Mathematics

Algebra II Public Overview

1st 9 Weeks
Assessments
MAP Growth Math: September 2nd – September 3rd

What are we learning? How can I help at home?
Topic 1: Functions

In this topic, students explore the key features of linear, quadratic, and absolute value functions, including intercepts, vertices, maximums and minimums, domain, range, and intervals of increase and decrease. Students learn how changing the values of a, b, h, and k in an equation affects the graph by creating translations, reflections, stretches, and compressions. They also investigate piecewise-defined functions, such as absolute value and step functions, and learn how to graph and interpret them. Students then focused on transformations of absolute value functions, analyzing how graphs shift and change shape. In addition, they learn to write and solve absolute value equations and inequalities and interpret their solutions in context. To connect mathematics to real-world situations, students use data to create lines of best fit, develop linear models, and make predictions based on trends. These skills help students strengthen their understanding of functions, graphical representations, and mathematical modeling.

Essential Question:

What are the ways in which functions can be used to represent and solve problems involving quantities?

Timeline: August 11th – September 4th
Essential Standards: 2A.2A, 2A.6E, 2A.8C
Link to TEKS/Parent Guide:

- Texas Essential Knowledge and Skills for Mathematics Algebra II
- Topic Family Engagement aligned to the topics are available through the students' digital access.

Content:

- Identify and describe key features of linear, quadratic, and absolute value graphs, including intercepts, vertices, and maximum or minimum values.
- Explain how changing values in a function affect the graph's shape and position.
- Graph and compare transformations, including translations, reflections, stretches, and compressions.
- Recognize and graph piecewise-defined functions, such as absolute value and step functions.
- Interpret the meaning of key features of a graph in mathematical and real-world situations.
- Write and solve absolute value equations.

- Write and solve absolute value inequalities.
- Use tables, graphs, and equations to model real-world data.
- Determine and write a line of best fit for a set of data.
- Use a linear model to make predictions and justify my reasoning.
- Explain my mathematical thinking using appropriate vocabulary and representations

At-Home Connection:

- **Talk About Graphs in Everyday Life:** Look for graphs in weather forecasts, sports statistics, stock market reports, or social media trends. Ask your child to identify key features such as increasing and decreasing trends, maximums, minimums, and intercepts.
- **Explore Transformations Together:** Give your child a simple function, such as $y = x$, and discuss what happens when the graph moves up, down, left, or right. Encourage them to explain how changes in an equation affect the graph's appearance.
- **Use Data to Make Predictions:** Collect real-world data, such as daily temperatures, the number of steps walked each day, or time spent reading. Have your child create a graph, identify patterns, and make predictions using a line of best fit or trend line.

Topic 2: Quadratic Functions and Equations

In this topic, students explore different forms of quadratic function such as vertex, standard, and factored for and learn how each form helps identify key features such as zeros, vertices, and maximum or minimum values. They solve quadratic equations using factoring, completing the square, and the Quadratic Formula, including problems with complex solutions. Students also use quadratic functions to model real-world data, make predictions, and analyze quadratic inequalities. Finally, they investigate the properties of parabolas, including the focus, directrix, and the relationship between a parabola's equation and its graph.

Essential Question:

How can different forms of quadratic functions help us analyze, solve, and model real-world situations?

Timeline: September 8th – October 22nd
Essential Standards: 2A.4B, 2A.8C, 2A.4F
Link to TEKS/Parent Guide:

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Content:

- Identify and compare quadratic functions written in vertex, standard, and factored form.
- Graph quadratic functions and describe their key features, including the vertex, axis of symmetry, zeros, and maximum or minimum value.
- Rewrite quadratic functions in different forms to determine important information about the graph.

- Solve quadratic equations by factoring.
- Solve quadratic equations by completing the square.
- Use the Quadratic Formula to find solutions to quadratic equations.
- Determine whether a quadratic equation has real or complex solutions.
- Model real-world situations using quadratic functions.
- Analyze data and choose an appropriate quadratic model.
- Use quadratic models to make and justify predictions.
- Represent and interpret quadratic inequalities using graphs.
- Describe the key properties of a parabola, including its focus and directrix.
- Explain my mathematical reasoning using graphs, equations, and appropriate mathematical vocabulary.

At-Home Connection:

- **Connect Quadratics to Real Life:** Look for examples of quadratic relationships in sports, amusement park rides, fountains, or objects being thrown. Ask your child how the path of the object resembles a parabola and what features of the graph are important.
- **Practice Finding Patterns:** Have your child create a table of values for a quadratic equation and graph the results. Encourage them to identify the vertex, zeros, and axis of symmetry and explain what these features mean.
- **Use Data to Make Predictions:** Collect data from a real-life situation, such as a ball bounce experiment or the height of a basketball shot over time. Ask your child to describe the pattern and discuss how a quadratic model could be used to make predictions.

2nd 9 Weeks

Assessments

Semester Exams: December 15th – December 18th

What are we learning?
How can I help at home?

Topic 2: Quadratic Functions and Equations *(Continued)*

See 1st 9 weeks for details

Topic 3: System of Linear Equations and Inequalities

In this topic, students solve systems of equations and inequalities using a variety of methods, including substitution, elimination, graphing, and matrices. They determine solutions to systems of linear equations and identify solution regions for systems of linear inequalities by graphing and analyzing overlapping areas. Students also extend their understanding of systems to include quadratic equations and inequalities, solving systems that involve both linear and quadratic relationships. Using graphs and algebraic methods, students interpret points of intersection and solution sets in mathematical and real-world contexts. Through these experiences, students strengthen their ability to analyze relationships, solve complex problems, and connect multiple representations of functions.

Essential Question:

What are the ways in which systems of equations and inequalities can be used to represent and solve problems?

Timeline: October 23rd – November 10th
Essential Standards: 2A.3A, 2A.3B
Link to TEKS/Parent Guide:

- Texas Essential Knowledge and Skills for Mathematics Algebra II
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Content:

- Solve systems of linear equations using substitution.
- Solve systems of linear equations using elimination.
- Use matrices to solve systems of equations.
- Determine whether a system has one solution, no solution, or infinitely many solutions.
- Graph systems of linear inequalities and identify the solution set.
- Interpret what a solution means in a mathematical or real-world context.
- Solve systems that include both linear and quadratic equations.
- Solve systems that include linear and quadratic inequalities.
- Use graphs to find points of intersection and solution sets.
- Use substitution to solve systems involving quadratic equations.
- Compare different methods and choose an appropriate strategy for solving a system.
- Explain my mathematical reasoning using equations, graphs, and appropriate mathematical vocabulary.

At-Home Connection:

- **Discuss Real-World Systems:** Talk about situations where two conditions must be true at the same time, such as comparing the cost of two phone plans or determining when two travelers arrive at the same location. Ask your child how a system of equations could help solve the problem.
- **Explore Graphs Together:** Look at graphs in the news, sports, or weather reports and discuss where trends might intersect. Ask your child what the intersection point represents and why it is important.
- **Compare Solution Methods:** Give your child a simple system of equations and ask them to explain how they could solve it using graphing, substitution, or elimination. Encouraging them to explain their thinking helps strengthen understanding and communication skills.

Topic 4: Polynomials

In this topic, students explore polynomial functions and operations by adding, subtracting, multiplying, factoring, and dividing polynomials. Students use long division and synthetic division to divide polynomials and identify the zeros of polynomial functions. They also investigate the

relationship between a polynomial's degree, coefficients, and roots using the Rational Root Theorem and the Fundamental Theorem of Algebra. Students graph and analyze polynomial functions by examining key features such as intercepts, leading coefficients, degree and turning points. They use zeros to sketch graphs, explore transformations of cubic and quartic functions, and write equations from graphs. Through these experiences, students strengthen their understanding of polynomial relationships and use algebraic and graphical representations to solve problems and model real-world situations.

Essential Question:

What are the ways in which functions can be used to represent and solve problems involving quantities?

Timeline: November 11th – January 15th
Essential Standards: 2A.2A, 2A.7E
Link to TEKS/Parent Guide:

- **Texas Essential Knowledge and Skills for Mathematics Algebra II**
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Content:

- Identify and describe key features of polynomial graphs, including intercepts, degree, and turning points.
- Add, subtract, multiply, and divide polynomials.
- Use long division and synthetic division to divide polynomial expressions.
- Rewrite expressions using polynomial identities, Pascal's Triangle, and the Binomial Theorem.
- Factor polynomial expressions using a variety of strategies.
- Use the Factor Theorem to determine whether a binomial is a factor of a polynomial.
- Find the zeros of polynomial functions using factoring and synthetic division.
- Apply the Rational Root Theorem to identify possible rational zeros.
- Explain the relationship between a polynomial's degree and the number of its roots.
- Sketch polynomial graphs using even/odd function, zeros, and multiplicities.
- Graph and analyze transformations of cubic and quartic parent functions.
- Write polynomial equations from graphs and graphs from equations.
- Use polynomial functions to model and solve real-world problems.
- Explain my mathematical thinking using graphs, equations, and appropriate mathematical vocabulary.

At-Home Connection:

- **Look for Polynomial Patterns:** Find patterns in real life, such as the shape of a roller coaster, a bridge arch, or the path of a ball, and discuss how polynomial graphs can model these situations.
- **Practice Factoring and Finding Zeros:** Have your child explain how factors and zeros are connected and how they help determine where a graph crosses or touches the x-axis.
- **Connect Graphs and Equations**: Show your child a graph and ask them to describe its key features, such as intercepts, and discuss how those features relate to the equation.

3rd 9 Weeks
Assessments MAP Growth Math: January 20th – January 21st

What are we learning? How can I help at home?
Topic 4: Polynomials *(Continued)* *See 2nd 9 weeks for details*

Topic 5: Rational Functions

In this topic, students explore rational functions and their graphs, focusing on identifying and interpreting key features such as vertical and horizontal asymptotes. They learn how translations affect the reciprocal parent function and use asymptotes to graph rational functions. Students apply rational functions to model and analyze real-world situations. They also develop fluency with rational expressions by rewriting equivalent expressions and simplifying common factors. Students add, subtract, multiply, and divide rational expressions and solve rational equations using common denominators. Throughout the unit, students verify solutions algebraically and graphically while strengthening their understanding of the relationship between rational equations, expressions, and graphs.

Essential Question:

Timeline: January 19th – February 11th
Essential Standards: 2A.2A, 2A.6I, 2A.6L, 2A.7F
Link to TEKS/Parent Guide:

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Content:

- Identify vertical and horizontal asymptotes of a rational function.
- Graph rational functions using asymptotes and key points.
- Describe how translations affect the reciprocal parent function.
- Model real-world situations using rational functions.
- Rewrite rational expressions in equivalent forms.
- Simplify rational expressions using common factors.
- Add and subtract rational expressions.
- Multiply and divide rational expressions.
- Solve rational equations.
- Check whether a solution is valid in the domain.
- Verify solutions using graphs and algebra.
- Explain my mathematical reasoning using appropriate vocabulary.

At-Home Connection:

- **Explore Asymptotes in Real Life:** Discuss situations where a value gets very close to something but never reaches it, such as dividing a fixed amount among an increasing number of people. Talk about how this relates to asymptotes in rational functions.
- **Practice Simplifying Expressions:** Encourage your child to explain how common factors can be used to simplify fractions and rational expressions. Connecting algebraic fractions to numerical fractions can help reinforce understanding.
- **Analyze Graphs Together:** Look at graphs online, in the news, or in everyday situations and ask your child to identify key features such as intercepts, increasing or decreasing intervals, and any asymptotes. Have them explain what those features tell us about the situation being modeled.

Topic 6: Rational Exponents and Radical Functions

In this topic, students solve radical equations and explore function operations. They use nth roots to solve equations involving variables raised to powers and solve radical equations containing one or more radicals, as well as equations with rational exponents. Students graph radical functions, analyze transformations, and use graphs to estimate and verify solutions. They also learn the importance of checking for extraneous solutions. In addition, students perform operations with functions, including adding, subtracting, multiplying, and dividing functions while determining the resulting domain. Students further develop their understanding of functions by composing functions and using composition to verify whether two functions are inverse functions. Through these experiences, students strengthen their ability to analyze, manipulate, and connect multiple representations of functions.

Essential Question:

How are rational exponents and radical equations used to solve real-world problems?

Timeline: February 16th – March 25th
Essential Standards: 2A.2A, 2A.4C, 2A.4C, 2A.5D, 2A.4F, 2A.7H
Link to TEKS/Parent Guide:

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Content:

- Solve equations with variables raised to powers.
- Solve radical equations.
- Solve equations that contain rational exponents.
- Check for and identify extraneous solutions.
- Graph radical functions and identify key features.
- Describe and graph transformations of radical functions.
- Use graphs to estimate and verify solutions.
- Add, subtract, multiply, and divide functions.
- Determine the domain of a function and its operations.

- Compose functions and evaluate compositions.
- Determine the domain of a composite function.
- Verify whether two functions are inverses.
- Explain my mathematical thinking using equations, graphs, and appropriate vocabulary.

At-Home Connection:

- **Connect Radicals to Real Life:** Look for examples of square roots and roots in everyday situations, such as finding the side length of a square from its area. Ask your child to explain how roots help solve problems.
- **Explore Function Machines:** Create simple "input-output" rules at home and have your child determine the output for different inputs. Then combine two rules to explore function composition.
- **Discuss Graph Transformations:** Have your child sketch a basic radical graph and explain how adding, subtracting, or changing values in the equation shifts or transforms the graph. Teaching someone else is a great way to deepen understanding.

4th 9 Weeks

Assessments

MAP Growth Math: May 5th – May 6th

What are we learning?
How can I help at home?

Topic 6: Rational Exponents and Radical Functions *(Continues)*

See 3rd 9 weeks for details

Topic 7: Exponential Functions

In this topic, students explore exponential functions and their applications in real-world situations. They investigate the key features of exponential growth and decay and use exponential models to represent and analyze data. Students learn about the natural base e and its connection to continuously compounded interest. They graph exponential functions, evaluate them for different values, and use exponential regression to determine the best-fitting model for a data set. Students also compare linear, quadratic, and exponential models to identify which best represents a given situation. In addition, they examine how transformations affect exponential functions, including translations, stretches, compressions, and reflections. Through graphing and analyzing transformed functions, students strengthen their understanding of exponential relationships and how functions can be used to model and predict real-world phenomena.

Essential Question:

How do you use exponential functions to model situations and solve problems?

Timeline: March 29th – April 16th

Essential Standards: 2A.5A, 2A.8C, 2A.2A, 2A.5D
Link to TEKS/Parent Guide:

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Content:

- Identify key features of exponential functions.
- Distinguish between exponential growth and exponential decay.
- Graph exponential functions and interpret their meaning.
- Evaluate exponential functions for given values.
- Use exponential functions to model real-world situations.
- Explain the role of the number **e** in exponential models.
- Compare linear, quadratic, and exponential models.
- Determine the best-fit model for a set of data.
- Use exponential regression to create a model from data.
- Make predictions using an exponential model.
- Graph translations of exponential functions.
- Graph stretches, compressions, and reflections of exponential functions.
- Describe how transformations affect the graph of an exponential function.
- Write an equation that matches a transformed exponential graph.
- Explain my mathematical thinking using graphs, tables, and equations.

At-Home Connection:

- **Explore Exponential Growth and Decay:** Discuss real-world examples of exponential functions, such as population growth, viral videos, savings accounts earning interest, or the depreciation of a car. Ask your child whether the situation represents growth or decay and how they know.
- **Analyze Data and Make Predictions:** Collect data from a real-life situation, such as social media followers, weekly savings, or plant growth. Have your child identify patterns and predict future values using what they know about exponential relationships.
- **Connect Graphs to Transformations:** Ask your child to explain how an exponential graph changes when it is shifted, stretched, compressed, or reflected. Encouraging them to describe the transformations in their own words helps reinforce their understanding.

Topic 8: Logarithmic Functions

In this topic, students explore logarithmic functions and their relationship to exponential functions. They learn to convert between exponential and logarithmic forms and use this relationship to solve equations. Students evaluate logarithms, apply the properties of logarithms to expand and condense expressions, and use the Change of Base Formula to work with different bases. They graph logarithmic functions, identify key features, and analyze transformations. Students also solve exponential and logarithmic equations using common bases, logarithmic properties, and graphing techniques. Throughout the topic, students check for extraneous solutions and use graphs to verify their answers.

These experiences help students deepen their understanding of inverse functions and strengthen their ability to model and solve real-world problems involving exponential and logarithmic relationships.

Essential Question:

How do you use logarithmic functions to model situations and solve problems?

Timeline: April 19th – May 27th
Essential Standards: 2A.5A, 2A.5D, 2A.2A, 2A.2C
Link to TEKS/Parent Guide:

- Texas Essential Knowledge and Skills for Mathematics Algebra II
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Content:

- Convert between exponential and logarithmic forms.
- Explain the relationship between exponential and logarithmic functions.
- Evaluate common and natural logarithms.
- Use logarithm properties to expand and simplify expressions.
- Rewrite logarithmic expressions using the Change of Base Formula.
- Graph logarithmic functions and identify key features.
- Graph transformations of logarithmic functions.
- Solve exponential equations using a common base.
- Solve exponential equations using logarithms.
- Solve logarithmic equations.
- Check solutions for extraneous values.
- Use graphs to solve and verify exponential and logarithmic equations.
- Explain my mathematical thinking using equations, graphs, and appropriate vocabulary.

At-Home Connection:

- **Connect Logarithms to Real Life:** Discuss examples where exponential growth or decay occurs, such as population growth, investments, or technology. Ask your child how logarithms can help determine how long a process takes.
- **Practice Converting Forms:** Have your child explain how an exponential equation can be rewritten as a logarithmic equation and vice versa. Teaching someone else is a great way to deepen understanding.
- **Explore Graphs and Technology:** Use a graphing calculator or online graphing tool to compare exponential and logarithmic graphs. Ask your child to describe how the graphs are related and identify important features such as intercepts and asymptotes.