Algebra 2 (3rd Quad Expectations)

Chapter (McGraw-Hill Algebra 2)	CCSS covered	Key Vocabulary	Vertical Alignment
Chapter 7 *(Suggested Pacing 14 Days)*		**Mathematical Practices:** 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	**Before Chapter 7** *(Related Topics from Algebra 2)* • use tools including the properties of exponents to simplify expressions **After Chapter 7** *(Preparation for Precalculus)* • describe parent functions symbolically and graphically, including $f(x) = \log_a x$ and $f(x) = \ln x$ • investigate the concepts of continuity, end behavior, and asymptotes, and connect these characteristics to functions represented graphically and numerically • investigate logarithmic and exponential properties
Lesson 7-1: Graphing Exponential Functions	**F.IF.7.e** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. **F.IF.8.b** Use the properties of exponents to interpret expressions for exponential functions.		
Lesson 7-2: Solving Exponential Equations and Inequalities	**A.CED.1** Create equations and inequalities in one variable and use them to solve problems. **F.LE.4** For exponential models, express as a logarithm the solution to $abct = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.		
Lesson 7-3: Logarithms and Logarithmic Functions	**F.IF.7.e** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. **F.BF.3** Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.	**exponential function** **exponential growth** **asymptote** **growth factor** **exponential decay** **decay factor** **exponential equation** **compound interest** **exponential inequality** **logarithm**	
Lesson 7-4: Solving Logarithmic Equations and Inequalities	**A.SSE.2** Use the structure of an expression to identify ways to rewrite it. **A.CED.1** Create equations and inequalities in one variable and use them to solve problems.		
Lesson 7-5: Properties of Logarithms	**A.CED.1** Create equations and inequalities in one variable and use them to solve problems.		
Lesson 7-6: Common Logarithms	**A.CED.1** Create equations and inequalities in one variable and use them to solve problems.	**logarithmic function** **logarithmic equation** **logarithmic inequality** **common logarithm** **Change of Base Formula** **natural base, e** **natural base exponential function** **natural logarithm**	**Essential Questions:** How can you make good decisions? What factors can affect good decision making?
Lesson 7-7: Base e and Natural Logarithms	**A.SSE.2** Use the structure of an expression to identify ways to rewrite it.		
Lesson 7-8: Using Exponential and Logarithmic Functions	**F.LE.4** For exponential models, express as a logarithm the solution to $abct = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.		

Chapter 8 *(Suggested Pacing 11 Days)*		**Mathematical Practices:**	**Before Chapter 8** *(Related Topics from Algebra 1)*
Lesson 8-1: Multiplying and Dividing Rational Expressions	**A.APR.7** Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning. **rational expression** **complex fraction** **reciprocal function** **hyperbola, rational function** **vertical asymptote** **horizontal asymptote** **oblique asymptote** **point discontinuity** **direct variation** **constant of variation** **joint variation** **inverse variation** **combined variation** **rational equation** **weighted average** **rational inequality**	• use Commutative, Associative, and Distributive Properties to simplify algebraic expressions • identify mathematical domains and ranges and determine reasonable domain and range values for given situations • solve problems involving proportional change *(Previous Topics from Algebra 2)* • sketch graphs of parent functions, including linear functions • use tools including factoring to transform and solve equations **After Chapter 8** (Preparation for Precalculus) • determine the domain and range of functions using graphs, tables, and symbols • investigate the concepts of continuity, end behavior, and asymptotes, and connect these characteristics to functions represented graphically and numerically ***Essential Question:*** Why are graphs useful?
Lesson 8-2: Adding and Subtracting Rational Expressions	**A.APR.7** Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.		
Lesson 8-3: Graphing Reciprocal Functions	**A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **F.BF.3** Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.		
Lesson 8-4: Graphing Rational Functions	**A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **F.IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).		
Lesson 8-5: Variation Functions	**A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.		
Lesson 8-6: Solving Rational Equations and Inequalities	**A.CED.1** Create equations and inequalities in one variable and use them to solve problems. **A.REI.2** Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.		

Chapter 9 *(Suggested Pacing 12 Days)*		Mathematical Practices:	
Lesson 9-1: Midpoint and Distance Formulas	**A.CED.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning. **parabola** **focus** **directrix** **circle** **center of a circle** **radius** **ellipse** **foci** **major axis** **minor axis** **center of an ellipse** **vertices** **co-vertices** **constant sum** **hyperbola** **transverse axis** **conjugate axis** **constant difference**	**Before Chapter 9** *(Related Topics from Algebra 1)* • use tools including factoring and properties of exponents to simplify expressions • graph equations of lines • solve systems of linear equations using algebraic methods *(Previous Topics from Algebra 2)* • solve quadratic equations using algebraic methods • determine solutions of square root equations using algebraic methods **After Chapter 9** *(Preparation for Precalculus)* • use conic sections to model motion, such as motion of the planets • use conic sections to describe physical phenomena such as the reflective properties of light and sound ***Essential Question:*** How does mathematics help us to describe the physical world?
Lesson 9-2: Parabolas	**A.SSE.1.b** Interpret complicated expressions by viewing one or more of their parts as a single entity. **A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.		
Lesson 9-3: Circles	**A.SSE.1.b** Interpret complicated expressions by viewing one or more of their parts as a single entity. **A.CED.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.		
Lesson 9-4: Ellipses	**A.SSE.1.b** Interpret complicated expressions by viewing one or more of their parts as a single entity. **A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.		
Lesson 9-5: Hyperbolas	**A.SSE.1.b** Interpret complicated expressions by viewing one or more of their parts as a single entity. **A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.		
Lesson 9-6: Identifying Conic Sections	**A.SSE.1.b** Interpret complicated expressions by viewing one or more of their parts as a single entity. **F.IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).		
Lesson 9-7: Solving Linear-Nonlinear Systems	**A.REI.11** Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.		

Glencoe ALGEBRA 2 (CCSS)

▼ **Contents in Brief and Pacing**

Contents	Pacing (Days)	Block Pacing
Chapter 0 Preparing for Advanced Algebra		
Unit 1 Linear Relations and Functions		
Chapter 1 Equations and Inequalities	9	5
Chapter 2 Linear Relations and Functions	13	7
Chapter 3 Systems of Equations and Inequalities	15	8
Unit 2 Quadratic, Polynomial, and Radical Functions and Relations		
Chapter 4 Quadratic Functions and Relations	14	7
Chapter 5 Polynomials and Polynomial Functions	14	7
Chapter 6 Inverses and Radical Functions and Relations	11	6
Unit 3 Advanced Functions and Relations		
Chapter 7 Exponential and Logarithmic Functions and Relations	14	10
Chapter 8 Rational Functions and Relations	11	5
Chapter 9 Conic Sections	12	7
Unit 4 Discrete Mathematics		
Chapter 10 Sequences and Series	13	7
Chapter 11 Probability and Statistics	11	8
Unit 5 Trigonometry		
Chapter 12 Trigonometric Functions	15	8
Chapter 13 Trigonometric Identities and Equations	8	4
Total Days	160	89

Number and Quantity
The Complex Number System N-CN
Perform arithmetic operations with complex numbers.

1. Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real.

2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

Use complex numbers in polynomial identities and equations.

7. Solve quadratic equations with real coefficients that have complex solutions.

8. (+) Extend polynomial identities to the complex numbers.

9. (+) Know the Fundamental Theorem of Algebra; show that it is true or quadratic polynomials.

Algebra
Seeing Structure in Expressions A-SSE
Interpret the structure of expressions.

1. Interpret expressions that represent a quantity in terms of its context. ★

    a. Interpret parts of an expression, such as terms, factors, and coefficients.

    b. Interpret complicated expressions by viewing one or more of their parts as a single entity.

2. Use the structure of an expression to identify ways to rewrite it.

Write expressions in equivalent forms to solve problems.

4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. ★

Arithmetic with Polynomials and Rational Expressions A-APR
Perform arithmetic operations on polynomials.

1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

Understand the relationship between zeros and factors of polynomials.

2. Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.

3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

Use polynomial identities to solve problems.

4. Prove polynomial identities and use them to describe numerical relationships.

5. (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.

Rewrite rational expressions.

6. Rewrite simple rational expressions in different forms; write $\dfrac{a(x)}{b(x)}$ in the form $q(x) + \dfrac{r(x)}{b(x)}$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.

7. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Creating Equations ★ A-CED

Create equations that describe numbers or relationships.

1. Create equations and inequalities in one variable and use them to solve problems.

2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.

4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Reasoning with Equations and Inequalities A-REI

Understand solving equations as a process of reasoning and explain the reasoning.

2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Represent and solve equations and inequalities graphically.

11. Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or g (x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★

Functions

Interpreting Functions F-IF

Interpret functions that arise in applications in terms of the context.

4. 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. ★

5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★

Analyze functions using different representations.

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★

    b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

    c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

    e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

    a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

    b. Use the properties of exponents to interpret expressions for exponential functions.

9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Building Functions F-BF

1. Build a function that models a relationship between two quantities.

    b. Combine standard function types using arithmetic operations.

Build new functions from existing functions.

3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.

4. Find inverse functions.

    a. Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse.

Linear, Quadratic, and Exponential Models F-LE

Construct and compare linear and exponential models and solve problems.

4. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

Trigonometric Functions F-TF

Extend the domain of trigonometric functions using the unit circle.

1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

Model periodic phenomena with trigonometric functions.

5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. ★

Prove and apply trigonometric identities.

8. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.

Statistics and Probability
Interpreting Categorical and Quantitative Data S-ID

Summarize, represent, and interpret data on a single count or measurement variable.

4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

Making Inferences and Justifying Conclusions S-IC

Understand and evaluate random processes underlying statistical experiments

1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.

Make inferences and justify conclusions from sample surveys, experiments, and observational studies

3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

6. Evaluate reports based on data.

Using Probability to Make Decisions S-MD

6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).

7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

(+) Advanced Mathematics Standards

★ Mathematical Modeling Standards