FOUNDATIONS OF MATHEMATICS
GRADE 12

[C] Communication	**[PS]** Problem Solving
[CN] Connections	**[R]** Reasoning
[ME] Mental Mathematics and Estimation	**[T]** Technology
	[V] Visualization

Financial Mathematics	**General Outcome:** Develop number sense in financial applications.
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*
A1. Solve problems that involve compound interest in financial decision making. [C, CN, PS, T, V]	1.1 Explain the advantages and disadvantages of compound interest and simple interest. 1.2 Identify situations that involve compound interest. 1.3 Graph and compare, in a given situation, the total interest paid or earned for different compounding periods. 1.4 Determine, given the principal, interest rate and number of compounding periods, the total interest of a loan. 1.5 Graph and describe the effects of changing the value of one of the variables in a situation that involves compound interest. 1.6 Determine, using technology, the total cost of a loan under a variety of conditions; e.g., different amortization periods, interest rates, compounding periods and terms. 1.7 Compare and explain, using technology, different credit options that involve compound interest, including bank and store credit cards and special promotions. 1.8 Solve a contextual problem that involves compound interest.

[C] Communication	**[PS]** Problem Solving
[CN] Connections	**[R]** Reasoning
[ME] Mental Mathematics and Estimation	**[T]** Technology
	[V] Visualization

Financial Mathematics (continued)	**General Outcome:** Develop number sense in financial applications.
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*
A2. Analyze costs and benefits of renting, leasing and buying. [CN, PS, R, T]	2.1 Identify and describe examples of assets that appreciate or depreciate. 2.2 Compare, using examples, renting, leasing and buying. 2.3 Justify, for a specific set of circumstances, if renting, buying or leasing would be advantageous. 2.4 Solve a problem involving renting, leasing or buying that requires the manipulation of a formula. 2.5 Solve, using technology, a contextual problem that involves cost-and-benefit analysis.
A3. Analyze an investment portfolio in terms of: • interest rate • rate of return • total return. [ME, PS, R, T]	3.1 Determine and compare the strengths and weaknesses of two or more portfolios. 3.2 Determine, using technology, the total value of an investment when there are regular contributions to the principal. 3.3 Graph and compare the total value of an investment with and without regular contributions. 3.4 Apply the Rule of 72 to solve investment problems, and explain the limitations of the rule. 3.5 Determine, using technology, possible investment strategies to achieve a financial goal. 3.6 Explain the advantages and disadvantages of long-term and short-term investment options. 3.7 Explain, using examples, why smaller investments over a longer term may be better than larger investments over a shorter term. 3.8 Solve an investment problem.

[C] Communication	**[PS]** Problem Solving
[CN] Connections	**[R]** Reasoning
[ME] Mental Mathematics and Estimation	**[T]** Technology
	[V] Visualization

Logical Reasoning	**General Outcome:** Develop logical reasoning.
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*
B1. Analyze puzzles and games that involve numerical and logical reasoning, using problem-solving strategies. [CN, ME, PS, R]	*(It is intended that this outcome be integrated throughout the course by using games and puzzles such as chess, Sudoku, Nim, logic puzzles, magic squares, Kakuro and cribbage.)* 1.1 Determine, explain and verify a strategy to solve a puzzle or to win a game; e.g., • guess and check • look for a pattern • make a systematic list • draw or model • eliminate possibilities • simplify the original problem • work backward • develop alternative approaches. 1.2 Identify and correct errors in a solution to a puzzle or in a strategy for winning a game. 1.3 Create a variation on a puzzle or a game, and describe a strategy for solving the puzzle or winning the game.

[C] Communication	**[PS]** Problem Solving
[CN] Connections	**[R]** Reasoning
[ME] Mental Mathematics and Estimation	**[T]** Technology
	[V] Visualization

Logical Reasoning (continued)	**General Outcome:** Develop logical reasoning.
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*
B2. Solve problems that involve the application of set theory. [CN, PS, R, V]	2.1 Provide examples of the empty set, disjoint sets, subsets and universal sets in context, and explain the reasoning. 2.2 Organize information such as collected data and number properties, using graphic organizers, and explain the reasoning. 2.3 Explain what a specified region in a Venn diagram represents, using connecting words (and, or, not) or set notation. 2.4 Determine the elements in the complement, the intersection or the union of two sets. 2.5 Explain how set theory is used in applications such as Internet searches, database queries, data analysis, games and puzzles. 2.6 Identify and correct errors in a given solution to a problem that involves sets. 2.7 Solve a contextual problem that involves sets, and record the solution, using set notation.
B3. Solve problems that involve conditional statements. [C, CN, PS, R]	3.1 Analyze an "if-then" statement, make a conclusion, and explain the reasoning. 3.2 Make and justify a decision, using "what if?" questions, in contexts such as probability, finance, sports, games or puzzles, with or without technology. 3.3 Determine the converse, inverse and contrapositive of an "if-then" statement; determine its veracity; and, if it is false, provide a counterexample. 3.4 Demonstrate, using examples, that the veracity of any statement does not imply the veracity of its converse or inverse. 3.5 Demonstrate, using examples, that the veracity of any statement does imply the veracity of its contrapositive. 3.6 Identify and describe contexts in which a biconditional statement can be justified. 3.7 Analyze and summarize, using a graphic organizer such as a truth table or Venn diagram, the possible results of given logical arguments that involve biconditional, converse, inverse or contrapositive statements.

[C] Communication	**[PS]** Problem Solving
[CN] Connections	**[R]** Reasoning
[ME] Mental Mathematics and Estimation	**[T]** Technology
	[V] Visualization

Probability	**General Outcome:** Develop critical thinking skills related to uncertainty.
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*
C1. Interpret and assess the validity of odds and probability statements. [C, CN, ME]	1.1 Provide examples of statements of probability and odds found in fields such as media, biology, sports, medicine, sociology and psychology. 1.2 Explain, using examples, the relationship between odds (part-part) and probability (part-whole). 1.3 Express odds as a probability and vice versa. 1.4 Determine the probability of, or the odds for and against, an outcome in a situation. 1.5 Explain, using examples, how decisions may be based on probability or odds and on subjective judgments. 1.6 Solve a contextual problem that involves odds or probability.
C2. Solve problems that involve the probability of mutually exclusive and non–mutually exclusive events. [CN, PS, R, V]	2.1 Classify events as mutually exclusive or non–mutually exclusive, and explain the reasoning. 2.2 Determine if two events are complementary, and explain the reasoning. 2.3 Represent, using set notation or graphic organizers, mutually exclusive (including complementary) and non–mutually exclusive events. 2.4 Solve a contextual problem that involves the probability of mutually exclusive or non–mutually exclusive events. 2.5 Solve a contextual problem that involves the probability of complementary events. 2.6 Create and solve a problem that involves mutually exclusive or non–mutually exclusive events.

[C] Communication	**[PS]** Problem Solving
[CN] Connections	**[R]** Reasoning
[ME] Mental Mathematics and Estimation	**[T]** Technology
	[V] Visualization

Probability (continued)	**General Outcome:** Develop critical thinking skills related to uncertainty.
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*
C3. Solve problems that involve the probability of two events. [CN, PS, R]	3.1 Compare, using examples, dependent and independent events. 3.2 Determine the probability of an event, given the occurrence of a previous event. 3.3 Determine the probability of two dependent or two independent events. 3.4 Create and solve a contextual problem that involves determining the probability of dependent or independent events.
C4. Solve problems that involve the fundamental counting principle. [PS, R, V]	4.1 Represent and solve counting problems, using a graphic organizer. 4.2 Generalize the fundamental counting principle, using inductive reasoning. 4.3 Identify and explain assumptions made in solving a counting problem. 4.4 Solve a contextual counting problem, using the fundamental counting principle, and explain the reasoning.
C5. Solve problems that involve permutations. [ME, PS, R, T, V]	*(It is intended that circular permutations not be included.)* 5.1 Represent the number of arrangements of n elements taken n at a time, using factorial notation. 5.2 Determine, with or without technology, the value of a factorial. 5.3 Simplify a numeric or algebraic fraction containing factorials in both the numerator and denominator. 5.4 Solve an equation that involves factorials. 5.5 Determine the number of permutations of n elements taken r at a time. 5.6 Determine the number of permutations of n elements taken n at a time where some elements are not distinct. 5.7 Explain, using examples, the effect on the total number of permutations of n elements when two or more elements are identical. 5.8 Generalize strategies for determining the number of permutations of n elements taken r at a time. 5.9 Solve a contextual problem that involves probability and permutations.

[C] Communication	**[PS]** Problem Solving
[CN] Connections	**[R]** Reasoning
[ME] Mental Mathematics and Estimation	**[T]** Technology
	[V] Visualization

Probability (continued)	**General Outcome:** Develop critical thinking skills related to uncertainty.
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*
C6. Solve problems that involve combinations. [ME, PS, R, T, V]	6.1 Explain, using examples, why order is or is not important when solving problems that involve permutations or combinations. 6.2 Determine the number of combinations of n elements taken r at a time. 6.3 Generalize strategies for determining the number of combinations of n elements taken r at a time. 6.4 Solve a contextual problem that involves combinations and probability.

[C] Communication	**[PS]** Problem Solving
[CN] Connections	**[R]** Reasoning
[ME] Mental Mathematics and Estimation	**[T]** Technology
	[V] Visualization

Relations and Functions	**General Outcome:** Develop algebraic and graphical reasoning through the study of relations.
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*
D1. Represent data, using polynomial functions (of degree ≤ 3), to solve problems. [C, CN, PS, T, V]	1.1 Describe, orally and in written form, the characteristics of polynomial functions by analyzing their graphs. 1.2 Describe, orally and in written form, the characteristics of polynomial functions by analyzing their equations. 1.3 Match equations in a given set to their corresponding graphs. 1.4 Graph data and determine the polynomial function that best approximates the data. 1.5 Interpret the graph of a polynomial function that models a situation, and explain the reasoning. 1.6 Solve, using technology, a contextual problem that involves data that is best represented by graphs of polynomial functions, and explain the reasoning.
D2. Represent data, using exponential and logarithmic functions, to solve problems. [C, CN, PS, T, V]	2.1 Describe, orally and in written form, the characteristics of exponential or logarithmic functions by analyzing their graphs. 2.2 Describe, orally and in written form, the characteristics of exponential or logarithmic functions by analyzing their equations. 2.3 Match equations in a given set to their corresponding graphs. 2.4 Graph data and determine the exponential or logarithmic function that best approximates the data. 2.5 Interpret the graph of an exponential or logarithmic function that models a situation, and explain the reasoning. 2.6 Solve, using technology, a contextual problem that involves data that is best represented by graphs of exponential or logarithmic functions, and explain the reasoning.

[C] Communication	**[PS]** Problem Solving
[CN] Connections	**[R]** Reasoning
[ME] Mental Mathematics and Estimation	**[T]** Technology
	[V] Visualization

Relations and Functions (continued)	**General Outcome:** Develop algebraic and graphical reasoning through the study of relations.
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*
D3. Represent data, using sinusoidal functions, to solve problems. [C, CN, PS, T, V]	3.1 Describe, orally and in written form, the characteristics of sinusoidal functions by analyzing their graphs. 3.2 Describe, orally and in written form, the characteristics of sinusoidal functions by analyzing their equations. 3.3 Match equations in a given set to their corresponding graphs. 3.4 Graph data and determine the sinusoidal function that best approximates the data. 3.5 Interpret the graph of a sinusoidal function that models a situation, and explain the reasoning. 3.6 Solve, using technology, a contextual problem that involves data that is best represented by graphs of sinusoidal functions, and explain the reasoning.

[C] Communication	**[PS]** Problem Solving
[CN] Connections	**[R]** Reasoning
[ME] Mental Mathematics and Estimation	**[T]** Technology
	[V] Visualization

Mathematics Research Project	**General Outcome:** Develop an appreciation of the role of mathematics in society.
Specific Outcomes *It is expected that students will:*	**Achievement Indicators** *The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*
E1. Research and give a presentation on a current event or an area of interest that involves mathematics. [C, CN, ME, PS, R, T, V]	1.1 Collect primary or secondary data (statistical or informational) related to the topic. 1.2 Assess the accuracy, reliability and relevance of the primary or secondary data collected by: • identifying examples of bias and points of view • identifying and describing the data collection methods • determining if the data is relevant • determining if the data is consistent with information obtained from other sources on the same topic. 1.3 Interpret data, using statistical methods if applicable. 1.4 Identify controversial issues, if any, and present multiple sides of the issues with supporting data. 1.5 Organize and present the research project, with or without technology.