Algebra 2 (2nd Quad Expectations)

Chapter (McGraw-Hill Algebra 2)	CCSS covered	Key Vocabulary	Vertical Alignment
Chapter 4 *(14 Days Suggested Pacing)*		**Mathematical Practices:**	**Before Chapter 4** *(Related Topics From Algebra 1)*
Lesson 4-1: Graphing Quadratic Functions	**A.SSE.1.a** Interpret parts of an expression, such as terms, factors, and coefficients. **F.IF.9 C**ompare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively.	• approximate the value of irrational numbers • analyze graphs of quadratic functions and draw conclusions
Lesson 4-2: Solving Quadratic Equations by Graphing	**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.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.	3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically.	• solve linear inequalities using graphs *(Previous Topics from Algebra 2)* • use tools including factoring to transform and solve equations
Lesson 4-3: Solving Quadratic Equations by Factoring	**A.SSE.2** Use the structure of an expression to identify ways to rewrite it. **F.IF.8.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.	6. Attend to precision. 7. Look for and make use of structure.	**After Chapter 4** *(Preparation for Precalculus)*
Lesson 4-4: Complex Numbers	**N.CN.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. **N.CN.2** Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	8. Look for and express regularity in repeated reasoning.	• determine the domain and range of functions using graphs, tables, and symbols
Lesson 4-5: Completing the Square	**N.CN.7** Solve quadratic equations with real coefficients that have complex solutions. **F.IF.8.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.	**quadratic term** **linear term, constant term** **vertex, maximum value** **minimum value**	• recognize and use connections among significant values of a function, points on the graph of a function, and the symbolic representation of a function
Lesson 4-6: The Quadratic Formula and the Discriminant	**N.CN.7** Solve quadratic equations with real coefficients that have complex solutions. **A.SSE.1.b** Interpret complicated expressions by viewing one or more of their parts as a single entity.	**quadratic equation** **standard form** **root, zero, imaginary unit** **pure imaginary number**	• apply basic transformations to the parent functions
Lesson 4-7: Transformations of Quadratic Graphs		**complex number** **complex conjugates** **completing the square**	***Essential Question:*** Why do we use different methods to solve math problems?
Lesson 4-8: Quadratic Inequalities	**A.CED.1** Create equations and inequalities in one variable and use them to solve problems. **A.CED.3** Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.	**Quadratic Formula** **discriminant, vertex form** **quadratic inequality**	

Chapter 5 *(Suggested Pacing 14 Days)*		**Mathematical Practices:**	**Before Chapter 5** *(Related Topics from Algebra 1)*
Lesson 5-1: Operations with Polynomials	**A.APR.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.	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.	• simplify numerical expressions involving exponents • use the Distributive Property to simplify algebraic expressions • find specific function values • solve quadratic equations using graphs
Lesson 5-2: Dividing Polynomials	**A.APR.6** Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + 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.		*(Previous Topics from Algebra 2)* • use complex numbers to describe the solutions of quadratic equations
Lesson 5-3: Polynomial Functions	**F.IF.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.		**After Chapter 5** *(Preparation for Precalculus)*
Lesson 5-4: Analyzing Graphs of Polynomial Functions	**F.IF.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. **F.IF.7.c** Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.	**simplify** **degree of a polynomial** **synthetic division** **polynomial in one variable** **leading coefficient** **polynomial function** **power function** **end behavior** **relative maximum**	• recognize and use connections among significant values of a function, points on the graph of a function, and the symbolic representation of a function
Lesson 5-5: Solving Polynomial Functions	**A.CED.1** Create equations and inequalities in one variable and use them to solve problems.		
Lesson 5-6: The Remainder and Factor Theorems	**A.APR.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). **F.IF.7.c** Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.	**relative minimum** **extrema** **turning points** **prime polynomials** **quadratic form**	• investigate properties of polynomial functions • use functions such as a polynomial functions to model real-life data
Lesson 5-7: Roots and Zeros	**N.CN.9** Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. **A.APR.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.	**synthetic substitution** **depressed polynomial**	***Essential Question:*** Why is math used to model real-world situations?
Lesson 5-8: Rational Zero Theorem			

Chapter 6 *(Suggested Pacing 11 Days)*

Lesson	Standards
Lesson 6-1: Operations on Functions	**F.IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). **F.BF.1.b** Combine standard function types using arithmetic operations.
Lesson 6-2: Inverse Functions and Relations	**F.IF.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. **F.BF.4.a** Find inverse functions. - 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.
Lesson 6-3: Square Root Functions and Inequalities	**F.IF.7.b** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. **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 6-4: nth Roots	**A.SSE.2** Use the structure of an expression to identify ways to rewrite it.
Lesson 6-5: Operations with Radical Expressions	**A.SSE.2** Use the structure of an expression to identify ways to rewrite it.
Lesson 6-6: Rational Exponents	
Lesson 6-7: Solving Radical Equations and Inequalities	**A.SSE.2** Use the structure of an expression to identify ways to rewrite it.

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.

composition of functions
inverse relation
inverse function
square root function
radical function
square root inequality
***n*th root**
radical sign
index
radicand
principal root
rationalizing the denominator
conjugates
radical equation
extraneous solution
radical inequality

Before Chapter 6
(Related Topics from Algebra 1)
- simplify polynomial expressions
- transform and solve equations
- graph equations of lines
- use the Distributive Property to simplify algebraic expressions

(Previous Topics from Algebra 2)
- use the properties of exponents to simplify expressions

After Chapter 6
(Preparation for Precalculus)
- define functions, describe characteristics of functions, and translate among verbal, numerical, graphical, and symbolic representations of functions, including power functions
- perform operations including composition of functions, finding inverses, and describing these procedures and results verbally, numerically, symbolically, and graphically

Essential Question:
How can you choose a model to represent a set of data?

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