse centered at (h,k)
  -convert from standard to general form
  -determine major and minor axis of an ellipse
  -word problems dealing with major and minor axis and Foci of an ellipse

- **Hyperbolas**
  -investigate hyperbolas by looking at the cross section of a double-napped cone
  -introduce the standard form of the hyperbola centered at (h,k)
  -convert from standard to general form
  -determine transverse and conjugate axis of a hyperbola
  -word problems dealing with transverse and conjugate axis of a hyperbola

Recommended Instructional Components:

-Direct instruction and demonstrations

-Guided practice and feedback

-Group work and peer teaching

-Project-based application of content

-Field trips to local Universities

Recommended Assessment Components:

Students will be graded based on summative assessment, guided by clear expectations, will be ongoing throughout the course and will include teacher, self and peer feedback. Most universities evaluate their students using summative assessment techniques therefore I will be assessing these students in a similar manner to help them with understanding what is being asked of them to produce in their university math courses.

Assignments and Projects:	15%
Exams/Quizzes:	85%

Learning Resources:

Addison Wesley Mathematics 12 Textbooks. Michelson Principles 12 Workbook, Kutasoft