

CURRICULUM

GUIDE

Pre-Calculus

Pro[✓]vidence
Schools

QUARTER I

Content students have to learn

Processes students will learn and use

Unit 1.1 – Relations and Functions

(8 days)

- Use characteristics of functions to compare and contrast the similarities and differences between relations and functions.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.
- » Use and create representations to solve problems and organize thoughts and ideas.
- » Determine and use the appropriate mathematical representation to model situations.

Unit 1.2 – Exponents and Logarithms

(6 days)

- Use characteristics of exponential and logarithmic functions to compare and contrast the similarities and differences of functions.
- Solve real-world applications with exponential and logarithmic functions.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.
- » Use and create representations to solve problems and organize thoughts and ideas.
- » Determine and use the appropriate mathematical representation to model situations.

Unit 1.3 – Transformations

(6 days)

- Use multiple representations (including graphical, tabular, verbal, and algebraic forms) of functions to identify their relationships in families of functions (linear, quadratic, cubic, rational, exponential, logarithmic, polynomial, etc.).
- Use knowledge of characteristics of families of functions to solve applications of science and art (dilations) situations.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics.

Unit 1.4 – Matrices

(6 days)

- Understand conceptually matrices and their uses as tools for solving various real-world applications.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.

QUARTER I

Content students have to learn

Processes students will learn and use

Unit 1.5 – Complex Numbers (7 days)

- Understand conceptually the meaning of complex roots in the context of polynomial functions.
- Graphically represent complex numbers.

- » Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.
- » Use and create representations to solve problems and organize thoughts and ideas.
- » Determine and use the appropriate mathematical representation to model situations.
- » Use different strategies to solve problems.

Unit 1.6 – Theorems (7 days)

- Understand that the complex number system is made up of real and imaginary numbers.
- Use polynomial theorems (fundamental theorem, remainder theorem, rational root theorem, and intermediate value theorem) and factoring to identify the characteristics of polynomials.
- Understand the characteristics of polynomials and the implications for their use in the real world.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Explain and justify thinking and develop a problem-solving model that incorporates understanding the problem.
- » Identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics.
- » Use different strategies to solve problems.

QUARTER 2

Content students have to learn

Processes students will learn and use

Unit 2.1 – Probability, Part 1: Combinations, Permutations, and the Basic Counting Principle (5 days)

- Understand the concept of probability (both permutations and combinations) and its use for solving various real-world applications.

- » Evaluate the effectiveness of different representations to communicate ideas and formulate questions, conjectures, definitions, and generalizations about data, information, and problem situations.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Use and create representations to solve problems and organize thoughts and ideas.

Unit 2.2 – Odds and Probability (6 days)

- Understand the concept of odds and probability and their use as tools for solving various realworld applications.

- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.
- » Identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics.

Unit 2.3 – Statistics (5 days)

- Understand the concept of statistics and their use in analyzing data in real-world situations.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Explain and justify thinking and develop a problem-solving model that incorporates understanding the problem.
- » Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.
- » Identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics.

Unit 2.4 – Trigonometry, Part 1: Working with Circles (9 days)

- Use the conceptual understanding of trigonometric characteristics of circles and angles.
- Understand the conceptual difference between Euclidean and non-Euclidean geometric systems.

- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.

QUARTER 2

Content students have to learn

Processes students will learn and use

Unit 2.5 – Trigonometry, Part 2: Right Triangle and Unit Circle Trigonometry (8 days)

- Use right triangle concepts to find trigonometric ratios.
- Use trigonometric ratios to solve real-world problems.
- Use unit circle concepts to solidify the conceptual understanding of the trigonometric ratios.

Unit 2.6 – Trigonometry, Part 3: Law of Sines and Cosines Probability (7 days)

- Use the law of sines and law of cosines to solve real-world problems.

- » Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.
- » Determine and use the appropriate mathematical representation to model situations.
- » Use different strategies to solve problems.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Use informal and formal reasoning and proof to explain and justify conclusions.
- » Identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics.
- » Use different strategies to solve problems.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Use informal and formal reasoning and proof to explain and justify conclusions.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Use reasoning and proof to formulate, test, and justify mathematical conjectures and arguments.
- » Apply mathematical reasoning skills in other disciplines.

QUARTER 3

Content students have to learn

Processes students will learn and use

Unit 3.1 – Trigonometry, Part 4: Graphing Trigonometric Functions (12 days)

- Use the conceptual understanding of how to graph trigonometric functions and transform them.

- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.
- » Use and create representations to solve problems and organize their thoughts and ideas.
- » Determine and use the appropriate mathematical representation to model situations.

Unit 3.2 – Trigonometry, Part 5: Trigonometric Identities (9 days)

- Understand the conceptual ideas of trigonometric identities.

- » Use informal and formal reasoning and proof to explain and justify conclusions.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Use reasoning and proof to formulate, test, and justify mathematical conjectures and arguments.
- » Apply mathematical reasoning skills in other disciplines.
- » Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.

Unit 3.3 – Trigonometry, Part 6: Solving Trigonometric Equations (5 days)

- Understand the concept of trigonometric equations and inequalities and their uses as tools for various real-world applications.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.

Unit 3.4 – Vectors (6 days)

- Understand the concept of vectors and their uses as tools for various real-world applications.

- » Use informal and formal reasoning and proof to explain and justify conclusions.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Use reasoning and proof to formulate, test, and justify mathematical conjectures and arguments.
- » Apply mathematical reasoning skills in other disciplines.
- » Explain and justify thinking and develop a problem-solving model that incorporates understanding of the problem.
- » Evaluate the effectiveness of different representations to communicate ideas: formulate questions, conjectures, definitions, and generalizations about data, information, and problem situations.

QUARTER 3

Content students have to learn

Processes students will learn and use

Unit 3.5 – Polar Coordinates (9 days)

- Understand conceptually the difference between rectangular and polar graphs.
 - Graphically represent complex numbers using both polar and rectangular graphs.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
 - » Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.
 - » Use and create representations to solve problems and organize their thoughts and ideas.
 - » Determine and use the appropriate mathematical representation to model situations.

QUARTER 4

Content students have to learn

Processes students will learn and use

Unit 4.1 – Conics, Part 1: Circles (4 days)

- Understand conceptually the characteristics and use of standard and general forms of the equation of the circle.
- Uses analytic geometry to prove mathematical concepts.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Use informal and formal reasoning and proof to explain and justify conclusions.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Use reasoning and proof to formulate, test, and justify mathematical conjectures and arguments.
- » Apply mathematical reasoning skills in other disciplines.

Unit 4.2 – Conics, Part 2: Ellipses (4 days)

- Understand conceptually the characteristics and use of standard and general forms of the equation of the ellipse.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Use informal and formal reasoning and proof to explain and justify conclusions.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Use reasoning and proof to formulate, test, and justify mathematical conjectures and arguments.
- » Apply mathematical reasoning skills in other disciplines.

Unit 4.3 – Conics, Part 3: Hyperbolas (5 days)

- Understand conceptually the characteristics and use of standard and general forms of the equation of the hyperbola.
- Use multiple representations to show the characteristics of hyperbolas.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Use informal and formal reasoning and proof to explain and justify conclusions.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Use reasoning and proof to formulate, test, and justify mathematical conjectures and arguments.
- » Apply mathematical reasoning skills in other disciplines.

Content students have to learn

Processes students will learn and use

**Unit 4.4 – Conics, Part 4: Parabolas and Systems
(11 days)**

- Understand conceptually the characteristics and use of standard and general forms of the equation of the parabola.
- Understand algebraically and geometrically the solutions of systems of equations and inequalities of conic sections.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Use informal and formal reasoning and proof to explain and justify conclusions.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.
- » Use reasoning and proof to formulate, test, and justify mathematical conjectures and arguments.
- » Apply mathematical reasoning skills in other disciplines.

**Unit 4.5 – Sequences and Series
(8 days)**

- Use patterns to generate partial sums and make connections to other functions and the real world.
- Use patterns to generate infinite geometric sequences and series and make connections to other functions and the real world.
- Understand the concept of limits as they apply to convergent or divergent series.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.

**Unit 4.6 – Limits, Part I: Derivatives
(5 days)**

- Use the conceptual idea of limits and derivatives of a function to solve real-world applications.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.

**Unit 4.7 – Limits, Part I: Derivatives
(5 days)**

- Use the conceptual idea of limits and the integral of a function to solve real-world applications.

- » Select or develop an appropriate problem-solving strategy from a variety of different types.
- » Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.
- » Reflect on solutions and the problem-solving process for a given situation and refine strategies as needed.
- » Draw logical conclusions and make generalizations using deductive and inductive reasoning.

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