

Mathematics 12

Outcomes

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Mathematics 12

General Curriculum Outcomes

Students will be expected to

- develop number sense in financial applications
- develop logical reasoning
- develop critical-thinking skills related to uncertainty
- develop algebraic and graphical reasoning through the study of relations
- develop an appreciation of the role of mathematics in society

Specific Curriculum Outcomes

Performance indicators are samples of how students may demonstrate their performance of the goals of a specific curriculum outcome. The range of samples provided is meant to reflect the scope of the SCO. In the SCOs, the word **including** indicates that any ensuing items *must* be addressed to fully achieve the learning outcome. The phrase **such as** indicates that the ensuing items are provided for clarification only and are **not** requirements that must be addressed to fully achieve the learning outcome. The word **and** used in an outcome indicates that both ideas must be addressed to achieve the learning outcome, although not necessarily at the same time or in the same question.

Process Standards Key

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

Financial Mathematics (FM)

FM01 Students will be expected to solve problems that involve compound interest in financial decision making.

Performance Indicators

- FM01.01 Explain the advantages and disadvantages of compound interest and simple interest.
- FM01.02 Identify situations that involve compound interest.
- FM01.03 Graph and compare, in a given situation, the total interest paid or earned for different compounding periods.
- FM01.04 Determine, given the principal, interest rate, and number of compounding periods, the total interest of a loan.
- FM01.05 Graph and describe the effects of changing the value of one of the variables in a situation that involves compound interest.
- FM01.06 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).
- FM01.07 Compare and explain, using technology, different credit options that involve compound interest, including bank and store credit cards and special promotions.
- FM01.08 Solve a contextual problem that involves compound interest.

FM02 Students will be expected to analyze costs and benefits of renting, leasing and buying.

Performance Indicators

- FM02.01 Identify and describe examples of assets that appreciate or depreciate.
- FM02.02 Compare, using examples, renting, leasing and buying.
- FM02.03 Justify, for a specific set of circumstances, if renting, buying, or leasing would be advantageous.
- FM02.04 Solve a problem involving renting, leasing, or buying that requires the manipulation of a formula.
- FM02.05 Solve, using technology, a contextual problem that involves cost-and-benefit analysis.

FM03 Students will be expected to analyze an investment portfolio in terms of interest rate, rate of return, and total return.

Performance Indicators

- FM03.01 Determine and compare the strengths and weaknesses of two or more portfolios.
- FM03.02 Determine, using technology, the total value of an investment when there are regular contributions to the principal.
- FM03.03 Graph and compare the total value of an investment with and without regular contributions.
- FM03.04 Apply the Rule of 72 to solve investment problems, and explain the limitations of the rule.
- FM03.05 Determine, using technology, possible investment strategies to achieve a financial goal.
- FM03.06 Explain the advantages and disadvantages of long-term and short-term investment options.
- FM03.07 Explain, using examples, why smaller investments over a longer term may be better than larger investments over a shorter term.
- FM03.08 Solve an investment problem.

Logical Reasoning (LR)

LR01 Students will be expected to analyze puzzles and games that involve numerical and logical reasoning, using problem-solving strategies.

Performance Indicators

(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.)

- LR01.01 Determine, explain, and verify a strategy to solve a puzzle or to win a game; for example,
 - 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
- LR01.02 Identify and correct errors in a solution to a puzzle or in a strategy for winning a game.
- LR01.03 Create a variation on a puzzle or a game, and describe a strategy for solving the puzzle or winning the game.

LR02 Students will be expected to solve problems that involve the application of set theory.

Performance Indicators

- LR02.01 Provide examples of the empty set, disjoint sets, subsets, and universal sets in context, and explain the reasoning.
- LR02.02 Organize information such as collected data and number properties using graphic organizers, and explain the reasoning.
- LR02.03 Explain what a specified region in a Venn diagram represents, using connecting words (and, or, not) or set notation.
- LR02.04 Determine the elements in the complement, the intersection, or the union of two sets.
- LR02.05 Explain how set theory is used in applications such as Internet searches, database queries, data analysis, games, and puzzles.
- LR02.06 Identify and correct errors in a given solution to a problem that involves sets.
- LR02.07 Solve a contextual problem that involves sets, and record the solution, using set notation.

LR03 Students will be expected to solve problems that involve conditional statements.

Performance Indicators

- LR03.01 Analyze an “if-then” statement, make a conclusion, and explain the reasoning.
- LR03.02 Make and justify a decision, using “what if?” questions, in contexts such as probability, finance, sports, games, or puzzles, with or without technology.
- LR03.03 Determine the converse, inverse, and contrapositive of an “if-then” statement; determine its veracity; and, if it is false, provide a counterexample.
- LR03.04 Demonstrate, using examples, that the veracity of any statement does not imply the veracity of its converse or inverse.
- LR03.05 Demonstrate, using examples, that the veracity of any statement does imply the veracity of its contrapositive.
- LR03.06 Identify and describe contexts in which a biconditional statement can be justified.
- LR03.07 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.

Probability (P)

P01 Students will be expected to interpret and assess the validity of odds and probability statements.

Performance Indicators

- P01.01 Provide examples of statements of probability and odds found in fields such as media, biology, sports, medicine, sociology, and psychology.
- P01.02 Explain, using examples, the relationship between odds (part-part) and probability (part-whole).
- P01.03 Express odds as a probability and vice versa.
- P01.04 Determine the probability of, or the odds for and against, an outcome in a situation.
- P01.05 Explain, using examples, how decisions may be based on probability or odds and on subjective judgments.
- P01.06 Solve a contextual problem that involves odds or probability.

P02 Students will be expected to solve problems that involve the probability of mutually exclusive and non-mutually exclusive events.

Performance Indicators

- P02.01 Classify events as mutually exclusive or non-mutually exclusive, and explain the reasoning.
- P02.02 Determine if two events are complementary, and explain the reasoning.
- P02.03 Represent, using set notation or graphic organizers, mutually exclusive (including complementary) and non-mutually exclusive events.
- P02.04 Solve a contextual problem that involves the probability of mutually exclusive or non-mutually exclusive events.
- P02.05 Solve a contextual problem that involves the probability of complementary events.
- P02.06 Create and solve a problem that involves mutually exclusive or non-mutually exclusive events.

P03 Students will be expected to solve problems that involve the probability of two events.

Performance Indicators

- P03.01 Compare, using examples, dependent and independent events.
- P03.02 Determine the probability of an event, given the occurrence of a previous event.
- P03.03 Determine the probability of two dependent or two independent events.
- P03.04 Create and solve a contextual problem that involves determining the probability of dependent or independent events.

P04 Students will be expected to solve problems that involve the fundamental counting principle.

Performance Indicators

- P04.01 Represent and solve counting problems, using a graphic organizer.
- P04.02 Generalize the fundamental counting principle, using inductive reasoning.
- P04.03 Identify and explain assumptions made in solving a counting problem.
- P04.04 Solve a contextual counting problem, using the fundamental counting principle, and explain the reasoning.

P05 Students will be expected to solve problems that involve permutations.

Performance Indicators

(It is intended that circular permutations not be included.)

- P05.01 Represent the number of arrangements of n elements taken n at a time, using factorial notation.
- P05.02 Determine, with or without technology, the value of a factorial.
- P05.03 Simplify a numeric or algebraic fraction containing factorials in both the numerator and denominator.
- P05.04 Solve an equation that involves factorials.
- P05.05 Determine the number of permutations of n elements taken r at a time.
- P05.06 Determine the number of permutations of n elements taken n at a time where some elements are not distinct.
- P05.07 Explain, using examples, the effect on the total number of permutations of n elements when two or more elements are identical.
- P05.08 Generalize strategies for determining the number of permutations of n elements taken r at a time.
- P05.09 Solve a contextual problem that involves probability and permutations.

P06 Students will be expected to solve problems that involve combinations.

Performance Indicators

- P06.01 Explain, using examples, why order is or is not important when solving problems that involve permutations or combinations.
- P06.02 Determine the number of combinations of n elements taken r at a time.
- P06.03 Generalize strategies for determining the number of combinations of n elements taken r at a time.
- P06.04 Solve a contextual problem that involves combinations and probability.

Relations and Functions (RF)

RF01 Students will be expected to represent data, using polynomial functions (of degree ≤ 3), to solve problems.

Performance Indicators

- RF01.01 Describe, orally and in written form, the characteristics of polynomial functions by analyzing their graphs.
- RF01.02 Describe, orally and in written form, the characteristics of polynomial functions by analyzing their equations.
- RF01.03 Match equations in a given set to their corresponding graphs.
- RF01.04 Graph data and determine the polynomial function that best approximates the data.
- RF01.05 Interpret the graph of a polynomial function that models a situation, and explain the reasoning.
- RF01.06 Solve, using technology, a contextual problem that involves data that is best represented by graphs of polynomial functions, and explain the reasoning.

RF02 Students will be expected to represent data, using exponential and logarithmic functions, to solve problems.

Performance Indicators

- RF02.01 Describe, orally and in written form, the characteristics of exponential or logarithmic functions by analyzing their graphs.
- RF02.02 Describe, orally and in written form, the characteristics of exponential or logarithmic functions by analyzing their equations.
- RF02.03 Match equations in a given set to their corresponding graphs.
- RF02.04 Graph data and determine the exponential or logarithmic function that best approximates the data.
- RF02.05 Interpret the graph of an exponential or logarithmic function that models a situation, and explain the reasoning.
- RF02.06 Solve, using technology, a contextual problem that involves data that is best represented by graphs of exponential or logarithmic functions, and explain the reasoning.

RF03 Students will be expected to represent data, using sinusoidal functions, to solve problems.

Performance Indicators

- RF03.01 Demonstrate an understanding of angles expressed in degrees and radians.
- RF03.02 Describe, orally and in written form, the characteristics of sinusoidal functions by analyzing their graphs.

- RF03.03 Describe, orally and in written form, the characteristics of sinusoidal functions by analyzing their equations.
- RF03.04 Match equations in a given set to their corresponding graphs.
- RF03.05 Graph data and determine the sinusoidal function that best approximates the data.
- RF03.06 Interpret the graph of a sinusoidal function that models a situation, and explain the reasoning. Solve, using technology, a contextual problem that involves data that is best represented by graphs of sinusoidal functions, and explain the reasoning.

Mathematics Research Project (MRP)

- MRP01** Students will be expected to research and give a presentation on a topic that involves the application of mathematics.

Performance Indicators

- MRP01.01 Collect primary or secondary data (statistical or informational) related to the topic.
- MRP01.02 Assess the accuracy, reliability, and relevance of the primary or secondary data.
- MRP01.03 Make a statement and justify the statement based on your data.
- MRP01.04 Identify controversial issues, if any, and present multiple sides of the issues with supporting data.
- MRP01.05 Organize and present the research project, with or without technology.