Algebra 2   Trimester 3 Expectations

Chapter (McGraw-Hill Algebra 2)	CCSS Covered	Key Vocabulary	Vertical Alignment
Chapter 9 *(Suggested Pacing 12 Days)* **Conic Sections**		**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. **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 9-1: Midpoint and Distance Formulas	**A.CED.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.		
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.		

Chapter 10 *(Suggested Pacing 13 Days)* **Sequences and Series**		**Mathematical Practices:**	**Before Chapter 10** *(Related Topics before Alg 1)*
Lesson 10-1: Sequences as 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.	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.	• find and evaluate an algebraic expression to determine any term of an arithmetic sequence *(Related Topics from Algebra 1)* • look for patterns and represent generalizations algebraically • transform and solve equations • simplify polynomial expressions
Lesson 10-2: Arithmetic Sequences and Series	**A.CED.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.		
Lesson 10-3: Geometric Sequences and Series	**A.SSE.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.		**After Chapter 10** *(Preparation for Precalculus)* • represent patterns using arithmetic and geometric sequences and series • use arithmetic, geometric, and other sequences and series to solve real-life problems • describe limits of sequences and apply their properties to investigate convergent and divergent series • apply sequences and series to solve problems including sums and binomial expansion
Lesson 10-4: Infinite Geometric Series		**sequence** **finite sequence** **infinite sequence** **arithmetic sequence** **common difference** **geometric sequence** **common ratio** **arithmetic means** **series** **arithmetic series** **partial sum** **geometric means** **geometric series** **convergent series** **divergent series** **recursive sequence** **iteration** **mathematical induction** **induction hypothesis**	
Lesson 10-5: Recursion and Iteration			
Lesson 10-6: The Binomial Theorem	**A.APR.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.		**Essential Questions:** Where are patterns found in the real world? How can recognizing patterns help you solve real-world problems?
Lesson 10-7: Proof by Mathematical Induction	**A.SSE.1.b** Interpret complicated expressions by viewing one or more of their parts as a single entity. **A.APR.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.		

Chapter (McGraw-Hill Algebra 2)	CCSS Covered	Key Vocabulary	Vertical Alignment
Chapter 11 *(Suggested Pacing 11 Days)* **Statistics and Probability**		**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. **parameter, statistic, survey, experiment** **observational study** **random variable** **probability distribution** **expected value** **binomial experiment** **binomial distribution** **normal distribution** **z-value, confidence interval** **inferential statistics** **statistical inference** **hypothesis test** **null hypothesis** **alternative hypothesis**	**Before Chapter 11** *(Related Topics from Alg 1)* • construct sample spaces for simple or composite experiments • find the probabilities of dependent and independent events • use theoretical probabilities and experimental results to make predictions and decisions • select the appropriate measure of central tendency or range to describe a set of data • select and use an appropriate representation for presenting and displaying relationships among collected data • evaluate methods of sampling to determine validity of an inference made from a set of data *(Previous Topics from Alg 2)* • simplify polynomial expressions **After Chapter 11** *(Preparation for Chapter 12)* • This chapter reinforces skills needed in AP Statistics.
Lesson 11-1: Designing a Study	**S.IC.3** Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. **S.IC.5** Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.		
Lesson 11-2: Distributions of Data	**S.IC.1** Understand statistics as a process for making inferences about population parameters based on a random sample from that population.		
Lesson 11-3: Probability Distributions	**S.MD.7** Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).		
Lesson 11-4: The Binomial Distribution	**S.MD.6** Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). **S.MD.7** Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).		
Lesson 11-5: The Normal Distribution	**S.ID.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.		**Essential Questions:** How can you effectively evaluate information? How can you use information to make decisions?
Lesson 11-6: Confidence Intervals and Hypothesis Testing	**S.IC.1** Understand statistics as a process for making inferences about population parameters based on a random sample from that population. **S.IC.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.		

Chapter 12 *(Suggested Pacing 15 Days)*
Trigonometric Functions

Lesson	Standards
Lesson 12-1: Trigonometric Functions in Right Triangles	
Lesson 12-2: Angles and Angle Measure	**F.TF.1** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
Lesson 12-3: Trigonometric Functions of General Angles	
Lesson 12-4: Law of Sines	
Lesson 12-5: Law of Cosines	
Lesson 12-6: Circular and Periodic Functions	**F.TF.1** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. **F.TF.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.
Lesson 12-7: Graphing Trigonometric Functions	**F.IF.7.e** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. **F.TF.5** Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
Lesson 12-8: Translations of Trigonometric Graphs	**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 $f(x) + k$, 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 12-9: Inverse Trigonometric 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.

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.

trigonometry
sine, cosine, tangent
cosecant, secant, cotangent
angle of elevation
angle of depression
standard position
radian
Law of Sines
ambiguous case
Law of Cosines
unit circle
circular function
periodic function
cycle,   period,   amplitude
frequency

Before Chapter 12
(Related Topics before Alg 1)
- use the Pythagorean Theorem
- apply formulas to solve problems

(Previous Topics from Alg 2)
- introduce new notations for inverse functions when logarithmic functions are explored
- restrict domains when inverses for functions, such as y = x2, are found

After Chapter 12
(Preparation for Precalculus)
- continue the study of amplitude, period, and frequency for trigonometric and other periodic functions
- explore trigonometric functions and periodic functions
- explore amplitude and frequency for periodic functions
- look at translations of graphs
- use trigonometric functions for sum and difference of angles
- solve equations involving trigonometric functions

Essential Question:
What types of real-world problems can be modeled and solved using trigonometry?

Chapter 13 **Trigonometric Identities and Equations** (content being assessed by the classroom teacher, not at the district level)		**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. **trigonometric identity** **quotient identity** **reciprocal identity** **Pythagorean identity** **cofunction identity** **negative angle identity** **trigonometric equation**	**Before Chapter 13** *(Previous Topics from Alg 2)* • investigate the six trigonometric functions • work with angles measured in degrees or radians • investigate angles as rays in standard position and as points on the unit circle • explore periodicity and inverse trigonometric functions **After Chapter 13** *(Preparation for Precalculus)* • use trigonometric formulas and identities while analyzing vertical and horizontal translations of graphs and how these translations are related to changes in the algebraic description of the graphs **Essential Question:** How can representing the same mathematical concept in different ways be helpful?
Lesson 13-1: Trigonometric Identities	**F.TF.8** Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.		
Lesson 13-2: Verifying Trigonometric Identities	**F.TF.8** Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.		
Lesson 13-3: Sum and Difference of Angles Identities	**F.TF.8** Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.		
Lesson 13-4: Double-Angle and Half-Angle Identities	**F.TF.8** Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.		
Lesson 13-5: Solving Trigonometric Equations	**F.TF.8** Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.		

Glencoe ALGEBRA 2 CCSS

▼ Contents in Brief and Pacing

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Unit 5 Trigonometry		
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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 $\frac{a(x)}{b(x)}$ in the form $q(x) + \frac{r(x)}{b(x)}$, 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