Math II

Conceptual Category ***Number and Quantity N***

Domain ***The Real Number System RN***

Cluster ***Extend the properties of exponents to rational exponents.***

Pacing

2nd Quarter

Standards

N-NR.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.

For example, we define $5^{\frac{1}{3}}$ *to be the cube root of 5 because we want* $(5^{\frac{1}{3}})^3 = 5^{(\frac{1}{3})3}$ *to hold, so* $\left(5^{\frac{1}{3}}\right)^3$ *must equal 5.*

Learning Targets

I can:

- Apply properties of exponents.
- Apply the definition of nth root for various values and explain why it is true.
- Apply properties of exponents and definitions of nth roots to explain that they are equivalent.

N-NR.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Learning Targets

I can:

- Apply the properties of exponents to simplify algebraic expressions with integer and rational exponents.
- Write radical expression as expressions with rational exponents.
- Write expressions with rational exponents as radical expressions.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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.

From the K-8 Math Standards Progression.

Key Advances from Grades K-8

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Math II

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Content Vocabulary • rational exponent • radical • radicand • index • nth root	**Academic Vocabulary** • radical
Formative Assessments • performance tasks • pretests • quizzes • interviews	**Summative Assessments** • MVP assessments • Teacher created assessments • PARCC
Resources • Mathematics Vision Project • PARCC Model Content Framework	**Enrichment Strategies**
Integrations • Modeling projects	**Intervention Strategies**

Math II

Conceptual Category ***Number and Quantity N***	
Domain ***The Real Number System RN***	
Cluster ***Use properties of rational and irrational numbers.***	**Pacing** **2nd Quarter**
Standards **N-NR.3 Explain why sums and products of rational numbers are rational, why the sum of a rational number and an irrational number is irrational, and why the product of a nonzero rational number and an irrational number is irrational.** **Learning Targets** **I can:** • Classify and state examples of rational and irrational numbers. • Explain why the sum and the product of two rational numbers is rational. • Explain why the sum and the product of a rational and an irrational number is irrational.	**Content Elaborations** **Standards of Mathematical Practice** ***Mathematically proficient students:*** 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. **From the K-8 Math Standards Progression.** **Key Advances from Grades K-8** • Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities. • Students formalize their understanding of the definition of a function, particularly their understanding of linear functions, emphasizing the structure of linear expressions. Students also begin to work on exponential functions, comparing them to linear functions. • Work with congruence and similarity motions that started in grades 6-8 progresses. Students also consider sufficient conditions for congruence of triangles. • Work with the bivariate data and scatter plots in grades 6-8 is extended to working with lines of best fit.

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Math II

Conceptual Category *Number and Quantity N*

Domain *The Complex Number System CN*

Cluster ***Perform arithmetic operations with complex numbers. (Limit to multiplications that involve i^2 as the highest power of i.)***

Pacing

2nd Quarter

Standards

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.

Learning Targets

I can:

- Identify i is a complex number where $i = \sqrt{-1}$ and $i^2 = -1$.
- Identify that a complex number is written in $a + bi$ form.

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

Learning Targets

I can:

- Recognize that i^n = 1, -1, i, or $-i$ if $n = 4k$, $4k - 2$, $4k - 1$ or $4k - 3$.
- Use the commutative, associative, and distributive properties to multiply complex numbers substituting – 1 for i^2.

(+) N-CN.3 (Honors) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

Learning Targets

I can:

- Determine the conjugate of a complex number.
- Define the modulus of a complex number as the positive square root of the sum of the squares of the real and imaginary parts of a complex number.
- Use conjugates to express quotients of complex numbers in standard form.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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.
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Math II

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• real numbers
• complex numbers
• imaginary numbers
• $a + bi$
• i

Honors (+)
• conjugate
• modulus
• magnitude
• complex plane</td><td>Academic Vocabulary
• complex</td></tr>
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Math II

Conceptual Category *Number and Quantity N*

Domain *The Complex Number System CN*

Cluster ***Use complex number in polynomial identities and equations. (Limit to quadratics with real coefficients.)***

Pacing

2nd Quarter

Standards

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

Learning Targets

I can:

- Determine when a quadratic equation has complex roots by looking at its graph or by calculating the discriminant.
- Solve quadratic equations with real numbers as coefficients.
- Express the solution of a quadratic as a complex number.

(+) N-CN.8 (Honors) Extend polynomial identities to the complex numbers.

For example, rewrite $x^2 + 4 = (x + 2i)(x - 2i)$.

Learning Targets

I can:

- Write the factors of polynomials using complex numbers.
- Use complex numbers to rewrite a sum of squares as the product of a complex number and its conjugate.
- Show that factored quadratics (e.g., $(x + 3 + 2i)(x + 3 - 2i)$ have real coefficients when written in standard form.

(+) N-CN.9 (Honors) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Learning Targets

I can:

- Explain the Fundamental Theorem of Algebra in my own words.
- Use the Linear Factorization Theorem to demonstrate that a quadratic has two linear factors.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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2. Reason abstractly and quantitatively.
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- Solve a quadratic in factored form for its zeros even if they are complex.

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Content Vocabulary

- conjugates
- complex numbers
- i
- factor
- Fundamental Theorem of Algebra
- solutions
- complex
- roots
- closed
- multiplicity

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Academic Vocabulary

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Formative Assessments

- performance tasks
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Math II

Conceptual Category ***Algebra A***	
Domain ***Arithmetic with Polynomials and Rational Expressions APR***	
Cluster ***Perform arithmetic operations on polynomials (linear or quadratic in a positive integer power of x).***	**Pacing** **2nd Quarter**
Standards **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.** **Learning Targets** **I can:** • Apply the definition of an integer to explain why adding, subtracting, or multiplying 2 integers always produces another integer. • Apply the definition of polynomial to explain why adding, subtracting, or multiplying two polynomials always produces a polynomial. • Add, subtract, and multiply polynomials.	**Content Elaborations** **Standards of Mathematical Practice** ***Mathematically proficient students:*** 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. **From the K-8 Math Standards Progression.** **Key Advances from Grades K-8** • Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities. • Students formalize their understanding of the definition of a function, particularly their understanding of linear functions, emphasizing the structure of linear expressions. Students also begin to work on exponential functions, comparing them to linear functions. • Work with congruence and similarity motions that started in grades 6-8 progresses. Students also consider sufficient conditions for congruence of triangles. • Work with the bivariate data and scatter plots in grades 6-8 is extended to working with lines of best fit.

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Content Vocabulary • like terms • binomial • trinomial • polynomial • closure	**Academic Vocabulary**
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Math II

Conceptual Category ***Algebra A***	
Domain ***Seeing Structure in Expressions SSE***	
Cluster ***Interpret the structure of expressions. (Focus on quadratic and exponential expressions; exponents extended to rational exponents, emphasizing those that represent square and cube roots.)***	**Pacing** **2nd Quarter**

Standards

A-SSE.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. *For example, interpret* $P(1+r)^n$ *as the product of* P *and a factor not depending on* P.

Learning Targets

I can:

- Define and interpret the real world meaning of terms, factors, and coefficients of an expression in terms of their units.
- Group the parts of an expression differently in order to better interpret their meaning.

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

For example, see $x^4 - y^4$ *as* $(x^2)^2 - (y^2)^2$*, thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$.

Learning Targets

I can:

- Explain why equivalent expressions are equivalent.
- Apply models for factoring and multiplying polynomials to rewrite expressions.
- Look for and identify clues in the structure of expressions (e.g., like terms, common factors, difference of squares, perfect squares) in order to rewrite the expression.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

1. Make sense of problems and persevere in solving them.
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• terms
• exponent
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Math II

Conceptual Category ***Algebra A***

Domain ***Seeing Structure in Expressions SSE***

Cluster ***Write expressions in equivalent forms to solve problems. (Balance conceptual understanding of what each form reveals with procedural skill in factoring and completing the square. Extend work with quadratics to include the relationship between coefficients and roots, and once roots are known, a quadratic equation can be factored.)***

Pacing

2nd Quarter

Standards

A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

a. Factor a quadratic expression to reveal the zeros of the function it defines.
b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
c. Use the properties of exponents to transform expressions for exponential functions.
For example, the expression 1.15^t *can be rewritten as* $\left(1.15^{\frac{1}{12}}\right)^{12t} - 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.)*

Learning Targets

I can:

- Factor a quadratic expression to find the zeros of the function it represents.
- Identify and factor perfect square trinomials.
- Complete the square to rewrite a quadratic expression from standard to vertex form.
- Predict whether a quadratic will have a min or max based on the value of a.
- Identify the max or min of a quadratic written in vertex form.
- Define an exponential function.
- Rewrite exponential functions using the properties of exponents.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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Math II

Conceptual Category ***Algebra A***

Domain ***Reasoning with Equations and Inequalities REI***

Cluster ***Solve equations and inequalities in one variable (solving any quadratic equations with real coefficients including those with complex solutions).***

Pacing

2nd Quarter

Standards

A-REI.4 Solve quadratic equations in one variable.

a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.

b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.

Learning Targets

I can:

- Identify a quadratic expression, a perfect square trinomial.
- Factor a perfect square trinomial.
- Complete the square of standard form quadratics to write them in vertex form.
- Derive the quadratic formula by completing the square.
- Solve quadratic equations by inspection, finding square roots, completing the square, the quadratic formula, or factoring.
- Explain that complex solutions result when the discriminant is negative.
- Write complex number solutions in $a + bi$ form.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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Content Vocabulary • radicals • complex numbers • solve • factor • discriminant	**Academic Vocabulary**
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Math II

Conceptual Category ***Algebra A***	
Domain ***Reasoning with Equations and Inequalities REI***	
Cluster ***Solve systems of equations. (Include systems consisting of one linear and one quadratic equation. Include systems that lead to work with fractions. For example, finding the intersections between $x^2 + y^2 = 1$ and $y = \frac{x+1}{2}$ leads to the point $(\frac{3}{5}, \frac{4}{5})$ on the unit circle, corresponding to the Pythagorean triple, $3^2 + 4^2 = 5^2$.***	**Pacing** **2nd Quarter**
Standards **A-REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.** *For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.* **Learning Targets** **I can:** • Distinguish between equations that are linear and quadratic. • Use substitution to solve a system of equations in which one equation is linear and one is quadratic. • Graph a linear and quadratic equation on a coordinate plane. • Determine the approximate solution of a system of equations in which one equation is linear and one is quadratic from its graph.	**Content Elaborations** **Standards of Mathematical Practice** ***Mathematically proficient students:*** 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. **From the K-8 Math Standards Progression.** **Key Advances from Grades K-8** • Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities. • Students formalize their understanding of the definition of a function, particularly their understanding of linear functions, emphasizing the structure of linear expressions. Students also begin to work on exponential functions, comparing them to linear functions. • Work with congruence and similarity motions that started in grades 6-8 progresses. Students also consider sufficient conditions for congruence of triangles.

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- Work with the bivariate data and scatter plots in grades 6-8 is extended to working with lines of best fit.

Fluency Recommendations

A/G High school students should become fluent in solving characteristic problems involving the analytic geometry of lines, such as finding the equation of a line given a point and a slope. This fluency can support students in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

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S Students should be able to create a visual representation of a data set that is useful in understanding possible relationships among variables.
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Content Vocabulary

- quadratic function
- unit circle
- system of equations
</td><td>

Academic Vocabulary
</td></tr>
<tr><td>

Formative Assessments

- performance tasks
- pretests
- quizzes
- interviews
</td><td>

Summative Assessments

- MVP assessments
- Teacher created assessments
- PARCC
</td></tr>
<tr><td>

Resources

- Mathematics Vision Project
- PARCC Model Content Framework
</td><td>

Enrichment Strategies
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Integrations

- Modeling projects
</td><td>

Intervention Strategies
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</table>

Math II

Conceptual Category ***Algebra A***	
Domain ***Creating Equations CED***	
Cluster ***Create equations that describe numbers or relationships (extend linear/exponential to quadratic and to formulas involving squared variables).***	**Pacing** **2nd Quarter**
Standards **A-CED.1 Create equations and inequalities in one variable and use them to solve problems. (Include equations arising from linear, quadratic functions, and exponential functions.)** **Learning Targets** **I can:** • Identify the variables and quantities represented in a real-world problem. • Determine the best model for the real-world problem (linear, quadratic, or exponential). • Write, solve, and interpret an equation or inequality that best models the problem. **A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.** **Learning Targets** **I can:** • Identify the variables and quantities represented in a real-world problem. • Determine the best model for the real-world problem (linear, quadratic, or exponential). • Write an equation that best models the problem. • Set up coordinate axes using an appropriate scale and label. • Graph equations on coordinate axes with appropriate labels and scales. **A-CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's**	**Content Elaborations** **Standards of Mathematical Practice** ***Mathematically proficient students:*** 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. **From the K-8 Math Standards Progression.** **Key Advances from Grades K-8** • Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities. • Students formalize their understanding of the definition of a function, particularly their understanding of linear functions, emphasizing the structure of linear expressions. Students also begin to work on exponential functions, comparing them to linear functions. • Work with congruence and similarity motions that started in grades 6-8 progresses. Students also consider sufficient conditions for congruence of triangles. • Work with the bivariate data and scatter plots in grades 6-8 is extended to working with lines of best fit.

Math II

Law $V = IR$ to highlight resistance R.

Learning Targets

I can:

- Solve formulas for a specific variable.

Fluency Recommendations

A/G High school students should become fluent in solving characteristic problems involving the analytic geometry of lines, such as finding the equation of a line given a point and a slope. This fluency can support students in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

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S Students should be able to create a visual representation of a data set that is useful in understanding possible relationships among variables.

Content Vocabulary

- recursive
- explicit
- rational
- dependent variable
- independent variable
- rate of change
- constant
- variable
- formula
- literal equation

Academic Vocabulary

- interest

Formative Assessments

- performance tasks
- pretests
- quizzes
- interviews

Summative Assessments

- MVP assessments
- Teacher created assessments
- PARCC

Resources

- Mathematics Vision Project
- PARCC Model Content Framework

Enrichment Strategies

Integrations

- Modeling projects

Intervention Strategies

Math II

Conceptual Category ***Functions F***

Domain ***Interpreting Functions IF***

Cluster ***Interpret functions that arise in applications in terms of a context. (Focus on quadratic; compare with linear and exponential.)***

Pacing

Standards

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. (Key features include: intercepts; intervals where the function is increasing, decreasing, positive or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.)

Learning Targets

I can:

- Interpret the meaning of an ordered pair.
- Determine if negative inputs/outputs make sense in the problem situation.
- Identify the x and y-intercepts.
- Interpret the meaning of the x and y-intercepts for the problem situation.
- Explain why some functions have more than 1 x-intercept.
- Define and identify an "increasing" and "decreasing" interval.
- Define and identify the extrema.
- Interpret the extrema for the situation.
- Identify symmetries in the graph.
- Define the end behavior of the graph.
- Create a graph that matches the description and indicates all key features.

F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*

Learning Targets

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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.

From the K-8 Math Standards Progression.

Key Advances from Grades K-8

- Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities.
- Students formalize their understanding of the definition of a function, particularly their understanding of linear functions, emphasizing the structure of linear expressions. Students also begin to work on exponential functions, comparing them to linear functions.
- Work with congruence and similarity motions that started in grades 6-8 progresses. Students also consider sufficient conditions for congruence of triangles.
- Work with the bivariate data and scatter plots in grades 6-8 is extended to working with lines of best fit.

Math II

I can:

- Explain how the domain of a function is represented in its graph.
- State the appropriate domain of a function of a real-world situation.
- Explain why the domain (set of numbers) of a function is appropriate and what exceptions may exist.

F-IF.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.

Learning Targets

I can:

- Define an interval, rate of change, and average rate of change.
- Explain the connection between average rate of change and slope.
- Calculate the average rate of change of a function using the equation, graph, or table.
- Compare the rates of change of two or more functions.
- Interpret the meaning of the average rate of change (using units) as it relates to a real-world problem.

Fluency Recommendations

A/G High school students should become fluent in solving characteristic problems involving the analytic geometry of lines, such as finding the equation of a line given a point and a slope. This fluency can support students in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

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Content Vocabulary

- domain
- function
- independent variable
- dependent variable
- discrete
- continuous
- increasing
- decreasing
- interval
- intercept
- maximum
- minimum
- symmetry
- end behavior
- average rate of change
- interval
- secant line
- quadratic
- vertex

Academic Vocabulary

- relate
- interpret

Formative Assessments

- performance tasks
- pretests
- quizzes
- interviews

Summative Assessments

- MVP assessments
- Teacher created assessments
- PARCC

Math II

Resources • Mathematics Vision Project • PARCC Model Content Framework	**Enrichment Strategies**
Integrations • Modeling projects	**Intervention Strategies**

Math II

Conceptual Category ***Functions F***	
Domain ***Interpreting Functions IF***	
Cluster ***Analyze functions using different representations. (Compare/contrast ABS, step, and piecewise functions with linear, quadratic, and exponential functions. Consider domain and range in all cases. Extend work with exponential functions with integer exponents.)***	**Pacing** **1st Quarter**
Standards **F-IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.** a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph piecewise-defined functions, including step functions and absolute value functions. **Learning Targets** **I can:** • Identify the parent function of a linear and quadratic function. • Identify the x and y-intercepts, increasing/decreasing intervals, max and min of a function from its graph of a linear or quadratic function. • Graph a linear and quadratic function. • Interpret the critical information of a quadratic. • Estimate and calculate the vertex of a quadratic. • Use technology to graph and interpret a linear and/or quadratic function. • Use the discriminant to determine if the function has x-intercepts. • Identify the parent function of a square root, cube root, piecewise, step and absolute value function. • Graph a square root, cube root, piecewise, step and abs function by hand. • Use technology to graph a square root, cube root, step, abs, or piecewise function. • Identify the rules of a piecewise function and their associated domain. • Identify the critical information of an abs function.	**Content Elaborations** **Standards of Mathematical Practice** ***Mathematically proficient students:*** 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. **From the K-8 Math Standards Progression.** **Key Advances from Grades K-8** • Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities. • Students formalize their understanding of the definition of a function, particularly their understanding of linear functions, emphasizing the structure of linear expressions. Students also begin to work on exponential functions, comparing them to linear functions. • Work with congruence and similarity motions that started in grades 6-8 progresses. Students also consider sufficient conditions for congruence of triangles. • Work with the bivariate data and scatter plots in grades 6-8 is extended to

- Estimate the x-intercepts of an abs function.

F-IF.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.

Learning Targets

I can:

- Explain and identify the 3 forms of a quadratic.
- Identify the graph of a quadratic.
- Solve a quadratic function by factoring.
- Use the x-intercepts and/or the vertex to find the axis of symmetry.
- Use the axis of symmetry to find the vertex.
- Identify the vertex and axis of symmetry when written in vertex form.
- Use algebra to find x-intercepts from vertex form.
- Convert from standard form to vertex form by completing the square.
- Graph a parabola from an equation in vertex form.
- Write the function that describes a parabola in all three forms from the graph.
- Distinguish between exponential growth and decay.
- Interpret the components of an exponential function.
- Use exponential functions to model real-world situations.
- Use the properties of exponents to rewrite an exponential function.

F-IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

Learning Targets

I can:

- Compare properties of two functions when represented in different

working with lines of best fit.

Fluency Recommendations

A/G High school students should become fluent in solving characteristic problems involving the analytic geometry of lines, such as finding the equation of a line given a point and a slope. This fluency can support students in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

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ways (algebraically, graphically, numerically in tables, or verbal descriptions).	
Content Vocabulary • piecewise • step function • axis of symmetry • absolute value • binomial • trinomial • perfect square trinomial • completing the square • zero • extreme values (maximum and minimum) • vertex • intercepts • rates of change • end behavior • extreme values • symmetry • axis of symmetry	**Academic Vocabulary**
Formative Assessments • performance tasks • pretests • quizzes • interviews	**Summative Assessments** • MVP assessments • Teacher created assessments • PARCC
Resources • Mathematics Vision Project • PARCC Model Content Framework	**Enrichment Strategies**
Integrations • Modeling projects	**Intervention Strategies**

Math II

Conceptual Category ***Functions F***

Domain ***Building Functions BF***

Cluster ***Building functions that model a relationship between two quantities.***

Pacing

1st Quarter

Standards

F-BF.1 Write a function that describes a relationship between two quantities.

a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

b. Combine standard function types using arithmetic operations. (For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.)

Learning Targets

I can:

- Define explicit and recursive expressions of functions.
- Identify the quantities being compared in a real-world problem.
- Write an explicit and/or recursive expression of a function to describe a real-world situation.
- Recall the parent functions.
- Apply transformations to equations of parent functions.
- Combine different parent functions (adding, subtracting, multiplying, and/or dividing) to write a function that describes a real-world situation.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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.

From the K-8 Math Standards Progression.

Key Advances from Grades K-8

- Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities.
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Math II

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Content Vocabulary • explicit • expression • function	**Academic Vocabulary**
Formative Assessments • performance tasks • pretests • quizzes • interviews	**Summative Assessments** • MVP assessments • Teacher created assessments • PARCC
Resources • Mathematics Vision Project • PARCC Model Content Framework	**Enrichment Strategies**
Integrations • Modeling projects	**Intervention Strategies**

Math II

Conceptual Category ***Functions F***	
Domain ***Building Functions BF***	
Cluster ***Build new functions from existing functions. (Focus on quadratics and include absolute value functions; for inverse functions, restrict to linear, and simple domain restrictions such as finding the inverse of*** $(x) = x^2,\ x > 0$ **.**	**Pacing** **1st Quarter**

Standards

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. (Include recognizing even and odd functions from their graphs and algebraic expressions for them.)

Learning Targets

I can:

- Explain and identify horizontal and vertical translations.
- Explain and identify horizontal and vertical stretches.
- Describe the transformation that has been applied when given graphs of the pre-image and image.
- Identify the transformation factor k of [$f(x) \pm k$, $f(x \pm k)$, $kf(x)$, and $f(kx)$].
- Use technology to generate examples of functions with different k values.
- Analyze the similarities and differences between functions with different k values.
- Recognize if a function is even or odd.

F-BF.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.
For example: $f(x) = 2x^3$ or $f(x) = \frac{x+1}{x-1}$ for $x \neq 1$.

Learning Targets

I can:

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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.

From the K-8 Math Standards Progression.

Key Advances from Grades K-8

- Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities.
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- Work with the bivariate data and scatter plots in grades 6-8 is extended to working with lines of best fit.

- Find the inverse of a function algebraically.
- Explain the numerical (table) relationship between a function and its inverse.

Fluency Recommendations

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Content Vocabulary

- even functions
- odd function
- rigid transformation
- dilation
- symmetry
- inverse
- $f^{-1}(x)$
- restricted domain

Academic Vocabulary

- experiment

Formative Assessments

- performance tasks
- pretests
- quizzes
- interviews

Summative Assessments

- MVP assessments
- Teacher created assessments
- PARCC

Resources

- Mathematics Vision Project
- PARCC Model Content Framework

Enrichment Strategies

Integrations

- Modeling projects

Intervention Strategies

Math II

Conceptual Category ***Functions F***	
Domain ***Linear, Quadratic, and Exponential Models LEA***	
Cluster ***Construct and compare linear, quadratic, and exponential models and solve problems.***	**Pacing** **1st Quarter**
Standards **F-LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.** **Learning Targets** **I can:** • Use graphs or tables to compare the output values of linear, quadratic, and exponential functions. • Estimate the intervals for which the output of one function is greater than that of another. • Use technology to find the point of intersection of two functions. • Use points of intersection to list the intervals for which one function is greater than another. • Use graphs or tables to compare the rates of change of linear, quadratic, and exponential functions. • Explain why exponential functions eventually have a greater output value than linear or quadratic functions.	**Content Elaborations** **Standards of Mathematical Practice** ***Mathematically proficient students:*** 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. **From the K-8 Math Standards Progression.** **Key Advances from Grades K-8** • Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities. • Students formalize their understanding of the definition of a function, particularly their understanding of linear functions, emphasizing the structure of linear expressions. Students also begin to work on exponential functions, comparing them to linear functions. • Work with congruence and similarity motions that started in grades 6-8 progresses. Students also consider sufficient conditions for congruence of triangles. • Work with the bivariate data and scatter plots in grades 6-8 is extended to working with lines of best fit.

Math II

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Content Vocabulary • exponential • quadratic • rate of change	**Academic Vocabulary** • function
Formative Assessments • performance tasks • pretests • quizzes • interviews	**Summative Assessments** • MVP assessments • Teacher created assessments • PARCC
Resources • Mathematics Vision Project • PARCC Model Content Framework	**Enrichment Strategies**
Integrations • Modeling projects	**Intervention Strategies**

Math II

Conceptual Category ***Functions F***	
Domain ***Trigonometric Functions TF***	
Cluster ***Prove and apply trigonometric identities. (Limit angle to between 0 and 90 degrees; connect with the Pythagorean Theorem and the distance formula.)***	**Pacing** **4th Quarter**

Standards

F-TF.8 Prove the Pythagorean Identity $sin^2\theta + cos^2\theta = 1$ and use it to find *sin* θ, *cos* θ, or *tan* θ given a trigonometric ratio and the quadrant of the angle.

Learning Targets

I can:

- Derive the Pythagorean identity $sin^2\theta + cos^2\theta = 1$ by using Unit Circle definitions.
- Use the Pythagorean Identity to calculate the value of $sin(x)$ or $cos(x)$.
- Use the quotient identity to calculate $tan(x)$.

(+) F-TF.9 (Honors) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

Learning Targets

I can:

- Prove the addition and subtraction formulas for sine, cosine, and tangent using trigonometric identities.
- Solve problems using addition and subtraction of trigonometric functions.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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.

From the K-8 Math Standards Progression.

Key Advances from Grades K-8

- Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities.
- Students formalize their understanding of the definition of a function, particularly their understanding of linear functions, emphasizing the structure of linear expressions. Students also begin to work on exponential functions, comparing them to linear functions.
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Math II

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Content Vocabulary • sine • cosine • tangent	**Academic Vocabulary**
Formative Assessments • performance tasks • pretests • quizzes • interviews	**Summative Assessments** • MVP assessments • Teacher created assessments • PARCC
Resources • Mathematics Vision Project • PARCC Model Content Framework	**Enrichment Strategies**
Integrations • Modeling projects	**Intervention Strategies**

Math II

Conceptual Category *Geometry G*

Domain *Similarity, Right Triangles, and Trigonometry SRT*

Cluster ***Understand similarity in terms of similarity transformations.***

Pacing

4th Quarter

Standards

G-SRT.1 Verify experimentally the properties of dilations given by a center and a scale factor.

a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.
b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

Learning Targets

I can:

- Define dilation.
- Perform a dilation with a given scale factor on a figure in the coordinate plane.
- Verify that when a side passes through the center, the side and its image lie on the same line.
- Verify that corresponding sides of the preimage and image are parallel.
- Verify that side lengths in the image are scale factors of side lengths in the preimage.

G-SRT.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain, using similarity transformations, the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

Learning Targets

I can:

- Define similarity as a composition of transformations in which angle measure is preserved.
- Identify corresponding sides and angles of similar triangles.
- Demonstrate that in similar triangles, corresponding angles are congruent and corresponding sides are proportional.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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.

From the K-8 Math Standards Progression.

Key Advances from Grades K-8

- Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities.
- Students formalize their understanding of the definition of a function, particularly their understanding of linear functions, emphasizing the structure of linear expressions. Students also begin to work on exponential functions, comparing them to linear functions.
- Work with congruence and similarity motions that started in grades 6-8 progresses. Students also consider sufficient conditions for congruence of triangles.
- Work with the bivariate data and scatter plots in grades 6-8 is extended to working with lines of best fit.

- Determine that two figures are similar by verifying congruent angles and proportional sides.

G-SRT.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

Learning Targets

I can:

- Show and explain the AA Similarity and Third Angle Theorems.
- Conclude and explain that AA Similarity is a sufficient condition for triangle similarity.

Fluency Recommendations

A/G High school students should become fluent in solving characteristic problems involving the analytic geometry of lines, such as finding the equation of a line given a point and a slope. This fluency can support students in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

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S Students should be able to create a visual representation of a data set that is useful in understanding possible relationships among variables.

Content Vocabulary

- dilation
- center of dilation
- scale factor
- similarity
- transformation
- corresponding parts
- $\cong$
- $\perp$
- AA

Academic Vocabulary

- compositions

Formative Assessments

- performance tasks
- pretests
- quizzes
- interviews

Summative Assessments

- MVP assessments
- Teacher created assessments
- PARCC

Resources

- Mathematics Vision Project
- PARCC Model Content Framework

Enrichment Strategies

Integrations

- Modeling projects

Intervention Strategies

Math II

Conceptual Category ***Geometry G***

Domain ***Similarity, Right Triangles, and Trigonometry SRT***

Cluster ***Prove theorems involving similarity.***

Pacing

4th Quarter

Standards

G-SRT.4 Prove theorems about triangles. (Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.)

Learning Targets

I can:

- Use theorems, postulates, or definitions about triangles including side-splitting, proportional parts, and the Pythagorean Theorem.

G-SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Learning Targets

I can:

- Find lengths of measures of sides and angles of congruent and similar triangles.
- Use triangle congruence and similarity to solve problems (indirect measurement: sides and angles).
- Use triangle congruence and similarity to prove relationships in geometric figures.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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.

From the K-8 Math Standards Progression.

Key Advances from Grades K-8

- Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities.
- Students formalize their understanding of the definition of a function, particularly their understanding of linear functions, emphasizing the structure of linear expressions. Students also begin to work on exponential functions, comparing them to linear functions.
- Work with congruence and similarity motions that started in grades 6-8 progresses. Students also consider sufficient conditions for congruence of triangles.
- Work with the bivariate data and scatter plots in grades 6-8 is extended to working with lines of best fit.

Math II

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Content Vocabulary • parallel lines • Pythagorean Theorem • similarity • similar triangles • congruence • congruent triangles • similar triangles • corresponding angles • corresponding sides	**Academic Vocabulary**
Formative Assessments • performance tasks • pretests • quizzes • interviews	**Summative Assessments** • MVP assessments • Teacher created assessments • PARCC
Resources • Mathematics Vision Project • PARCC Model Content Framework	**Enrichment Strategies**
Integrations • Modeling projects	**Intervention Strategies**

Math II

Conceptual Category ***Geometry G***

Domain ***Similarity, Right Triangles, and Trigonometry SRT***

Cluster ***Define trigonometric ratios and solve problems involving right triangles.***

Pacing

4th Quarter

Standards

G-SRT.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

Learning Targets

I can:

- Demonstrate that within a right triangle line segments parallel to a leg create similar triangles.
- Use the characteristics of similar figures to justify the trig ratios.
- Define the three basic trig ratios for acute angles in a right triangle.
- Use division and the Pythagorean Theorem to prove the Pythagorean Identity.

G-SRT.7 Explain and use the relationship between the sine and cosine of complementary angles.

Learning Targets

I can:

- Define complementary angles.
- Calculate sine and cosine ratios for acute angles in a right triangle when given two sides.
- Use a diagram of a right triangle to explain that for a pair of complementary angles, the sine of and angle = the *cos* of the same angle.

G-SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Learning Targets

I can:

- Use angle measures to estimate side lengths.
- Use side lengths to estimate angle measures.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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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.
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- Solve for missing information of a right triangle given 2 other pieces of information.
- Use sine, cosine, tangent, and their inverses to solve for unknown sides and/or angle measures.
- Use the Pythagorean Theorem to solve for an unknown side length.
- Draw right triangles to illustrate real-world situations.
- Solve application problems involving right triangles.

Fluency Recommendations

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Content Vocabulary

- similar triangles
- ratio
- right triangle
- complementary angles
- cosine
- Pythagorean Theorem
- sine
- tangent
- angle of elevation
- angle of depression

Academic Vocabulary

Formative Assessments

- performance tasks
- pretests
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Enrichment Strategies

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- Modeling projects

Intervention Strategies

Math II

Conceptual Category *Geometry G*

Domain *Congruence CO*

Cluster ***Prove geometric theorems. (Encourage multiple ways of writing proofs, such as narrative paragraphs, using flow diagrams, in two-column format, and using diagrams without words. Students should be encouraged to focus on the validity of the underlying reasoning while exploring a variety of formats for expressing that reasoning. May be extended to include concurrence of perpendicular bisectors and angle bisectors for preparation for circles.)***

Pacing

3rd Quarter

Standards

G-CO.9 Prove theorems about lines and angles. (Theorems include: vertical angles; given parallel lines, alternate interior angles are congruent, corresponding angles are congruent; points on a perpendicular bisector of a line segment are equidistant.)

Learning Targets

I can:

- Identify and use the properties of congruence and equality.
- Order statements based on the Law of Syllogism.
- Correctly interpret geometric diagrams by identifying what can and cannot be assumed.
- Use theorems, postulates, or definitions to prove theorems about lines and angles (vertical angles, angles, parallel lines and a transversal, perpendicular bisectors).

G-CO.10 Prove theorems about triangles. (Theorems include: triangle sum, isosceles triangle base angles, the segment joining the midpoints of two sides of a triangle is parallel to the third side and half its length, medians of a triangle intersect at a point.)

Learning Targets

I can:

- Order statements based on the Law of Syllogism when constructing a proof.
- Correctly interpret geometric diagrams and identify what can and

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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.
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From the K-8 Math Standards Progression.

Key Advances from Grades K-8

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- Work with congruence and similarity motions that started in grades 6-8

cannot be assumed.
- Use theorems, postulates, or definitions to prove theorems about triangles (measures of interior angles, sum of the angles in a triangle, isosceles triangles, midsegments and the median of a triangle).

G-CO.11 Prove theorems about parallelograms. (Theorems include: opposite sides are congruent, opposite angles congruent, diagonals bisect each other, rectangles are parallelograms with congruent diagonals.)

Learning Targets

I can:
- Use theorems, postulates, or definitions to prove theorems about parallelograms including proving the sufficient conditions.

progresses. Students also consider sufficient conditions for congruence of triangles.
- Work with the bivariate data and scatter plots in grades 6-8 is extended to working with lines of best fit.

Fluency Recommendations

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S Students should be able to create a visual representation of a data set that is useful in understanding possible relationships among variables.

Content Vocabulary
- proof
- vertical angles
- parallel lines
- transversal
- alternate interior angles
- corresponding angles
- perpendicular bisector
- interior/exterior angles
- supplementary angles
- complementary angles
- linear pair
- isosceles
- base
- legs
- base angles
- vertex angles
- midpoint
- median of a triangle
- auxiliary line
- parallelogram
- diagonal
- consecutive angles
- opposite angles
- bisect

Academic Vocabulary

Math II

Formative Assessments • performance tasks • pretests • quizzes • interviews	**Summative Assessments** • MVP assessments • Teacher created assessments • PARCC
Resources • Mathematics Vision Project • PARCC Model Content Framework	**Enrichment Strategies**
Integrations • Modeling projects	**Intervention Strategies**

Math II

Conceptual Category *Geometry G*	
Domain *Expressing Geometric Properties With Equations GPE*	
Cluster ***Translate between the geometric description and the equation for a conic section. (Connect the equations of circles and parabolas to prior work with quadratic equations. The directrix should be parallel to a coordinate axis.)***	**Pacing** **3rd Quarter**

Standards

G-GPE.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

Learning Targets

I can:

- Identify the center and radius of a circle given its equation.
- Draw a right triangle with a horizontal leg, vertical leg, and the radius of a circle as its hypotenuse.
- Use the Pythagorean Distance Formula, the coordinates of a circle's center, and the radius to write the equation of the circle.
- Convert an equation of a circle in general form to standard form by completing the square.
- Identify the center and radius of a circle given its equation.

G-GPE.2 Derive the equation of a parabola given a focus and a directrix.

Learning Targets

I can:

- Define a parabola.
- Find the distance from a point on the parabola to the directrix.
- Find the distance from a point on the parabola to the focus using the Pythagorean Distance Formula.
- Equate the two distance expressions for a parabola to write its equation.
- Identify the focus and directrix of a parabola when given its equation.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
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Math II

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Content Vocabulary • circle • center of a circle • radius of a circle • completing the square • focus • directrix • midpoint	**Academic Vocabulary** • derive • focus
Formative Assessments • performance tasks • pretests • quizzes • interviews	**Summative Assessments** • MVP assessments • Teacher created assessments • PARCC
Resources • Mathematics Vision Project • PARCC Model Content Framework	**Enrichment Strategies**
Integrations • Modeling projects	**Intervention Strategies**

Math II

Conceptual Category *Geometry G*

Domain *Expressing Geometric Properties With Equations GPE*

Cluster ***Use coordinates to prove simple geometric theorems algebraically. (Include simple proofs involving circles.)***

Pacing

3rd Quarter

Standards

G-GPE.4 Use coordinates to prove simple geometric theorems algebraically.

For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle. Prove or disprove that the point $(1, \sqrt{3})$ *lies on the circle centered at the origin and containing the point* $(0, 2)$.

Learning Targets

I can:

- Represent the vertices of a figure in the coordinate plane using variables.
- Connect a property of a figure to the tool needed to verify the property.
- Use coordinates and the right tool to prove or disprove a claim about a figure, [i.e., use slope (parallel or perpendicular), distance formula (congruent sides), midpoint formula (segment bisector)].

G-GPE.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

Learning Targets

I can:

- Calculate the point(s) on a directed line segment with endpoints and that partition the line segment.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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5. Use appropriate tools strategically.
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Math II

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• radius
• center
• diameter
• inscribed
• altitude
• diagonal
• perpendicular
• bisector
• median
• parallel
• midpoint
• Pythagorean Theorem
• coordinates
• a:b ratio
• directed line segment</td><td>Academic Vocabulary
• directed</td></tr>
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• Modeling projects</td><td>Intervention Strategies</td></tr>
</table>

Math II

Conceptual Category *Geometry G*

Domain *Circles C*

Cluster ***Understand and apply theorems about circles.***

Pacing

3rd Quarter

Standards

G-C.1 Prove that all circles are similar.

Learning Targets

I can:

- Prove that all circles are similar by showing that the preimage and image have equal central angle measures.

G-C.2 Identify and describe relationships among inscribed angles, radii, and chords. (Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.)

Learning Targets

I can:

- Identify central, inscribed, and circumscribed angles, diameters, radii, chords, and tangents.
- Describe the relationship between a central angle and the arc it intercepts.
- Describe the relationship between an inscribed angle and the arc it intercepts.
- Describe the relationship between a circumscribed angle and the arcs it intercepts.
- Recognize that an inscribed angle whose sides intersect the endpoints of a diameter is a right angle.
- Recognize that the radius of a circle is perpendicular to the tangent.

G-C.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

Learning Targets

I can:

Content Elaborations

Standards of Mathematical Practice

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- Define the terms inscribed, circumscribed, angle bisector, and perpendicular bisector.
- Construct the inscribed circle whose center is the point of intersection of the angle bisectors (the *incenter*).
- Construct the circumscribed circle whose center is the point of intersection of the perpendicular bisectors of each side of a triangle.
- Apply the Arc Addition Postulate to solve for missing arc measures.
- Prove that opposite angles in an inscribed quadrilateral are supplementary.

(+) G-C.4 (Honors) Construct a tangent line from a point outside a given circle to the circle.

Learning Targets

I can:

- Define and identify a tangent line.
- Construct a tangent line from a point outside the circle to the circle using construction tools or computer software.

Fluency Recommendations

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Content Vocabulary

- circle
- radius
- dilation
- inscribed angle
- central angle
- circumscribed angle
- radius
- chord
- diameter
- perpendicular
- tangent line
- inscribed
- circumscribed
- angle
- quadrilateral

Honors

- tangent
- circle

Academic Vocabulary

- construct
- apply

Formative Assessments

- performance tasks
- pretests

Summative Assessments

- MVP assessments
- Teacher created assessments

• quizzes • interviews	• PARCC
Resources • Mathematics Vision Project • PARCC Model Content Framework	**Enrichment Strategies**
Integrations • Modeling projects	**Intervention Strategies**

Math II

Conceptual Category ***Geometry G***	
Domain ***Circles C***	
Cluster ***Find arc length and areas of sectors of circles. (Emphasize the similarity of all circles. Note that by similarity of sectors with the same central angle, arc lengths are proportional to the radius. Use this as a basis for introducing radian as a unit of measure. It is not intended that it be applied to the development of circular trigonometry in this course.)***	**Pacing** **4th Quarter**
Standards **G-C.5 Derive, using similarity, the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.** **Learning Targets** **I can:** • Define similarity as rigid motions with dilations, which preserve angle measures and make lengths proportional. • Use similarity to calculate the length of an arc. • Define the radian measure of an angle as the ratio of an arc length to its radius. • Calculate a radian measure when given an arc length and a radius. • Convert degrees to radians and vice versa. • Calculate the area of a circle. • Define a sector of a circle. • Calculate the area of a sector.	**Content Elaborations** **Standards of Mathematical Practice** ***Mathematically proficient students:*** 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. **From the K-8 Math Standards Progression.** **Key Advances from Grades K-8** • Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities. • Students formalize their understanding of the definition of a function, particularly their understanding of linear functions, emphasizing the structure of linear expressions. Students also begin to work on exponential functions, comparing them to linear functions. • Work with congruence and similarity motions that started in grades 6-8 progresses. Students also consider sufficient conditions for congruence of triangles.

Math II

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Work with the bivariate data and scatter plots in grades 6-8 is extended to working with lines of best fit.

<u>Fluency Recommendations</u>

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Content Vocabulary

sector
arc length
constant of proportionality
radian
circumference
area

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Academic Vocabulary

derive

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Math II

Conceptual Category *Geometry G*

Domain *Geometric Measurement and Dimension GMD*

Cluster ***Explain volume formulas and use them to solve problems. (Informal arguments for area and volume formulas can make use of the way in which area and volume scale under similarity transformations when one figure in the plane results from another by applying a similarity transformation with scale factor k, its area is k^2 times the area of the first. Similarly, volumes of solid figures scale by k^3 under a similarity transformation with scale factor k.)***

Pacing

4th Quarter

Standards

G-GMD.1 Give an informal argument for the formulas for the circumference of a circle; area of a circle; and volume of a cylinder, pyramid, and cone. (Use dissection arguments, Cavalieri's principle, and informal limit arguments.)

Learning Targets

I can:

- Define π as the ratio of a circle's circumference to its diameter.
- Use algebra to derive the circumference formula from the definition of π.
- Inscribe a polygon in a circle, and triangulate it to find its area.
- Generate the area formula for a regular polygon and calculate its area.
- Use pictures to demonstrate the relationship between a circle and regular polygons.
- Identify the base for prisms, cylinders, pyramids, and cones and calculate their areas.
- Calculate the volume of prisms, pyramids, and cones.

G-GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

Learning Targets

I can:

- Calculate the volume of a cylinder, pyramid, cone, and sphere.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
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From the K-8 Math Standards Progression.

Key Advances from Grades K-8

- Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities.
- Students formalize their understanding of the definition of a function, particularly their understanding of linear functions, emphasizing the structure of linear expressions. Students also begin to work on exponential functions, comparing them to linear functions.
- Work with congruence and similarity motions that started in grades 6-8

- Use the volume formula of a cylinder, pyramid, cone, and/or sphere to solve problems.

progresses. Students also consider sufficient conditions for congruence of triangles.

- Work with the bivariate data and scatter plots in grades 6-8 is extended to working with lines of best fit.

Fluency Recommendations

A/G High school students should become fluent in solving characteristic problems involving the analytic geometry of lines, such as finding the equation of a line given a point and a slope. This fluency can support students in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

G High school students should become fluent in using geometric transformation to represent the relationships among geometric objects. This fluency provides a powerful tool for visualizing relationships, as well as a foundation for exploring ideas both within geometry (e.g., symmetry) and outside of geometry (e.g., transformations of graphs).

S Students should be able to create a visual representation of a data set that is useful in understanding possible relationships among variables.

Content Vocabulary

- cylinder
- right prism
- pyramid
- cone
- dissection argument
- Cavalieri's Principle
- limit argument
- sphere
- volume
- length
- width
- height
- base
- radius
- π

Academic Vocabulary

Formative Assessments

- performance tasks
- pretests
- quizzes
- interviews

Summative Assessments

- MVP assessments
- Teacher created assessments
- PARCC

Math II

Resources • Mathematics Vision Project • PARCC Model Content Framework	**Enrichment Strategies**
Integrations • Modeling projects	**Intervention Strategies**

Math II

Conceptual Category ***Statistics and Probability S***	
Domain ***Conditional Probability and the Rules of Probability CP***	
Cluster ***Understanding independence and conditional probability and use them to interpret data. (Build on work with two-way tables to develop conditional probability and independence.)***	**Pacing** **4th Quarter**

Standards

S-CP.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").

Learning Targets

I can:

- Define event and sample space.
- Establish events as subsets of a sample space.
- Define union, intersection, and complement.
- Establish events as subsets of a sample space based on the union, intersection, and/or complement of other events.

S-CP.2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

Learning Targets

I can:

- Define and identify independent events.
- Explain and provide an example to illustrate the probability of two independent events.
- Calculate the probability of an event.
- Predict if two events are independent, explain my reasoning, and check.

S-CP.3 Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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.

From the K-8 Math Standards Progression.

Key Advances from Grades K-8

- Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities.
- Students formalize their understanding of the definition of a function, particularly their understanding of linear functions, emphasizing the structure of linear expressions. Students also begin to work on exponential functions, comparing them to linear functions.
- Work with congruence and similarity motions that started in grades 6-8 progresses. Students also consider sufficient conditions for congruence of triangles.
- Work with the bivariate data and scatter plots in grades 6-8 is extended to working with lines of best fit.

Learning Targets

I can:

- Define dependent events and conditional probability.
- Explain that conditional probability and give examples.
- Use and explain the formula for conditional probability.
- Explain the relationship between independent events and conditional probability.
- Determine if two events are independent and justify my conclusion.

S-CP.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject. Estimate the probability that a randomly selected student from your school will favor science given that the student is in 10th grade. Do the same for other subjects and compare the results.*

Learning Targets

I can:

- Determine when a frequency table is an appropriate display for a set of data.
- Collect data from a random sample.
- Construct a frequency table for data using appropriate categories for each variable.
- Decide if events are independent by comparing conditional probabilities.
- Calculate the conditional probability of A given B using the formula.
- Pose a question for which a two-way frequency is appropriate.
- Use statistical techniques to sample the population and summarize the results.

S-CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*

Fluency Recommendations

A/G High school students should become fluent in solving characteristic problems involving the analytic geometry of lines, such as finding the equation of a line given a point and a slope. This fluency can support students in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

G High school students should become fluent in using geometric transformation to represent the relationships among geometric objects. This fluency provides a powerful tool for visualizing relationships, as well as a foundation for exploring ideas both within geometry (e.g., symmetry) and outside of geometry (e.g., transformations of graphs).

S Students should be able to create a visual representation of a data set that is useful in understanding possible relationships among variables.

Math II

Learning Targets

I can:

- Illustrate the concept of conditional probability using everyday examples of dependent events.
- Illustrate the concept of independence using everyday examples of independent events.

Content Vocabulary

- sample space
- subset
- outcome
- union
- intersection
- complement
- notations
- joint probability
- intersection
- event
- independent events
- $P(A)$, $P(A \cap B)$
- $P(A \text{ and } B)$
- conditional
- independence
- conditional probability
- $P(A|B)$

Academic Vocabulary

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Enrichment Strategies

Integrations

- Modeling projects

Intervention Strategies

Math II

Conceptual Category *Statistics and Probability S*

Domain *Conditional Probability and the Rules of Probability CP*

Cluster ***Use the rules of probability to compute probabilities of compound events in a uniform probability model.***

Pacing

4th Quarter

Standards

S-CP.6 Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.

Learning Targets

I can:

- Calculate the probability of the intersection of two events.
- Calculate the conditional probability of A given B.
- Interpret probability based on the context of the given problem.

S-CP.7 Apply the Addition Rule $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.

Learning Targets

I can:

- Apply the Addition Rule to determine the probability of the union of two events using the formula.
- Interpret the probability of unions and intersections based on the context of the given problem.

(+) S-CP.8 (Honors) Apply the general Multiplication Rule in a uniform probability model, $P(A \cap B) = P(A) \cdot P(B|A) = P(B) \cdot P(A|B)$, and interpret the answer in terms of the model.

Learning Targets

I can:

- Apply the general Multiplication Rule to calculate the probability of the intersection of two events using the formula.
- Interpret conditional probability based on the context of the given problem.

Content Elaborations

Standards of Mathematical Practice

Mathematically proficient students:

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.
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From the K-8 Math Standards Progression.

Key Advances from Grades K-8

- Students build on previous work with solving linear equations and systems of linear equations in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions, and (b) they solve linear inequalities.
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Math II

(+) S-CP.9 (Honors) Use permutations and combinations to compute probabilities of compound events and solve problems.

Learning Targets

I can:

- Apply the fundamental counting principle to find the total number of possible outcomes.
- Define factorial, permutation, combination, and compound event.
- Distinguish between situations that require permutations and combinations.
- Apply the permutation or combination formulas to determine the number of outcomes of an event.
- Compute probabilities of compound events.
- Solve problems involving permutations and combinations.
- Write and solve original problems involving compound events, permutations, and/or combinations.

Fluency Recommendations

A/G High school students should become fluent in solving characteristic problems involving the analytic geometry of lines, such as finding the equation of a line given a point and a slope. This fluency can support students in solving less routine mathematical problems involving linearity, as well as in modeling linear phenomena (including modeling using systems of linear inequalities in two variables).

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Content Vocabulary

- random variable
- probability model
- or
- and
- $P(A)$
- $\cup$
- $\cap$
- uniform probability model
- Multiplication Rule
- factorial
- permutation
- combination
- $P(n,r)$
- $_nP_r$
- $C(n,r)$
- $_nC_r$
- $\binom{n}{r}$

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Math II

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Integrations	**Intervention Strategies**
• Modeling projects	

Math II

Conceptual Category *Statistics and Probability S*	
Domain *Using Probability to Make Decisions MD*	
Cluster ***Use probability to evaluate outcomes of decisions. (Sets state for work in Math 3 where ideas of statistical inference are introduced.)***	**Pacing** **4th Quarter**

Standards

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

Learning Targets

I can:

- Use probability to create a method for making fair decisions.
- Use probability to analyze the results of a process and decide if it resulted in a fair decision.

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

Learning Targets

I can:

- Analyze data to determine whether or not the best decision was made.
- Analyze the available strategies, recommend a strategy, and defend my choice.

(+) S-MD.8 (Honors) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A) \cdot P(B|A) = P(B) \cdot P(A|B)$, and interpret the answer in terms of the model.

Learning Targets

I can:

- Define the probability of even (A and B) as the probability of the intersection of events A and B.
- Understand $P(A|B)$ to mean the probability of event B occurring when A has already occurred.
- Use the Multiplication Rule to determine $P(A \text{ and } B)$.

Content Elaborations

Standards of Mathematical Practice

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- Determine the probability of dependent and independent events in real contexts.

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Content Vocabulary

- random
- random number tables
- random number generator
- fair decision
- variability
- modeling
- sample
- uniform probability model
- Multiplication Rule

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Academic Vocabulary

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