North Gibson School Corporation

High School Precalculus: Algebra
SY 2022/2023

High School Precalculus: Algebra

Units of Study			
Unit 1:	Equations and Inequalities	15 days	2nd semester
Unit 2:	Functions and Relations	15 days	2nd semester
Unit 3:	Polynomial and Rational Functions	15 days	2nd semester
Unit 4:	Exponential and Logarithmic Functions	15 days	2nd semester
Unit 5:	Conic Sections	15 days	2nd semester
Unit 6:	Sequences and Series	15 days	2nd semester
Unit 7:	Intro to Calculus (Honors Only)	15 days	2nd semester

Appendices

Appendix A: Proficiency Scale Template

Appendix B: Curriculum Refinement Form

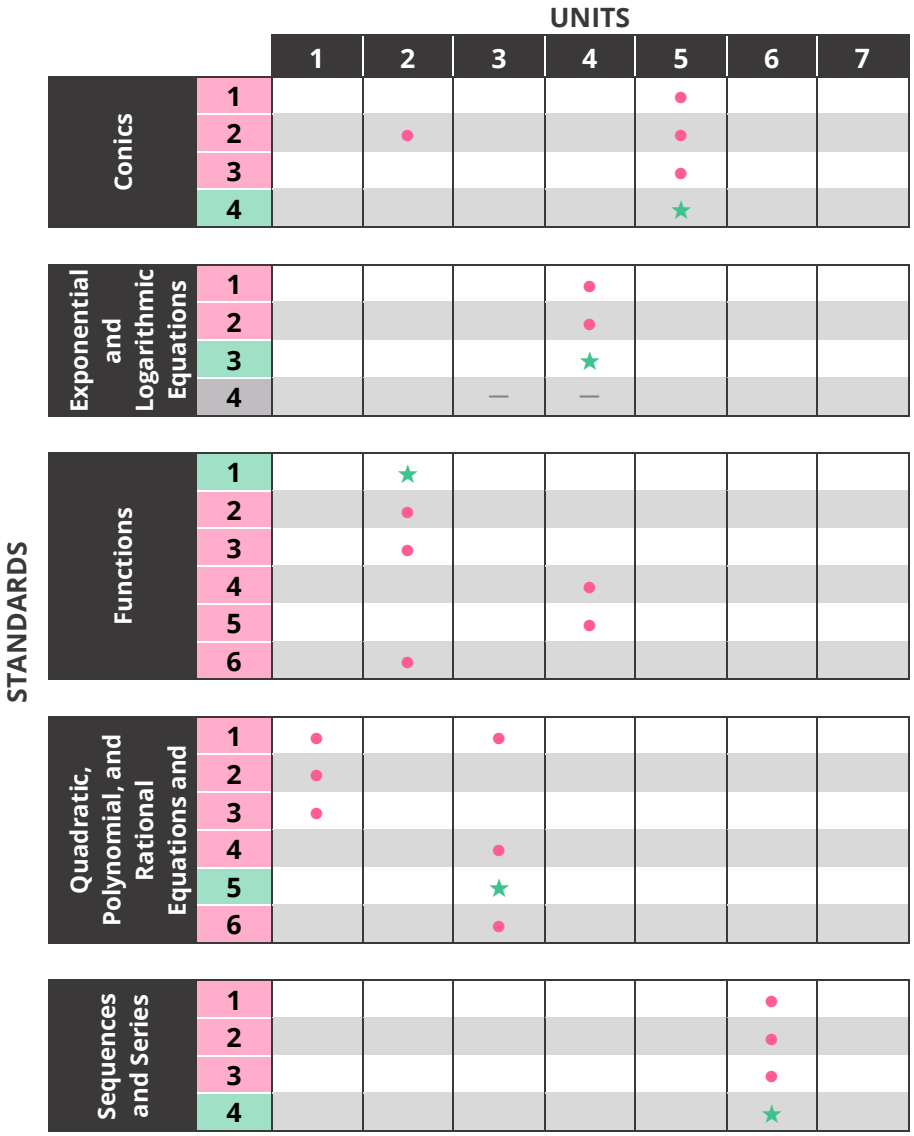
Appendix C: North Gibson Priority Standards Vertical Articulation Document

High School Precalculus: Algebra Priority Standards

Priority Standards	**PC.CO.4**	Graph conic sections. Identify and describe features like center, vertex or vertices, focus or foci, directrix, axis of symmetry, major axis, minor axis, and eccentricity.
	PC.EL.3	Graph and solve real-world and other mathematical problems that can be modeled using exponential and logarithmic functions; interpret the solution and determine whether it is reasonable. Identify and describe features such as intercepts, domain, range, asymptotes, and end behavior.
	PC.F.1	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.
	PC.QPR.5	Understand the Fundamental Theorem of Algebra. Find a polynomial function of lowest degree with real coefficients when given its roots.
	PC.SS.4	Model and solve real-world problems involving applications of sequences and series, interpret the solutions and determine whether the solutions are reasonable.

Standards Breakdown

★: Priority Standards ●: Supporting Standards —: Additional Standards



General Description of the Unit

In this unit, students solve a variety of equations and inequalities, including: linear, quadratic, absolute value, and rational equations. For quadratic equations, students work with completing the square and use it to derive the quadratic formula. Students also work with complex numbers, including plotting on the complex plane. Many of the textbook sections are aligned to not aligned to any PreCalculus Indiana Academic Standards, but are still being taught as a review and to satisfy Dual-Credit requirements.

Priority Standards

- N/A

Supporting Standards

- **PC.QPR.1:** Use the method of completing the square to transform any quadratic equation into an equation of the form (x – p)^2 = q that has the same solutions. Derive the quadratic formula from this form.
- **PC.QPR.2:** Understand and use addition, subtraction, multiplication, and conjugation of complex numbers.
- **PC.QPR.3:** Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.

Enduring Understandings

- Completing the square is another method for solving a quadratic equation. The quadratic formula can be derived from it.
- When adding complex numbers, we combine like terms. When multiplying, we utilize distribution and properties of exponents, being careful to fully simplify all numbers down to a single real and single imaginary part.
- When we multiply an imaginary number by its conjugate, the result is a real number.
- A complex number a + bi can be plotted on the complex plane, where the x-axis represents the real part of the number (a) and the y-axis represents the imaginary part (b). The distance and midpoint formulas can be applied, where (x, y) come from (a, b).

Essential Questions

- How does completing the square allow us to discover the quadratic formula?
- Why is it helpful to have multiple methods for solving a quadratic equation? Which is your favorite method? Why?
- How does the adding and multiplying complex numbers differ? Why is simplification important in both cases?
- How would you explain to someone why multiplying an imaginary number by its conjugate results in a real number?
- What are the similarities and differences between the complex plane and the Cartesian plane?

Key Concepts

- N/A

Related Concepts

- I can complete the square to transform any quadratic equation to the equivalent form (x – p)^2 = q. (PC.QPR.1)
- I can show that quadratic equations written in different but equivalent forms have the same solutions. (PC.QPR.1)
- I can derive the quadratic formula from a quadratic equation written in the from (x – p)^2 = q. (PC.QPR.1)
- I can add and subtract complex numbers. (PC.QPR.2)
- I can multiply complex numbers. (PC.QPR.2)
- I can perform the conjugation of complex numbers and explain the necessity of doing so. (PC.QPR.2)
- I can find the distance between numbers in the complex plane. (PC.QPR.3)

Vocabulary

- Complete the square
- Complex number
- Complex plane
- Conjugation
- Imaginary number
- Modulus
- Quadratic Equation
- Quadratic Formula
- Real number

	• I can understand that the modulus refers to the absolute value of a complex number. (PC.QPR.3) • I can use the distance formula in the complex plane. (PC.QPR.3) • I can find the midpoint of the line segment joining two complex numbers. (PC.QPR.3) • I can identify the midpoint of complex numbers by finding the average of the numbers at the endpoints. (PC.QPR.3)	

Mathematical Processes

- PS.7 Look for and make use of structure.
- PS.8 Look for and express regularity in repeated reasoning.

Resources

Proficiency Scales	Digital	Manipulatives
• N/A	• IDOE Examples/Tasks PC.QPR.1 • IDOE Examples/Tasks PC.QPR.2 • IDOE Examples/Tasks PC.QPR.3	• Coordinate Grid • Graphing Calculator • Ruler

School Resources

Textbook	Formative Assessments
Textbook: Indiana Reveal by McGraw-Hill Ch 1: Equations and Inequalities 1.1 Linear Equations and Rational Equations (Review/Dual Credit) 1.2 Applications with Linear and Rational Equations (Review/Dual Credit) 1.3 Complex Numbers 1.4 Quadratic Equations (Review) 1.5 Applications of Quadratic Equations 1.6 More Equations and Applications (Review/Dual Credit) 1.7 Linear, Compound, and Absolute Value Inequalities (Review/Dual Credit)	

Unit 2: Functions and Relations (15 days, 2nd semester)

General Description of the Unit

In this unit, students will expand on their understanding of key features of functions. They will explore composition of functions and even/odd functions. They will combine this knowledge with their previous understanding of functions to sketch a function from a verbal description of the key features and to identify key features from a given graph. Additionally, students will graph a circle on the coordinate plane. Finally, students find and use different types of linear models to interpret data and to make predictions. Many of these topics are used throughout the rest of the course.

Priority Standards

- **PC.F.1:** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

Supporting Standards

- **PC.CO.2:** Construct the equation of a circle of given center and radius. Complete the square to find the center and radius of a circle given by an equation.
- **PC.F.2:** Find linear models by using median fit and least squares regression methods, making use of technology. Decide which among several linear models gives a better fit. Interpret the slope and intercept in terms of the original context.
- **PC.F.3:** Compose functions and find the domain of composite functions.
- **PC.F.6:** Recognize even and odd functions from their graphs and algebraic expressions.

Enduring Understandings

- The equation of a circle with center (h, k) and radius r is (x-h)^2 + (y-k)^2 = r^2. If the equation is in standard form, the center and radius can be found from its equation by completing the square.
- Two functions can be composed, and this sometimes results in a new domain. We must consider domain restrictions on the composed function as well as the inner function.
- A function is even if it is symmetric about the y-axis and f(-x) = f(x). A function is odd if it is symmetric about the origin and f(-x) = -f(x).

Essential Questions

- The height of a thrown football is modeled by a function. Would you rather have the information given in a graph, table, or verbal description? What key information would the given representation be able to tell you about the football's path?
- What are some limitations of a linear model for a data set?
- What is a scenario where the composition of two functions would be helpful?aW

Key Concepts

- I can interpret key features, such as intercepts, intervals of increase or decrease, intervals where the function is positive or negative, relative extrema, symmetry, end behavior, and periodicity of a function given a graph. (PC.F.1)
- I can interpret key features, such as intercepts, intervals of increase or decrease, intervals where function is positive or negative, relative extrema, symmetry, end behavior, and periodicity of a function given a table. (PC.F.1)
- I can sketch a graph given a verbal description of a function. (PC.F.1)

Related Concepts

- I can use the center and radius of a circle to construct the equation of a circle. (PC.CO.2)
- I can complete the square in order to find the center and radius of a circle. (PC.CO.2)
- I can find a linear model using the median fit method. (PC.F.2)
- I can find a linear model using least squares regression while making use of technology. (PC.F.2)
- I can determine the best fit linear model when presented with multiple options. (PC.F.2)
- I can interpret the slope and intercept of a linear model in context. (PC.F.2)
- I can compose functions. (PC.F.3)
- I can find the domain of composite functions. (PC.F.3)

Vocabulary

- Center
- Complete the square
- Composite functions
- Composition of functions
- Decreasing
- Domain
- End behavior
- Equation of a circle
- Even function
- Increasing
- Intercepts
- Least squares regression
- Linear model
- Local maximum
- Local minimum
- Median-fit method
- Odd function
- Periodicity
- Pythagorean Theorem
- Radius
- Relative extrema
- Relative maximum

	• I can recognize the role the domain of a function plays in the combination of functions. (PC.F.3) • I can determine whether a function is even or odd graphically. (PC.F.6) • I can determine whether a function is even or odd algebraically. (PC.F.6)	• Relative minimum • Slope • Symmetry • x-intercept • y-intercept

Mathematical Processes

- PS.4 Model with mathematics.
- PS.7 Look for and make use of structure.

Resources

Proficiency Scales	Digital	Manipulatives
• PC.F.1	• IDOE Examples/Tasks PC.F.1 • IDOE Examples/Tasks PC.CO.2 • IDOE Examples/Tasks PC.F.2 • IDOE Examples/Tasks PC.F.3 • IDOE Examples/Tasks PC.F.6	• 3-D Conic Sections Virtual Manipulative • Coordinate Grid • Desmos Conic Sections • Graphing Calculator • **Ruler**

School Resources

Textbook	Formative Assessments
Ch 2: Functions and Relations 2.1 The Rectangular Coordinate System and Graphing Utilities (Review) 2.2 Circles 2.3 Functions and Relations (Mostly Review) 2.4 Linear Equations in Two Variables and Linear Functions (Review) 2.5 Applications of Linear Equations and Modeling 2.6 Transformations of Graphs (Review) 2.7 Analyzing Graphs of Functions and Piecewise - Defined Functions 2.8 Algebra of Functions and Function Composition	

Unit 3: Polynomial and Rational Functions (15 days, 2nd semester)

General Description of the Unit

Within polynomial functions, students will derive the quadratic formula and will explore the roots of a polynomial using multiple theorems, including the Fundamental Theorem of Algebra, the Remainder Theorem, and the Factor Theorem. For rational functions, students will focus on their graphs and key features, including asymptotes and holes. Quadratic and power functions are also used to model bivariate data set; this builds upon the work with linear models that students did in the previous unit.

Priority Standards

- **PC.QPR.5:** Understand the Fundamental Theorem of Algebra. Find a polynomial function of lowest degree with real coefficients when given its roots.

Supporting Standards

- **PC.QPR.4:** Know and apply the Remainder Theorem and the Factor Theorem.
- **PC.QPR.6:** Graph rational functions with and without technology. Identify and describe features such as intercepts, domain and range, and asymptotic and end behavior.
- **PC.QPR.1:** Use the method of completing the square to transform any quadratic equation into an equation of the form (x – p)^2 = q that has the same solutions. Derive the quadratic formula from this form.

Additional Standards

- **PC.EL.4:** Use technology to find a **quadratic**, exponential, logarithmic, or **power** function that models a relationship for a bivariate data set to make predictions.

Enduring Understandings

- The Fundamental Theorem of Algebra tells us that a polynomial of degree n will have n roots, though some of the roots may be repeats or imaginary.
- Classifying the roots as real or imaginary and as single or repeated gives us key information about the function's graph.
- The Remainder Theorem and Factor Theorem allow us to determine if an expression is a factor of an equation. This allows us to easily check if a value is a zero (root) of the function.
- A rational function is a function that can be written as the ratio of two polynomials; its graph will typically have multiple asymptotes and/or holes.

Essential Questions

- If a polynomial has degree n, does the Fundamental Theorem of Algebra tell us how many x-intercepts the graph will have? Why or why not?
- How are the Remainder Theorem and Factor Theorem related?
- What is the difference between a hole, a vertical asymptote, a horizontal asymptote, and a slant asymptote?
- If a researcher has data over the number of flu cases in the state, what are some questions a model function could answer?

Key Concepts

- I can demonstrate understanding of the Fundamental Theorem of Algebra. (PC.QPR.5)
- I can find a polynomial function of lowest degree with real coefficients when given its roots. (PC.QPR.5)
- I can determine the possible number of real and complex roots given the degree of a polynomial with real coefficients. (PC.QPR.5)
- I can determine the multiplicity of real roots of a polynomial graphically. (PC.QPR.5)
- I can use the concept of multiplicity to find a polynomial function of lowest degree with real coefficients. (PC.QPR.5)

Related Concepts

- I can effectively communicate the Remainder Theorem. (PC.QPR.4)
- I can apply the Remainder Theorem when dividing polynomials by a linear factor. (PC.QPR.4)
- I can use the Remainder Theorem to determine whether given values are zeros (solutions, roots) of a function. (PC.QPR.4)
- I can effectively communicate the Factor Theorem. (PC.QPR.4)
- I can apply the Factor Theorem. (PC.QPR.4)
- I can graph rational functions with technology. (PC.QPR.6)

Vocabulary

- Asymptote
- Bivariate data
- Complete the square
- Complex roots
- Degree of a polynomial
- Domain
- End-behavior
- Extrapolation
- Factor Theorem
- Fundamental Theorem of Algebra
- Interpolation
- Multiplicity
- Polynomial long division
- Power function
- Quadratic Equation
- Quadratic Formula
- Quadratic function

	• I can graph rational functions without technology. (PC.QPR.6) • I can identify and describe attributes of a rational function such as intercepts, domain, range, asymptotic, and end behavior by examining a graph. (PC.QPR.6) • I can identify and describe attributes of a rational function such as intercepts, domain, range, asymptotic, and end behavior algebraically. (PC.QPR.6) • I can use graphing technology to find an appropriate model for a bivariate data set. (PC.EL.4) • I can choose between a quadratic, exponential, logarithmic, or a power function when modeling a relationship between bivariate data in order to make predictions. (PC.EL.4) • I can complete the square to transform any quadratic equation to the equivalent form $(x – p)^2 = q$. (PC.QPR.1) • I can show that quadratic equations written in different but equivalent forms have the same solutions. (PC.QPR.1) • I can derive the quadratic formula from a quadratic equation written in the from $(x – p)^2 = q$. (PC.QPR.1)	• Range • Rational function • Real roots • Remainder Theorem • Root of a function • Synthetic division • X-intercept • Y-intercept • Zero of a function

Mathematical Processes

- PS.3 Construct convincing arguments and critique the reasoning of others.
- PS.5 Use tools appropriately.

Resources

Proficiency Scales	Digital	Manipulatives
• PC.QPR.5	• IDOE Examples/Tasks PC.QPR.5 • IDOE Examples/Tasks PC.QPR.1 • IDOE Examples/Tasks PC.QPR.4 • IDOE Examples/Tasks PC.QPR.6 • IDOE Examples/Tasks PC.EL.4	• Coordinate Grid • Curve Fitting • Graphing Calculator

School Resources	
Textbook Ch 3: Polynomial and Rational Functions 3.1 Quadratic Functions and Applications 3.2 Introduction to Polynomial Functions 3.3 Division of Polynomials and the Remainder and Factor Theorems 3.4 Zeros of Polynomials 3.5 Rational Functions 3.6 Polynomial and Rational Inequalities (Review/Dual Credit) 3.7 Variation (SKIP/Honors)	**Formative Assessments**

General Description of the Unit

In this unit, students explore exponential and logarithmic functions and their inverse relationship. Students will model real-world problems using exponential and logarithmic functions and equations, including using these functions to model a data set. They will solve these problems using both graphing and algebra. The algebra will involve applying logarithmic laws and the change of base formula. The change of base formula is also used to prove simple logarithmic laws. It is important to note that students solve and graphed exponential and logarithmic equations in Algebra 2.

Priority Standards

- **PC.EL.3:** Graph and solve real-world and other mathematical problems that can be modeled using exponential and logarithmic functions; interpret the solution and determine whether it is reasonable. Identify and describe features such as intercepts, domain, range, asymptotes, and end behavior.

Supporting Standards

- **PC.EL.1:** Use the definition of logarithms to convert logarithms from one base to another and prove simple laws of logarithms.
- **PC.EL.2:** Use the laws of logarithms to simplify logarithmic expressions, approximate the value of a logarithmic expression, and solve logarithmic equations.
- **PC.F.4:** Determine if a graph or table has an inverse, and justify if the inverse is a function, relation, or neither. Identify the values of an inverse function/relation from a graph or a table, given that the function has an inverse. Derive the inverse equation from the values of the inverse.
- **PC.F.5:** Produce an invertible function from a non-invertible function by restricting the domain.

Additional Standards

- **PC.EL.4:** Use technology to find a quadratic, **exponential**, **logarithmic**, or power function that models a relationship for a bivariate data set to make predictions.

Enduring Understandings

- Exponential and logarithmic functions are inverses, which results in graphs that are reflected over the line y=x.
- Using the change of base formula and the laws of logarithms allow us to simplify and/or evaluate logarithms.
- There are multiple approaches to solving logarithmic equations, including converting to exponential form and using the laws of logarithms.
- A non-invertible function can often become invertible by restricting the domain.

Essential Questions

- How are the graphs of exponential and logarithmic functions similar? How are they different?
- What would indicate that an exponential model is the right choice for a given situation? Logarithmic?
- How are the laws of logarithms similar to the laws of exponents?
- What is a scenario where it would be useful to find the inverse equation of a function? Why would it be useful?
- Why do some functions require us to restrict the domain in order to produce an inverse function?

Key Concepts

- I can graph real-world and other mathematical problems modeled with exponential functions.. (PC.EL.3)
- I can graph real-world and other mathematical problems modeled with logarithmic functions. (PC.EL.3)
- I can solve real-world and other mathematical problems modeled with exponential functions. (PC.EL.3)
- I can solve real-world and other mathematical problems modeled

Related Concepts

- I can use the Change of Base formula to evaluate a non-standard-base log. (PC.EL.1)
- I can use the definition of logarithms to convert logarithms from one base to another. (PC.EL.1)
- I can prove simple laws of logarithms. (PC.EL.1)
- I can use the laws of logarithms to simplify logarithmic expressions. (PC.EL.2)

Vocabulary

- Asymptote
- Bivariate data
- Change of Base Formula
- Domain
- End behavior
- Exponential function
- Extrapolation
- Function
- Horizontal line test
- Intercept
- Interpolation
- Inverse
- Invertible function

with logarithmic functions. (PC.EL.3) • I can determine the validity of my solution in the context of a problem. (PC.EL.3) • I can identify and describe key features of exponential and logarithmic functions. (PC.EL.3)	• I can find approximate values of logarithmic expressions using the laws of logarithms. (PC.EL.2) • I can solve logarithmic equations. (PC.EL.2) • I can determine if a graph has an inverse. (PC.F.4) • I can determine if a table has an inverse. (PC.F.4) • I can justify if the inverse of a graph or a table is function, relation, or neither. (PC.F.4) • I can use the horizontal line test to determine if a graph is one-to-one. (PC.F.4) • I can identify the values of an inverse function/relation from a graph or table, knowing that the function has an inverse. (PC.F.4) • I can derive an inverse equation given values of the inverse. (PC.F.4) • I can restrict the domain of a function. (PC.F.5) • I can determine whether a function is invertible. (PC.F.5) • I can determine the appropriate domain in order to produce the inverse of a non-invertible function. (PC.F.5) • I can use graphing technology to find an appropriate model for a bivariate data set. (PC.EL.4) • I can choose between a quadratic, exponential, logarithmic, or a power function when modeling a relationship between bivariate data in order to make predictions. (PC.EL.4)	• Laws of logarithms • Logarithmic equation • Logarithmic expression • Logarithmic function • Logarithms • One-to-one • Range • Relation

Mathematical Processes

- PS.4 Model with mathematics.
- PS.7 Look for and make use of structure.

Resources

Proficiency Scales	Digital	Manipulatives
• PC.EL.3	• IDOE Examples/Tasks PC.EL.3 • IDOE Examples/Tasks PC.EL.1 • IDOE Examples/Tasks PC.EL.2 • IDOE Examples/Tasks PC.F.4 • IDOE Examples/Tasks PC.F.5 • IDOE Examples/Tasks PC.EL.4	• Coordinate Grid • Curve Fitting • Graphing Calculator

School Resources	
Textbook Ch 4: Exponential and Logarithmic Functions 4.1 Inverse Functions 4.2 Exponential Functions 4.3 Logarithmic Functions 4.4 Properties of Logarithms 4.5 Exponential and Logarithmic Equations and Applications 4.6 Modeling with Exponential and Logarithmic Functions	**Formative Assessments**

General Description of the Unit

In this unit, students are introduced to the concept of conic sections for the first time. They will explore the definition of a conic section in terms of the intersection of a plane and double cone. Then they will graph conic sections (parabola, circle, ellipse, and hyperbola) and identify key information, including foci, directrix, axes, and vertex. Additionally, students will write the equation of a conic section from key information.

Priority Standards

- **PC.CO.4:** Graph conic sections. Identify and describe features like center, vertex or vertices, focus or foci, directrix, axis of symmetry, major axis, minor axis, and eccentricity.

Supporting Standards

- **PC.CO.1:** Construct the equation of a parabola given a focus and directrix.
- **PC.CO.2:** Construct the equation of a circle of given center and radius. Complete the square to find the center and radius of a circle given by an equation.
- **PC.CO.3:** Construct the equations of ellipses and hyperbolas given at least two of the following: foci, vertices, length of an axis, or point on the curve.

Enduring Understandings

- Conic sections are the result of a plane intersecting a double cone. There are four conic sections: a circle, parabola, hyperbola, and ellipse.
- A parabola is a curve that is the set of all points that are equal distance from the directrix and the focus.
- The quadratic equation for a parabola can be found from the directrix and focus.
- The center and radius of a circle can be found from its equation by completing the square.

Essential Questions

- How are the four conic sections similar and different?
- What real world situations are modeled by conic sections?
- How does the concept of a parabola as a conic section extend your understanding of quadratic equations?
- If you are asked to find the equation of an ellipse, what two pieces of information would you prefer to have? Why?

Key Concepts

- I can graph conic sections. (PC.CO.4)
- Given a conic section, I can identify the center, directrix, vertices, focus, and axis of symmetry. (PC.CO.4)
- I can distinguish between the major axis and the minor axis of a conic section, where applicable. (PC.CO.4)
- I can characterize the shape of a curve using the eccentricity of a conic section. (PC.CO.4)

Related Concepts

- I can identify the vertex of a parabola as the halfway point between the focus and the directrix. (PC.CO.1)
- I can determine the equation of a parabola given a focus and directrix. (PC.CO.1)
- I can use the center and radius of a circle to construct the equation of a circle. (PC.CO.2)
- I can complete the square in order to find the center and radius of a circle. (PC.CO.2)
- I can write the equation of an ellipse given at least two pieces of information. (PC.CO.3)
- I can write the equation of a hyperbola given at least two pieces of information. (PC.CO.3)

Vocabulary

- Axis of symmetry
- Center
- Complete the square
- Conic section
- Directrix
- Eccentricity
- Ellipse
- Equation of a circle
- Foci
- Focus
- Focus (foci)
- Hyperbola
- Major axis
- Minor axis
- Parabola
- Pythagorean Theorem
- Radius
- Vertex
- Vertex (vertices)
- Vertices

Mathematical Processes

- PS.1 Make sense of problems and persevere in solving them.
- PS.2 Reason abstractly and quantitatively.

Resources		
Proficiency Scales • PC.CO.4	**Digital** • IDOE Examples/Tasks PC.CO.4 • IDOE Examples/Tasks PC.CO.1 • IDOE Examples/Tasks PC.CO.2 • IDOE Examples/Tasks PC.CO.3	**Manipulatives** • 3-D Conic Sections Virtual Manipulative • Coordinate Grid • Desmos Conic Sections • Graphing Calculator • Interactive Ellipse • Interactive Hyperbola • Interactive Parabola

School Resources	
Textbook 2.2 Circles (Review from Ch 2) Ch 11: Analytic Geometry 11.1 The Ellipse 11.2 The Hyperbola 11.3 The Parabola 11.4 Rotation of Axes (SKIP) 11.5 Polar Equations of Conics (SKIP) 11.6 Plane Curves and Parametric Equations (SKIP)	**Formative Assessments**

General Description of the Unit

This unit serves as students' introduction to sequences and series, a topic that is foundational to Calculus. The heart of sequences and series in this unit is modeling and solving real-world situations with sequences and series. The focus is on arithmetic and geometric sequences and series.

Priority Standards

- **PC.SS.4:** Model and solve real-world problems involving applications of sequences and series, interpret the solutions and determine whether the solutions are reasonable.

Supporting Standards

- **PC.SS.1:** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
- **PC.SS.2:** Write arithmetic and geometric sequences both recursively and with an explicit formula; use them to model situations and translate between the two forms.
- **PC.SS.3:** Find partial sums of arithmetic and geometric series and represent them using sigma notation.

Enduring Understandings

- Sequences and series can be used as models for real world situations. Any solutions must be checked against the context to ensure reasonableness.
- Sequences are discrete functions that have either a finite or infinite number of terms.
- Sequences may be defined explicitly or recursively in either function notation or subscript notation.
- Some sequences are arithmetic, where each term is found by adding a constant amount to the previous term. Other sequences may be geometric, where each term is found by multiplying the previous term by the same number.
- A series is a sum of the terms of a sequence. The sum can be calculated by hand or sometimes with formulas.

Essential Questions

- What is a scenario that could be modeled by a sequence? By a series?
- How are sequences and equations similar and different?
- What characteristics of a situation would make it better modeled by a sequence than a function?
- What are the similarities and differences between arithmetic sequences and linear functions? Between geometric sequences and exponential functions?

Key Concepts

- I can model and solve problems involving application of sequences and series. (PC.SS.4)
- I can determine the validity of my solutions in the context of a problem. (PC.SS.4)

Related Concepts

- I can recognize that a sequence is a function. (PC.SS.1)
- I can define a sequence as a recursive function. (PC.SS.1)
- I can define the domain of a recursive function as the subset of integers. (PC.SS.1)
- I can write an arithmetic sequences both recursively and explicitly. (PC.SS.2)
- I can write a geometric sequence both recursively and explicitly. (PC.SS.2)
- I can use arithmetic and geometric sequences to model situations. (PC.SS.2)
- I can translate between recursive formulas and explicit formulas. (PC.SS.2)
- I can find partial sums of arithmetic series. (PC.SS.3)
- I can find partial sums of geometric series. (PC.SS.3)

Vocabulary

- Arithmetic sequence
- Arithmetic series
- Domain
- Explicit formula
- Geometric sequence
- Geometric series
- Integer
- Partial sum
- Recursive formula
- Recursive function
- Sequence
- Series
- Sigma notation

	• I can represent partial sums of arithmetic and geometric series using sigma notation. (PC.SS.3) • I can understand the parts of a series written in sigma notation. (PC.SS.3)	

Mathematical Processes

- PS.2 Reason abstractly and quantitatively.
- PS.6 Attend to precision.

Resources

Proficiency Scales	Digital	Manipulatives
• PC.SS.4	• IDOE Examples/Tasks PC.SS.4 • IDOE Examples/Tasks PC.SS.1 • IDOE Examples/Tasks PC.SS.2 • IDOE Examples/Tasks PC.SS.3	• Graphing Calculator

School Resources

Textbook	Formative Assessments
Ch 12: Sequences, Series, Induction, and Probability 12.1 Sequences and Series 12.2 Arithmetic Sequences and Series 12.3 Geometric Sequences and Series 12.4 Mathematical Induction (SKIP) 12.5 The Binomial Theorem (SKIP) 12.6 Principles of Counting (SKIP) 12.7 Introduction to Probability (SKIP)	

Unit 7: Intro to Calculus (Honors Only) (15 days, 2nd semester)

General Description of the Unit

This is an optional unit for the honors section. The unit will cover the beginning of the calculus course, including limits (by graphing and algebraically), an introduction to derivatives (including the limit definition), and derivative rules.

Priority Standards	**Supporting Standards**
• N/A	• N/A
Enduring Understandings	**Essential Questions**
• N/A	• N/A

Key Concepts	**Related Concepts**	**Vocabulary**
• N/A	• N/A	• N/A

Mathematical Processes

- PS.2 Reason abstractly and quantitatively.
- PS.6 Attend to precision.

Resources

Proficiency Scales	**Digital**	**Manipulatives**
• N/A	• N/A	• N/A

School Resources

Textbook	**Formative Assessments**
Larson PreCalculus Ch 12	