

SUMMER SCHOOL TEACHER GUIDE



Algebra II

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Summer School Teacher Guide

The Summer High School Program will be **20 days** for full credit and **10 days** for semester / half ($\frac{1}{2}$) credit). First Semester will be **days 1-10** and Second Semester will be **days 11-20**. Breakdown of days will have the following per semester / half ($\frac{1}{2}$) credit:

- Nine (9) days of daily lessons
- One (1) day post-test review and post-test

All students and staff will use Grade Results for their summer curriculum. Each lesson will open daily, and students will not be able to work ahead; however, students can work on previously opened lessons per semester. Students can retake a daily post-test 3 times before it locks. If a student needs to retake a daily lesson post-test for a 4th time, then the teacher will have to open the lesson post-test again. Teachers should not delete any prior lesson post-test. Grade Results will post the highest grade from each students' lesson post-test.

HS Classroom Schedule – Time below is an approximate breakdown of time.

- **Attendance in PowerSchool** – 5 minutes
- **Lesson Introduction (I Do)** – 5 minutes
- **Lesson Activities/Supplemental (We Do)** – 60 minutes
- **Break – 10 Minutes** (*Site Administrator will work with teachers on breaks*)
- **Teacher Lesson Review** – 5 minutes
- **Independent Work** – Student Lesson Review*/Post-test (They Do) – 40 minutes
- **Closing/Wrap Up** – 5 minutes
- **Total Time: 2 hours 10 minutes**

***Lesson Review** – Students will review lessons for essential knowledge/information prior to the daily test.

The following will be used within **Grade Results**:

- Lessons with Content Area, Videos, and Activities
- Supplemental Teacher Resources App– Some lessons will have a Supplemental resource (Example – Flocabulary)
- Post-Test – Each lesson will have a daily post-test.

Graded Work – The Posttest will be the daily graded work. Graded work is automatically calculated by the Grade Results Software.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 1

Topic/Lesson Title & Grade Results #: Lesson 1 -Forming and Solving Equations and Inequalities

Objective(s): Students will be able to:

- Form linear equations from the given situations and solve them.
- Form linear inequalities from the given situations and solve them.
- Form non-linear equations from the given situations and solve them.

Guiding Question(s):

How do you use patterns to understand mathematics and model situations?

How can a problem be solved and why is one method chosen over another?

TN Curriculum Standard(s):

A2.A.CED.A.1 Create equations and inequalities in one variable and use them to solve problems.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

Linear Equation: An equation in which the highest power of any variable is one.

Linear Inequality: An inequality which involves a linear function.

Quadratic Equation: A polynomial equation in which the highest power of the variable is two.

Rational Function: A function which can be defined by an algebraic fraction.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (30 min)

Part I: Linear Equations

Students will be working on forming and solving linear equations and inequalities. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Solving Equations, Solving Linear Inequalities, Solving Inequality, Vocabulary. Videos include Forming and Solving Linear Inequality

- **Slide 1** - Have student read the objective(s).
- **Slide 2** – Scenario: Victor has a total of 24 oranges—some in a basket, and 6 on the table. He is unsure of the number of oranges in the basket. How can this be represented in algebraic form?
Have the students discuss the given scenario to determine an equation and how algebra is used in the real-world. Ask the students to produce a different scenario and have others determine the equation represented by the scenario.
- **Slide 3** – Complete Example 1 - Four less than four times a number, N , is twelve. Translate the verbal phrase to algebraic form.
- **Slide 4** – Complete Example 2 - Cindy celebrated her 25th birthday three years ago. Her current age is two times Fred's age. Model this situation using a linear equation.
- **Slide 5** – Complete Example 3 - Three years from now, Jenny's age will be one plus two times her current age. What is Jenny's current age? If students are unsure of this topic, refer to the supplementary video.

Part II: Linear Inequalities

- **Slide 7**-Solving Linear Inequalities
- **Slides 8-9** – Linear Inequalities - Examples 1-2
- **Slides 14–17** - Solving Linear Inequalities - Examples 5-7 and Video (on slide 17)

Lesson Activities (We Do): (35 min) As a whole group, students will complete the guided activities. Guided activities include Solving Equations, Solving Linear Inequalities, Solving Inequality, and Vocabulary. These activities will be discussed as a whole group.

- **Slide 6** – Activity Solving Equations
- **Slide 10** – Activity Solving Linear Inequalities
- **Slides 11-12** –Examples 3-4 Solving Linear Inequalities
- **Slide 13** – Activity Solving Inequalities
- **Slide 18** – Example 1 Solving Rational Functions
- **Slide 19** – Example 3 Solving Quadratic Equations
- **Slide 20** – Example 4 Solving Exponential Functions
- **Slide 21** – Display Drag and Drop Activity and allow students to complete first

Supplemental: (As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson: Writing and Solving Linear Equations, Solving Linear Equations, Problem Solving with Linear Inequalities, Solving Linear Equations and Linear Inequalities (2 videos), Solving Inequalities, and Linear Equations.

Additional Teacher Resources: See Supplemental Resources

Lesson Review: (5 min)

Slide 22 – Lesson Review

- A statement which equates two expressions by an equal sign is called an algebraic equation.
- A linear equation is an equation in which the highest power of any variable is one.
- Inequality is a mathematical sentence that compares two quantities with any one of the four symbols: \leq , or \geq .
- If the inequality is $<$ or $>$, then the graph should have an open dot.
- If the inequality is \leq or \geq , then the graph should have a solid dot.
- When an inequality is multiplied or divided by a negative number, its inequality sign gets reversed.
- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – (They Do): (40 min) Explain that students will work independently to complete the post-test. Encourage them to think critically and do their absolute best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students
- Validate students home address

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 2

Topic/Lesson Title & Grade Results #: Lesson 2-Complex Numbers

Objective(s): Students will be able to:

- Define complex numbers and find the real and imaginary parts of a complex number.
- Perform arithmetic operations on complex numbers.

Guiding Question(s):

What are complex numbers?

TN Curriculum Standard(s):

A2.N.CN.A.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.

A2.N.CN.A.2 Know and use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

Complex Number: A number that takes the form $a + bi$, where a and b are real numbers.

Imaginary Number: A number of the form bi , where b represents a real number and i represents the imaginary unit.

Real Numbers: All numbers on the number line or numbers that are either rational or irrational.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (35 min) Students will be working on defining complex numbers and performing arithmetic operations on complex numbers. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Classification of Numbers, Finding the Sum, Quick Check, Drag and Drop. Videos include Complex numbers, simplifying expressions using complex numbers, adding, subtracting, and multiplying complex numbers, complex number operations.

- **Slide 1** - Have student read the objective(s).
- **Slide 2** – Scenario: A few ants are moving in the garden in a pathway, and their path is a parabolic curve which is represented by the equation $-x^2 - 1 = 0$. Have the students discuss the given scenario to determine a solution. Go over complex numbers and have students watch the video if still unsure about this topic.
- **Slide 3** – Review examples on Classification of numbers. Have students watch video if still confused.
- **Slide 4**- Complete Examples 1 and 2 Rewrite a Number using Imaginary Unit. Have students watch video if still unsure about this topic.
- **Slide 5**-Review when complex numbers are equal and complete Examples 3-4 Equality of Complex Numbers
- **Slide 6**- Review operations and complete Example 5 Operations on Complex Numbers
- **Slides 8-9** - Discuss Subtraction of Complex Numbers and complete Examples 7-8.
- **Slides 11-13** - Discuss Multiplication of Complex Numbers and complete Example 7 & 8 (*the examples are different despite having the same numbers*). Have students watch the video if still unsure about this topic.
- **Slides 14-16**-Discuss Conjugate of a Complex number and Division of Complex Numbers. Complete Examples 9-10. This is a perfect time to introduce performing operations with complex numbers using the calculator.

Lesson Activities (We Do): (30 min) As a whole group, students will complete the guided activities. Guided activities include Classification of Numbers, Finding the Sum, Quick Check, Drag and Drop. These activities will be discussed as a whole group.

- **Slide 3 cont.** - Classification of Numbers Drag and Drop Activity
- **Slide 4 cont.** - Matching Activity
- **Slide 5 cont.**- Quick Check Activity
- **Slide 7** – Complete Example 6 on Addition of Complex Numbers together and the Quick Check Activity. Have students watch video if still confused.
- **Slide 8 cont.**- Have students watch video on Subtraction of Complex Numbers if still unsure about this topic.
- **Slide 9**-Find the difference activity
- **Slide 10**-Quick Check Activity
- **Slide 17**- Drag and Drop Activity

Supplemental:(As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson: Adding and Subtracting Complex Numbers (2 videos), Subtracting and Multiplying Complex Numbers, Multiplying Complex Numbers (2 videos), Simplifying Complex Numbers.

Additional Teacher Resources: See Supplemental Resources

Lesson Review: (5 min)

Slide 18 – Lesson Review

- A complex number is a number of the form $a + bi$, where "a" and "b" are *real numbers* and *i* is the *imaginary part* such that $i^2 = -1$.
- The square root of a negative number can be written as the product of a real number and *i*, i.e., $\sqrt{-n} = \sqrt{n} \times i$
- Two complex numbers are equal if their corresponding real parts and imaginary parts are equal. i.e., if $Z_1 = a + bi$ and $Z_2 = c + di$, then $Z_1 = Z_2$ if and only if $a = c$ and $b = d$.
- The conjugate of a complex number $a + bi$ is the complex number $a - bi$.
- Arithmetic operations can be performed on complex numbers.

$$\text{Addition: } (a + bi) + (c + di) = a + bi + c + di$$

$$\text{Subtraction: } (a + bi) - (c + di) = a + bi - c - di$$

$$\text{Multiplication: } (a + bi)(c + di) = ac + adi + bci + bdi$$

$$\text{Division: } \frac{(a + bi)}{(c + di)} = \frac{(ac + bd) + (bc - ad)i}{c^2 + d^2}$$

- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the post-test. Encourage them to think critically and do their absolute best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students
- Validate students home address

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 3

Topic/Lesson Title & Grade Results #: Lesson 3-Different Methods to Solve Quadratic Equations

Objective(s): Students will be able to:

- Define quadratic equation and list down the different methods used for solving it.
- Describe the steps involved in factorization method.
- Find the roots of a quadratic equation using the quadratic formula.
- Graph quadratic equations.
- List down the steps used in completing the square method.
- Find the discriminant and determine the nature of the roots of quadratic equations.
- Solve quadratic equations using quadratic formula with complex solutions.

Guiding Question(s):

How can features of polynomial functions such as the equation, solutions, axis of symmetry, vertex, etc. be represented in tables, equations, and in “real world” context?

TN Curriculum Standard(s):

A2.A.REI.B.3 Solve quadratic equations and inequalities in one variable. **a.** Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, knowing, and applying 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 .

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

- **Coefficient:** A number multiplied with a variable.
- **Complex Number:** A number in the form $a + bi$, where a and b are real numbers and i is the imaginary unit given by $i = \sqrt{-1}$.
- **Conjugate of a Complex Number:** The complex number obtained by changing the sign of the imaginary part.
- **Discriminant:** Sign of the determinant that describes the nature of the roots of the quadratic equation.
- **Imaginary Part:** The coefficient of i in a complex number, $a + bi$.
- **Real Part:** For a complex number, $a + bi$, the real part is a .
- **Quadratic Equation:** A polynomial equation in which the highest power of the variable is two.
- **Vertex:** The point where the parabola crosses its axis of symmetry.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (35 min) Students will be working on solving quadratic equations using different methods. They will find the roots, graph, and use the quadratic formula to find solutions. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Quadratic equation representation, Quick Check, Graphing, Terminologies, and Solving Quadratic Equations. Videos include Solving Quadratic Equations by Completing the Square, Completing the Square to Solve Quadratic Equations, Discriminant of the Quadratic Formula, and Complex Roots from the Quadratic Formula.

- **Slide 1** - Have student read the objective(s).
- **Slide 2** – Scenario: Victor goes boating. He wants to determine the speed of the boat in water. How can he find the speed of the boat? Have the students discuss the given scenario to determine a quadratic equation.

- **Slide 3** – Discuss Different Methods used in Solving Quadratic Equations before completing quick activity (see We Do)
- **Slides 4-5** – Discuss steps to solve quadratic equations by factoring then complete Examples 1- 2 Solve Quadratic Equation by Factorization Method
- **Slides 6-7** – Review the quadratic formula and steps to solve quadratic equations using the quadratic formula then complete Examples 3-4 Solve Quadratic Equation by Quadratic Formula
- **Slides 8 –10** – Discuss solving quadratic equations by graphing as you complete Example 5-6 Solving Quadratic Equation by Graphical Method (quick check activity on slide 9 – see We Do below)
- **Slide 11** – Review the steps for Completing the Square Method
- **Slides 12-13** – Discuss and Complete Example 7 Solve Quadratic Equation by Completing the Square Method and have students watch video if still unsure about this topic. (Quick check activity on both slides – see We Do below)
- **Slide 14** – Review the Discriminant of Quadratic Equations
- **Slides 15** – Review Finding the Nature of Roots of a Quadratic Equation and complete Example 1
- **Slides 16-18** – Complete Examples 2-4 Finding the Nature of Roots of a Quadratic Equation. Have students watch video on slide 17 if still unsure about this topic
- **Slide 19** – Review Complex Numbers
- **Slides 20-25** – Complete Examples 5-10 Quadratic Equation with Complex Roots using the quadratic formula. Have students watch video on slide 21 if still unsure about this topic. Complete examples 5-6, 10 as I Do and the others as We Do.

Lesson Activities (We Do): (30 min) As a whole group, students will complete the guided activities. Guided activities include Quadratic equation representation, Quick Check, Graphing, Terminologies, and Solving Quadratic Equations. These activities will be discussed as a whole group.

- **Slide 3 cont.** -Which of the following represent(s) quadratic equations Activity
- **Slide 5 cont.** Find the solutions of the quadratic equation $x^2 - 6x + 9 = 0$ using factoring method Quick check activity
- **Slide 9 cont.** Find the solutions of the quadratic equation $y = 2x^2 + 2x - 4$ using graphical method Quick check activity
- **Slide 12 cont.** Find the solutions of the quadratic equation $x^2 + 14x + 40 = 0$ by completing the square method Quick check activity
- **Slide 13 cont.** Find the solutions of the quadratic equation $2x^2 - 5x - 3 = 0$ by completing the square method Quick check activity
- **Slide 25 cont.** Find the solutions of the quadratic equation $x^2 + 4x + 6$ Quick check activity
- **Slide 26**-Drag and Drop Vocabulary Activity
- **Slide 27**-Solving Quadratic Equations Activity

Supplemental:(As time permits) If the students are still unsure about this topic, then refer to the video listed under the Supplemental part of the lesson: Discriminant for Types of Solutions for a Quadratic.

Additional Teacher Resources: See Supplemental Resources

Lesson Review: (5 min)

Slide 28 – Lesson Review

- A quadratic equation is an equation where the highest exponent of the variable is 2.
- $ax^2 + bx + c = 0$, where $a \neq 0$; a , b , and c are real numbers.
- A quadratic equation can be solved by four methods. Factorization method, Quadratic Formula, Graphical method, and Completing the Square method.
- The quadratic formula is $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

- The graph of a quadratic equation is called a parabola, and the point with coordinates (h, k) is called the vertex of the parabola, which can be a maximum or a minimum point.
- When a is positive ($a > 0$), the graph opens up. When a is negative ($a < 0$), the graph opens down.
- Formula used to determine the nature of the roots of a quadratic equation is discriminant, $d = b^2 - 4ac$.
- If the discriminant is positive and a perfect square, then the roots of the quadratic equation are real and rational.
- If the discriminant is positive and not a perfect square, then the roots of the quadratic equation are real and irrational.
- If the discriminant is zero, then the roots of the quadratic equation are equal and real.
- If the discriminant is negative, then the roots of the quadratic equation are complex.
- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the post-test. Encourage them to think critically and do their absolute best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 4

Topic/Lesson Title & Grade Results #: Lesson 4-Solving System of Linear Equations

Objective(s): Students will be able to:

- List the types of solutions of systems of linear equations.
- Solve a system of equations by elimination method.

Guiding Question(s):

How does representing functions graphically help you solve systems of equations?
When can you use elimination to solve a system?

TN Curriculum Standard(s):

A2.A.REI.C.4 Write and solve a system of linear equations in context

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

- **Coefficient:** The number that appears along with the variable.
- **Coordinate Plane:** A two-dimensional surface on which points are plotted and located by their x- and y-coordinates.
- **Linear Equation:** An algebraic equation in which the highest exponent of the variable or variables is one.
- **System of Linear Equations:** A collection of linear equations involving the same set of variables.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (30 min) Students will be working on solving systems of equations. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Types of solutions to a system of linear equation, Graphing, Correct order, Pants and shirt, Sum of two numbers, and Drag and Drop. Videos include Addition Elimination Method, Solving Systems by elimination, and Addition Elimination Method-Problem.

- **Slide 1** - Have student read the objective(s).
- **Slide 2** – Scenario: An equation in which the highest power of every variable is one is known as a linear equation. How is a real- world scenario translated into a linear equation?
- **Slide 3** – System of Linear Equation example – review definition of a system of linear equations and number/types of solutions (one, infinitely many, none).
- **Slide 4**- Review Methods to Solve System of Linear Equations (steps for elimination on this slide)
- **Slides 5-6** -Complete Example 1-2 Solve System of Equations - Elimination Method. Have students watch video on Addition Elimination Method if still unsure about this topic. (Quick check activity – see We Do below)
- **Slide 7**-Complete Example 3 The cost of three candies and four buns is \$29 and the cost of a dozen buns and half dozen candies is \$78. Find the cost of a bun and a candy.
- **Slide 8**-Complete Example 4 John bought 3 pens and 2 notebooks for \$160. His friend Victor bought 5 pens and 1 notebook for \$150. Find the cost of each item.

Lesson Activities (We Do): (35 min) As a whole group, students will complete the guided activities. Guided activities include Types of solutions to a system of linear equation, Graphing, Correct order, Pants and shirt, Sum of two numbers, and Drag and Drop. These activities will be discussed as a whole group.

- **Slide 6 cont.** -Solving Systems of Equations – Elimination Method Quick Check Activity
- **Slide 7 cont.**-Real World example on Solving systems by Elimination
- **Slide 8 cont.**-Real World example on Addition Elimination Method & Quick Check Activity
- **Slide 9**-Matching Activity
- **Slide 10**-System of Equations Activity

Supplemental: (As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson: Substitution Method, Elimination Method, and Application Problems.

Additional Teacher Resources: See Supplemental Resources

Lesson Review: (5 min)

Slide 11 – Lesson Review

- The solution of a system of linear equations can be of three types. They are: One solution, infinitely many solutions, and No solution
- If the system has exactly one solution, then the equations are said to be independent.
- If the system has an infinite number of solutions, then the equations are said to be dependent.
- If the system of equations has at least one solution, then the system is consistent.
- If the system has no solution, then the system is inconsistent.
- The three different methods in solving a system of linear equations are: Substitution method, Elimination method, and Graphing method
- The coordinates of the intersection point of two equations become the solution to the system of equations.
- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the post-test. Encourage them to think critically and do their absolute best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students
- Validate students home address

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 5

Topic/Lesson Title & Grade Results #: Lesson 5- Linear or Exponential Function: Lesson A Linear or Exponential Function; Lesson B-Transformation of Expression to Exponential Functions

Objective(s): Students will be able to:

Lesson A

- Know the linear function and parameters used in the linear function.
- Know the exponential function and parameters used in the exponential function.
- List out the different strategies used to interpret functions.

Lesson B

- Define exponential expression and exponential function.
- Recall the properties of exponents.
- Transform expressions for exponential functions using the properties of exponents.

Guiding Question(s):

Lesson A

Why is $y=ae^x$ considered to be an exponential function?

Lesson B

What are the distinguishing features of the properties of logarithms: product property, quotient property, and power property?

TN Curriculum Standard(s):

Lesson A

A2. F.IF.B.4 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the properties of exponents to interpret expressions for exponential functions.

Lesson B

A2. A.SSE.B.2 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Use the properties of exponents to rewrite expressions for exponential functions.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

Lesson A

- **Exponential Function:** A function in the form of $y = ab^x$, and its graph is a smooth curve.
- **Linear Function:** A function in the form of $y = mx + b$, and its graph is a straight line.
- **Parameter:** A variable that is held constant but influences the behavior of a function.

Lesson B

- **Base:** The number raised to the power which represents the number of units of a number system.
- **Exponent:** The exponent of a number says how many times to use that number in multiplication.
- **Exponential expression:** A mathematical expression consisting of a constant (especially e) raised to a power.
- **Exponential function:** A function of the form $f(x) = ab^x$, where x is a variable, a is a non-zero positive constant, $b \neq 1$, and $b > 0$.
- **Compound Interest:** A method of computing interest on both the principal and the accrued interest.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (35 min total) Students will be working on linear and exponential functions. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities in Lesson A include Quick check, forming a linear function, using strategies to interpret functions, and Linear and exponential functions. Videos include Exponential Function. Guided activities in Lesson B include Quick Check and Matching. Videos include Exponential Notation.

Lesson A (20 minutes)

- **Slide 1** - Have student read the objective(s).
- **Slide 2** – Review Linear Functions
- **Slide 3** – Review Exponential Functions
- **Slide 4** – Complete Example 1 Real-Life Example -Linear Function
- **Slide 5** – Complete Example 2 Understanding the Equation's Context - Linear Function
- **Slide 7**- Complete Example 3 Exponential Function
- **Slide 9**- Complete Example 4 Understanding Equation's Context - Exponential Function
- **Slide 11** – Review Strategies to Interpret Functions
- **Slide 12** – If time permits, complete Example 5 Interpreting Parameters from Exponential Functions

Lesson B (15 minutes)

- **Slide 1** - Have student read the objective(s).
- **Slide 2** – Introduction of Properties of exponents and review the video on Exponential Notation if necessary.
- **Slide 3** – Review Example and watch video to be able to complete the table to determine the amount Jimmy makes in dollars, each day.
- **Slides 4-5** – Complete Examples 1-4 Simplifying Exponential Expressions (see We Do for activities)
- **Slide 6**- Complete Examples 5 on Compound Interest
- **Slide 7**- Complete Example 6 on Compound Interest (Matching Activity – see We Do below)
- **Slide 8**- Complete Example 7 on Compound Interest
- **Slide 9**- Complete Example 8 on Compound Interest (Matching Activity – see We Do below)

Lesson Activities (We Do): (30 min total) As a whole group, students will complete the guided activities. Guided activities in Lesson A include Quick check, forming a linear function, using strategies to interpret functions, and Linear and exponential functions. These activities will be discussed as a whole group. Guided activities in Lesson B include Quick Check and Matching. These activities will be discussed as a whole group.

Lesson A (15 min)

- **Slide 3 cont.** – Quick Check on Exponential Functions
- **Slide 6**-Activity - Forming a Linear Function
- **Slide 8**- Video Exponential Function – watch if necessary or have students watch independently
- **Slide 10**- Activity - Exponential Function
- **Slide 13**- If time permits, complete Activity - Use Strategies to Interpret Functions
- **Slide 14**-If time permits, complete Activity - Linear and Exponential Functions

Lesson B (15 min)

- **Slide 3**-Quick Check Activity
- **Slide 5**-Matching Activity
- **Slide 7**-Compound Interest Quick Check Activity
- **Slide 9**-Matching Activity

Supplemental: (As time permits) If the students are still unsure about this topic, then refer to the video listed under the Supplemental part of the lesson: Lesson A: Exponential Functions; Lesson B: Exponent Rules, Simplifying Exponential Expressions.

Additional Teacher Resources:

Lesson A: None

Lesson B: See Supplemental Resources

Lesson Review: (5 min)**Lesson A****Slide 15 – Lesson Review**

- A function in the form $y = mx + b$ is called as linear, and its graph is a straight line.
- The parameters m and b are used to compare linear functions.
- A function in the form of $y = ab^{kx}$ in which x is the independent variable and y is the dependent variable is called an exponential function.
- The parameters a , b , and k are used to compare the exponential functions.
- Have students review the slides and their notes to prepare for the Posttest.

Lesson B**Slide 10 – Lesson Review**

- An exponential function is a function of the form $f(x) = ab^x$, where x is a variable, a is a non-zero positive constant, $b \neq 1$, and $b > 0$.
- Exponential functions are used to model compound interest.
- Compound interest is a method of computing interest on both the principal and the accrued interest. $A = P(1 + \frac{r}{n})^{nt}$, where A = final amount, P = principal or original amount, r = rate of interest per year, n = number of times the interest is compounded per year, t = time in years.
- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the post-test. Encourage them to think critically and do their absolute best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students
- Validate students home address

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 6

Topic/Lesson Title & Grade Results #: Lesson 6- Solving Radical Equations

Objective(s): Students will be able to:

- Define radical and rational equations.
- Solve radical equations and rational equations.
- Explain how extraneous solutions are found in radical and rational equations.

Guiding Question(s):

How can you solve equations that include radicals or rational exponents?

How can you solve rational equations and identify extraneous solutions?

TN Curriculum Standard(s):

A2.A.REI.A.2 Solve rational and radical equations in one variable and identify extraneous solutions when they exist.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Key Vocabulary/Terms:

- **Equation:** An algebraic sentence which denotes that two expressions are equal.
- **Extraneous solution:** A solution that does not satisfy the original equation.
- **Radical equation:** An equation that contains radicals or rational exponents.
- **Rational equation:** An equation containing at least one rational expression.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (30 min) Students will be working on radical equations and rational equations. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Quick check, identifying a radical equation, use strategies and steps to solve radical equations with one and two variables, rational exponents, and extraneous solutions.

- **Slide 1** - Have student read the objective(s).
- **Slide 2** – Introduction (What causes the natural disaster *tsunami*?) Quick check: Identify the radical equation.
- **Slide 3** – Review Radical Equation (define & discuss parts of a radical); Identify the radical equation
- **Slide 4** – Complete Activity - Radical Equation showing identifying parts of radical equation
- **Slide 5** – Review Steps Involved in Solving Radical Equations
- **Slides 6-7, 10** – Complete Examples 1-3 Solving Radical Equations with Two Variables
- **Slide 13** – Complete Example 4 Solving Radical Equations
- **Slide 15** – Review Rational Equations
- **Slide 16** – Complete Example 5 – Solving Rational Equation
- **Slide 18** – Review Extraneous Solutions
- **Slides 19-20** – Complete Examples 5-7 – Solving Rational Equations with Extraneous Solution
- **Slide 21**-If time permits, complete Example 8 Solving Rational Equations with Extraneous Solutions

Lesson Activities (We Do): (35 min) As a whole group, students will complete the guided activities. Guided activities include Quick check, identifying a radical equation, use strategies and steps to solve radical equations with one and two

variables, rational exponents, and extraneous solutions. Videos include Solving Radical Equations, Solving Radical Equations with 2 Variables, and Solving Radical Equations with Extraneous Solutions. These activities will be discussed as a whole group.

- **Slide 8** – Video Solving Radical Equations
- **Slide 9** – Activity Solving Radical Equations
- **Slide 11** – Video Solving Radical Equations
- **Slide 12** – Quick Check (Quiz me) Solving Radical Equations
- **Slide 14** – Video Solving Radical Equations with Two Variables
- **Slide 17** – Quick Check (Quiz me) Solving Rational Functions
- **Slide 22** – Video Solving Radical Equations with Extraneous Solutions
- **Slide 23** – Quick Check (Quiz me) Solving Radical Equations with Extraneous Solutions
- **Slide 24** – If time permits, complete Activity Solving Radical Equations with Extraneous Solutions

Supplemental: (As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson: Extraneous Solutions for Radical Equations, Solving Radical Equations (4 videos), and Solving Multi-Step Radical Equations.

Additional Teacher Resources: None

Lesson Review: (5 min)

Slide 25 – Lesson Review

- An equation that contains at least one variable inside the radical symbol or with a rational exponent is called a radical equation.
- The number or expression inside a radical symbol is called radicand.
- The following steps are followed in solving a radical equation:
 - Isolate the radical.
 - Raise each side to a power equal to the index of the root.
 - Solve the equation obtained in the previous step, which is free from radicals.
 - Verify the solution by replacing it in the original equation.
- A rational equation is an equation containing at least one rational expression.
- Steps involved in solving a rational equation are
 - Eliminate fractions from the equation by multiplying with the LCD.
 - Simplify the resulting equation by distributing or combining like terms.
 - In the simplified equation, isolate the variable on one side of the equation.
 - Verify the solution by replacing it in the original equation.
- A solution that does not satisfy the original equation is called extraneous solution.
- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the posttest. Encourage them to think critically and do their absolute best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students
- Validate students home address

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 7

Topic/Lesson Title & Grade Results #: Lesson 7 – Zeros to Graph Polynomials & Remainder Theorem: Lesson A-Using Zeros to Graph Polynomials; Lesson B- Remainder Theorem

Objective(s): Students will be able to:

Lesson A

- Factorize and find zeroes of a given polynomial.
- Use zeros of a polynomial to graph it.

Lesson B

- Define the remainder theorem and solve problems on it.
- Define the factor theorem and solve problems on it.

Guiding Question(s):

Lesson A

How can algebra describe the relationship between a function and its graph?

Lesson B

When is it best to use long division vs. synthetic division?

TN Curriculum Standard(s):

Lesson A

A2.A.APR.A.2 Identify zeros of polynomials when suitable factorizations are available and use the zeros to construct a rough graph of the function defined by the polynomial.

Lesson B

A2.A.APR.A.1 Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a , the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

Lesson A

- **Polynomial:** A combination of variables, arithmetic operators, exponents, and numbers.
- **x-intercept:** A point at which a line or curve crosses the x-axis.
- **Zeros of a Polynomial:** The values of x which make the polynomial equal zero.

Lesson B

- **Factor:** An expression which when multiplied by some other expression produces a given expression.
- **Polynomial:** An algebraic expression which is the combination of variables, numbers, exponents, and arithmetic operators.
- **Remainder:** The quantity left over after division.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (30 min total) Students will be working on finding zeros of a polynomial. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Factoring Polynomials and Finding its zeros, quick check, number of zeros in each graph (drag & drop), plotting points, matching,

the Remainder Theorem activity, Quick check, True/False, and Drag & Drop. Videos include Polynomials, graphing, and quadratic equations.

Lesson A (15 min)

- **Slide 1** - Have student read the objective(s).
- **Slide 2** – Review the video on Polynomials & Go over examples.
- **Slide 3** – Discuss Factorizing Polynomial and Finding its Zeros
- **Slide 4** – Discuss Finding Zeros of the Polynomial (quick check activity – see We Do below)
- **Slide 5** – Discuss Using Zeros to Graph Polynomials. Have students watch video on Graphing Quadratic Equations if still unsure about this topic.
- **Slide 6**- Discuss Number of Zeros of Quadratic Functions
- **Slide 8**- Discuss Relationship Between Zeros and x-intercepts of the Polynomial
- **Slides 9-10**- Discuss Factor and Graph Polynomials

Lesson B (15 min)

- **Slide 1** - Have student read the objective(s).
- **Slide 2** – Introduce finding the remainder in division. How do you find the remainder in the division process of two numbers?
- **Slide 3** – Discuss Method to Find the Remainder When a Polynomial is Divided
- **Slide 4** – Complete Example 1 on Remainder Theorem
- **Slides 5-6** – Discuss Examples 2-3 Applying Remainder Theorem (activity on slides – see We Do below)
- **Slide 7**- Discuss Relation between Dividend and Divisor
- **Slide 8**- Complete Example 4 on Factor Theorem (T/F activity – see We Do)
- **Slides 9-10**-Complete Examples 5-6 Applying Factor Theorem

Lesson Activities (We Do): (35 min total) As a whole group, students will complete the guided activities. Guided activities include Factoring Polynomials and Finding its zeros, quick check, number of zeros in each graph (drag & drop), plotting points, matching, the Remainder Theorem activity, Quick check, True/False, and Drag & Drop. These activities will be discussed as a whole group.

Lesson A (15 min)

- **Slide 3** cont. -Find the common factor and find the zeros of the polynomial
- **Slide 4** cont. - Find the zeros of the polynomial Quick Check Activity
- **Slide 5** cont. - Find the zeros of the polynomial by equating the factors to zero
- **Slide 7**- Find the number of zeros in each graph Activity
- **Slides 9-10** -Find the zeros/factors of the given polynomial.
- **Slide 11**- Matching Activity

Lesson B (20 min)

- **Slide 4** cont. - Find the remainder
- **Slide 5** cont.- Find the remainder Activity
- **Slide 6**-Quick Check Activity
- **Slide 8**-True/False
- **Slide 9**-Determining factor Activity
- **Slide 10**-True/False
- **Slide 11**- Drag and Drop Activity

Supplemental:(As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson:

Supplemental A – Solve Quadratic Equations by Factoring, Finding the Zeros of a Polynomial Function on a Graphing Calculator (2 videos), Find Zeros of a Polynomial Function, and Real Zeros, Factors and Graphs of Polynomial Functions.

Supplemental B – Remainder Theorem, Factor Theorem (2 videos), Synthetic Division with Fractional Zeroes, Dividing Polynomials Using Synthetic Division (2 videos) and Synthetic Division.

Additional Teacher Resources: See Supplemental Resources

Lesson Review: (5 min)

Lesson A

Slide 12 – Lesson Review

- The number of zeros of a polynomial is equal to the degree of the polynomial.
- Roots, zeros, and solutions are the same.

Lesson B

Slide 12-Lesson Review

- The Remainder theorem states that if a polynomial $p(x)$ is divided by $(x - a)$, the remainder is $p(a)$.
- Factor theorem states that $(x - a)$ is a factor of a polynomial $p(x)$ if and only if $p(a) = 0$.
- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the post-test. Encourage them to think critically and do their best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students
- Validate students home address

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 8

Topic/Lesson Title & Grade Results #: Lesson 8 – Rational Expressions and Exponents: Lesson A-Rewriting Rational Expressions; Lesson B-Rational Exponents

Objective(s): Students will be able to:

Lesson A

- Rewrite rational expressions in the form $q(x) + r(x)/b(x)$ using inspection or factoring.
- Rewrite rational expressions in the form $q(x) + r(x)/b(x)$ using long division method.
- Know the radical form and exponent form of numbers.

Lesson B

- Explain how the rational exponents are extended from properties of integer exponents.
- Simplify rational exponents using properties of exponents.

Guiding Question(s):

Lesson A

What is the best way to factor certain forms of polynomial rational expressions?

Lesson B

How does the index relate to the rational exponent of a radical?

TN Curriculum Standard(s):

Lesson A

A2.A.SSE.A.1 Use the structure of an expression to identify ways to rewrite it.

Lesson B

A2.N.RN.A.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.

A2.N.RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

Lesson A

- **Dividend:** A polynomial that is being divided.
- **Divisor:** A polynomial that is dividing.
- **Quotient:** A result obtained by dividing one quantity by another.
- **Remainder:** A polynomial or integer that is left over after one polynomial or integer is divided by another polynomial or integer.
- **Rational Expression:** An expression which is the ratio of two polynomials.

Lesson B

- **Exponent:** The top number that tells the number of times the base expression must be multiplied by itself.
- **Radical:** The symbol used to represent the n^{th} root of a number.
- **Rational numbers:** Any real number written in the form of p/q , where p and q are integers and q is non-zero.
- **Rational exponent:** An exponent in the form of p/q , where p and q are integers and q is non-zero.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (35 min total) Students will be working on rewriting rational expressions and rational exponents. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Drag & Drop, Finding the GCF, Quick Check, Log Division activity, and Matching. Videos include Rational Exponents, Radical Equivalent to Rational exponents, and Simplify using Rational Exponents.

Lesson A (15 min)

- **Slide 1** - Have student read the objective(s).
- **Slide 2** –Introduce rational expressions and go over example.
- **Slide 3** – Discuss Significance of Division Algorithm
- **Slide 4** – Discuss Division Algorithm for Rational Expressions
- **Slides 5-7** – Discuss Rewriting Rational expressions and go over examples including Examples 1-2 (Quick Check Activity on slide 7 – see We Do below)
- **Slides 8-9** -Complete Examples 3-4 Rewrite Rational Expressions using Long Division Method
- **Slides 11-12** -Discuss Examples 5-6 Verbal Problems on Rewriting Rational Expressions

Lesson B (20 min)

- **Slide 1** - Have student read the objective(s).
- **Slide 2** –Introduction. A man fences his land which is in the shape of square. The side measure of the land is measured using measuring tools. How would you find the area of the land? Also, Identify the base and exponent
- **Slide 3** – Discuss Fractional Exponents (or) Rational Exponents and examples
- **Slide 4** – Discuss Rational Exponents and examples
- **Slide 5** – Discuss Laws of Exponents (or) Properties of Exponents and watch video if students are still unsure about this topic.
- **Slide 6**- Complete Example 1 on Simplifying Rational Exponents and watch video if students are still unsure about this topic.
- **Slides 7-8**- Complete Examples 2-4 on Simplifying Rational Exponents of the Form $a^{m/n}$ and watch video if students are still unsure about this topic.
- **Slide 9** -Discuss Negative Exponent.
- **Slides 10-11** – Complete Examples 5-6 on Simplifying Negative Exponents. Have students watch video if still unsure about this topic.

Lesson Activities (We Do): (30 min total) As a whole group, students will complete the guided activities. Guided activities include Drag & Drop, Finding the GCF, Quick Check, Long Division activity, and Matching. These activities will be discussed as a whole group.

Lesson A (15 min)

- **Slide 4 cont.**-Drag and Drop Activity
- **Slide 6**- Find the GCF
- **Slide 7 cont.** -Quick Check Activity
- **Slide 10**-Drag and Drop Activity
- **Slide 13**- Matching Activity

Lesson B (15 min)

- **Slide 5 cont.**- Matching Activity
- **Slide 7 cont.**- Quick Check Activity
- **Slide 10**-Triangular wall Activity
- **Slide 11**-Quick Check Activity
- **Slide 12**- Drag and Drop Activity
- **Slide 13**-Matching Activity

Supplemental: (As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson:

Supplemental A – Simplifying Rational Expressions (6 videos).

Supplemental B – Writing Radical in Rational Exponent Form, Simplifying Expressions with Rational Exponents, Rational exponents and Exponent Laws, and Simplifying Rational Exponents.

Additional Teacher Resources: See Supplemental Resources

Lesson Review: (5 min)

Lesson A

Slide 14- Lesson Review

- A rational expression is the ratio of two polynomials.
- The general form of division algorithm is, Dividend = (Quotient x Divisor) + Remainder.
- Every rational expression $a(x)/b(x)$ can be written in the form $q(x) + r(x)/b(x)$, where $q(x)$ = quotient, $r(x)$ = remainder, and $b(x)$ = divisor.

Lesson B

Slide 14- Lesson Review

- In general, the square root, cube root, or nth root, and so on of a number can be expressed using an exponential notation. $a^{\frac{m}{n}} = \sqrt[n]{a^m}$
- If the power of an exponent is in fraction form, then it is called as fractional or rational exponent.
- The expression of exponent in radical notation.
- The expression in the form of rational exponents.
- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the post-test. Encourage them to think critically and do their best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students
- Validate students home address

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 9

Topic/Lesson Title & Grade Results #: Lesson 9- Inverse of Functions

Objective(s): Students will be able to:

- Define inverse of a function.
- Find the inverse functions.
- Prove that two functions are inverses of each other.

Guiding Question(s):

How do you recognize and use inverse variation to create equations?

TN Curriculum Standard(s):

A2. F.BF.B.4 Find inverse functions. a. Find the inverse of a function when the given function is one-to-one.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

- **Function:** A relation formed from a set of inputs to a set of possible outputs, where each input is related to exactly one output.
- **Inverse of a Function:** An inverse function is a function that reverses another function.
- **Reflection Line:** The line about which a figure is congruent to the original figure.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (35 min) Students will be working on finding the inverse of a function. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Finding the inverse, Quick Check, Matching, and Drag and Drop. Videos include Intro to Function Inverses, Function Inverses, Finding Inverse of the Point Function, and Inverse Functions.

- **Slide 1** - Have student read the objective(s).
- **Slide 2** – Review Introduction. What do you infer from the above animation?
- **Slide 3** – Review Inverse Functions and the Inverses table and complete the example.
- **Slide 4**- Discuss the Steps in Finding the Inverse of a Function
- **Slide 5**- Discuss the Notation used to Represent a Function (Activity – see We Do below)
- **Slide 6** - Complete Example 1 Domain and Range of Inverse Function and watch the video if students are still unsure about this topic. (Activity – see We Do below)
- **Slides 7-8**-Complete Example 2- 3 Determining Inverse of a Function and watch the video if students are still unsure about this topic. (Activity – see We Do below)
- **Slide 9**- Complete Example 4 Prove Two Functions are Inverse to Each Other (Quick Check Activity – see We Do below)
- **Slide 11**- Discuss Inverses of the Points in the Plane (Activity – see We Do below)
- **Slide 12**- Complete Example 5 Finding Inverse of the Point from the Function. Have students watch video if still unsure about this topic.

Lesson Activities (We Do): (30 min) As a whole group, students will complete the guided activities. Guided activities include Finding the inverse, Quick Check, Matching, and Drag and Drop. These activities will be discussed as a whole group.

- **Slide 5**-Inverse of a Function Activity
- **Slide 6**-Domain Activity
- **Slides 7-8**- Find the inverse Activity
- **Slide 9**-Quick Check Activity
- **Slide 10**-Find Inverse of a Function Activity
- **Slide 11**-Quick Check Activity
- **Slide 13**-Find Inverse of a Function Activity

Supplemental: (As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson: Determining If Two Functions Are Inverses (2 videos).

Additional Teacher Resources: See Supplemental Resources

Lesson Review: (5 min)

Slide 14-Lesson Review

- If $f(x)$ and $g(x)$ are inverses of each other, then $f(g(x)) = g(f(x)) = x$, for each x in the domain of $g(x)$ each x in the domain of $f(x)$.
- The reflection/inverse of the point (x, y) across the line $y = x$ is (y, x) .
- The reflection/inverse of the point (x, y) across the line $y = -x$ is $(-y, -x)$.
- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the post-test. Encourage them to think critically and do their best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students
- Validate students home address

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 10

Topic/Lesson Title & Grade Results #: Final Post-Test Review & Post-Test

Objective(s):

- Students will review lessons to prepare for the final Post-Test.
- Final Post-test will open. All students must complete the final Post-Test

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Attendance in PowerSchool: 5 minutes

Lesson Introduction (I Do): 5 minutes

Identify the purpose of the course

Connect the course to missing or future coursework and Post-test

Lesson Activities/Supplemental (We Do)

Lesson Activities and Review (We Do): 40 minutes

Check Grade Results and have students review activities/lesson that they have not completed or need assistance with.

Hold an open Q&A for students to ask questions regarding the activities/lessons they are reviewing.

Independent Work – Posttest (They Do): 80 minutes

Students will review and complete any incomplete/missed/failed coursework.

Closing/Wrap Up: N/A

SEMESTER 2

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 11

Topic/Lesson Title & Grade Results #: Lesson 1-Graph Polynomial Functions and Show End Behaviors

Objective(s): Students will be able to:

- Explain the process involved in graphing a polynomial function.
- Explain the leading coefficient test used to find the end behavior of a polynomial function.
- Interpret the zeros, extreme values, and symmetry of the graph of a quadratic function.

Guiding Question(s): What are the key features of the graphs of rational functions?

TN Curriculum Standard(s):

A2. F.IF.A.1 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.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

- **Constant:** A number whose value does not change.
- **Coefficient:** The number associated with the variable.
- **Degree:** The highest power of a polynomial.
- **Leading coefficient:** The coefficient of a polynomial's leading term in descending order.
- **Polynomial:** An algebraic expression which is a combination of variables, numbers, and arithmetic operators.
- **Zero:** The value which makes the given polynomial zero.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (30 min) Students will be working on graphing polynomial functions and showing end behaviors. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Drag and Drop, Quiz me, Vocabulary, Graphing Quadratic Functions, Degree and Sign of Leading Coefficient of Quadratic Function, Interpreting Zeroes of Quadratic Functions, Finding Extreme Value of Quadratic Functions, and Finding Zeroes and Extreme Value of Quadratic Functions. Videos include Graphing Quadratic Functions

- **Slide 1** - Have student read the objective(s).
- **Slide 2** – Introduce The standard form of the quadratic equation.
- **Slide 3** – Discuss Graphing Polynomial Functions
- **Slide 4**- Discuss Determining the End Behavior (or) Leading Coefficient Test
- **Slide 5**-Complete Example 1 Determining End Behavior of Function
- **Slide 6**- Complete Example 2 Graphing Quadratic Function
- **Slide 8**- Discuss Video - Graphing Quadratic Function if necessary.
- **Slide 9**- Complete Example 3 Finding Zeros of Quadratic Function
- **Slide 11**-Complete Example 4 Interpreting Zeros and Extreme Values of Quadratic Function
- **Slide 12**- Complete Example 5 Determining Zeros Using Completing the Square Method
- **Slide 13**- Complete Example 6 Interpreting Zeros of Quadratic Function
- **Slide 15**- Complete Example 7 Finding Extreme Value of Quadratic Function

Lesson Activities (We Do): (35 min) As a whole group, students will complete the guided activities. Guided activities include Drag and Drop, Quiz me, Vocabulary, Graphing Quadratic Functions, Degree and Sign of Leading Coefficient of Quadratic Function, Interpreting Zeroes of Quadratic Functions, Finding Extreme Value of Quadratic Functions, and Finding Zeroes and Extreme Value of Quadratic Functions. These activities will be discussed as a whole group.

- **Slide 1-** Drag the labels Activity
- **Slide 2-** True/False Activity
- **Slide 4-**Turning Points Activity
- **Slide 5-**End Behavior Activity
- **Slide 6-**Degree of the polynomial & Turning Points Activity
- **Slide 7-**Graphing Quadratic Function Activity
- **Slide 9-** Y-intercept Activity
- **Slide 10-**Degree and Sign of Leading Coefficient of Quadratic Function Activity
- **Slide 13 -**Value of t Activity
- **Slide 14-** Interpreting Zeros of Quadratic Function Activity
- **Slide 15-** Find the maximum value of product of solution of quadratic equation Activity
- **Slide 16-** Finding Extreme Value of Quadratic Function Activity
- **Slide 17-** Finding Extreme Value of Quadratic Function Activity

Supplemental: (As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson: Determining End Behaviors, Characteristics of Polynomial Functions, Determining Intercepts and End Behavior of a Polynomial Function, Determining the End Behavior of an Exponential Function, Determining the End (Long Run) Behavior of a Polynomial Function (2 videos).

Additional Teacher Resources: See Supplemental Resources

Lesson Review: (5 min)

Slide 18 Lesson Review

- Zeros or x-intercepts can be found by replacing $y = 0$ in the given equation and solving for x . In the same way, y -intercept can be found by replacing $x = 0$ in the given equation.
- If $f(x) = f(-x)$, then the graph is symmetric about the y -axis.
- If $f(x) = -f(-x)$, then the graph is symmetric about the origin.
- The degree of the polynomial and the sign of the leading coefficient must be known in order to determine the end behavior of a function.

Degree of a Polynomial	Sign of Leading Coefficient	End Behavior
Even	Positive	$f(x) \rightarrow \infty$ as $x \rightarrow \pm \infty$
Even	Negative	$f(x) \rightarrow -\infty$ as $x \rightarrow \pm \infty$
Odd	Positive	$f(x) \rightarrow -\infty$ as $x \rightarrow -\infty$ $f(x) \rightarrow \infty$ as $x \rightarrow \infty$
Odd	Negative	$f(x) \rightarrow \infty$ as $x \rightarrow -\infty$ $f(x) \rightarrow -\infty$ as $x \rightarrow \infty$

- If a polynomial function has the degree of n , then it can have at most $(n - 1)$ turning points or bumps.
- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the post-test. Encourage them to think critically and do their best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 12

Topic/Lesson Title & Grade Results #: Lesson 2 - Graphing Transformation of Absolute Value Function

Objective(s): Students will be able to:

- Define absolute value functions.
- Apply transformations of absolute value functions.
- Graph absolute value functions by performing transformations on the parent function.

Guiding Question(s): How do you define absolute value functions and apply transformations of absolute value functions?

TN Curriculum Standard(s):

A2.F.IF.B.3 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

- **Absolute value:** The absolute value (or modulus) $|a|$ of a real number " a " is the numerical value of " a " without considering its sign.
- **Reflection:** A flip over a line of reflection.
- **Transformation:** The movement of an object in a coordinate axis.
- **Translation:** A transformation that shifts a graph either horizontally or vertically or both.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (35 min) Students will be working on absolute value functions and applying transformations to those absolute value functions. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Graphing, finding the value of a function, translations, finding the vertex, true statements, Matching, and Drag and Drop. Videos include Absolute Value Function and Graphing the absolute value functions.

- **Slide 1** - Have student read the objective(s).
- **Slide 2** – Introduce Absolute Value Function, watch video if necessary and review example.
- **Slide 3** – Discuss Properties of Absolute Value Functions and Parent Function of Absolute Value Function
- **Slide 4**- Discuss Transformations of Absolute Value Functions
- **Slides 5-8** - Complete Examples 1-4 Translation of Absolute Value Functions
- **Slide 9**- Discuss Stretching and Shrinking of Absolute Value Functions
- **Slide 10**- Discuss Reflection of Absolute Value Functions
- **Slide 11**- Go over the Steps Used in Graphing Absolute Value Functions and complete Example 5. Watch video If the students are still unsure about this topic.
- **Slides 12-13**- Complete Examples 6-7 Graphing Absolute Value Functions

Lesson Activities (We Do): (30 min) As a whole group, students will complete the guided activities. Guided activities include Graphing, finding the value of a function, translations, finding the vertex, true statements, Matching, and Drag and Drop. These activities will be discussed as a whole group.

- **Slide 2**- Value of the absolute value

- **Slide 3**-Find the value of the function
- **Slide 5**-Find the value of k
- **Slides 6-7**-Find the vertex of the function
- **Slides 8-9** -Which statement is true?
- **Slide 12**-Find the vertex of the function
- **Slide 13**-Matching Activity
- **Slide 14**-Drag and Drop Activity

Supplemental: (As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson: Absolute Value Functions and Graphing, Graphing an Absolute Value Function.

Additional Teacher Resources: None

Lesson Review: (5 min)

Slide 15 Lesson Review

- The absolute value $|a|$ of a real number "a" is a numerical value without considering its sign.
- The properties of absolute value functions are:
 1. An absolute value function is an even function.
 2. The domain of the absolute value function is the set of all real numbers.
 3. The range of the absolute value function is the set of all real numbers greater than or equal to zero.
- A transformation changes a graph's size, shape, position, or orientation. The transformations involved are translation, reflection, rotation, and dilation.
- Steps to graph an absolute value function:
 1. Find the vertex (h, k) of the given absolute value function.
 2. Find the axis of symmetry. i.e., the x-coordinate (h) of the vertex represents the axis of symmetry.
 3. Choose values for "x" (a few values greater and lesser than the x-coordinate of the vertex) and plug in the function and find their corresponding "y" values.
 4. Plot the vertex and points (table of values) on the coordinate plane and join the points in V-shape.
- The general form of the absolute value function is $y = a|x - h| + k$.
- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the post-test. Encourage them to think critically and do their best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students
- Validate students home address

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 13

Topic/Lesson Title & Grade Results #: Lesson 3- Build Standard Function Types Using Arithmetic Operations

Objective(s): Students will be able to:

- Define functions.
- List down the different arithmetic operations performed on functions.
- Apply arithmetic operations to build new standard functions.

Guiding Question(s): How do you combine standard function types using arithmetic operations?

TN Curriculum Standard(s):

A2.F.BF.A.1 Write a function that describes a relationship between two quantities. For example, given cost and revenue functions, create a profit function. **b.** Combine standard function types using arithmetic operations.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

- **Arithmetic Operation:** A mathematical operation which involves addition, subtraction, multiplication, or division.
- **Function:** A rule that assigns to each input value a unique output value.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (30 min) Students will be working on combining standard function types using arithmetic operations. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Arithmetic Operations on Functions, Matching, Find the factors, and Drag and Drop. Videos include Sum of Functions, Arithmetic Operations on Functions, Difference of the Functions, Quotient of the Functions, and Algebra of Functions

- **Slide 1** - Have student read the objective(s).
- **Slide 2** Introduction-Two friends Kevin and Steve are playing ball by throwing it upward. How do we determine the maximum height of the ball?
- **Slide 3** – Discuss Functions and go over examples of functions.
- **Slide 4**- Complete Example 1 Arithmetic Operations on Functions and watch video if students are still unsure about topic.
- **Slide 5** – Video – Arithmetic Operations on Functions (see We Do).
- **Slide 6** – Complete Example 2 Arithmetic Operations on Functions and watch video if students are still unsure about topic.
- **Slide 7** – Video – Arithmetic Operations on Functions (see We Do).
- **Slides 9-10**- Discuss Examples 3-4 Real Life Examples
- **Slide 11**- Discuss Applications of Exponential Decay Model and complete Example 5 and watch video if students are still unsure about exponential decay.

Lesson Activities (We Do): (35 min) As a whole group, students will complete the guided activities. Guided activities include Arithmetic Operations on Functions, Matching, Find the factors, and Drag and Drop. These activities will be discussed as a whole group.

- **Slides 5 and 7** – Watch video - Arithmetic Operations on Functions if students are still unsure about topic.

- **Slide 8-** Arithmetic Operation on Functions Matching Activity
- **Slide 12-** Drag and Drop Terminologies Activity

Supplemental:(As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson: Difference of the Functions, Sum or Difference of Functions, Sum of Functions, and Sum or Difference of Functions (2 videos).

Additional Teacher Resources: See Supplemental Resources

Lesson Review: (5 min)

Slide 13 Lesson Review

- A function is a relation between a set of inputs and a set of outputs with the property that each input is related to exactly one output.
- Arithmetic operations can be performed on functions. The resultant function is called a combined function.

Addition: $(f + g)(x) = f(x) + g(x)$

Subtraction: $(f - g)(x) = f(x) - g(x)$

Multiplication: $(f \times g)(x) = f(x) \times g(x)$

Division: $\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$

- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the posttest. Encourage them to think critically and do their best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 14

Topic/Lesson Title & Grade Results #: Lesson 4 - Arithmetic and Geometric Sequences-Recursive and Explicit Formulas

Objective(s): Students will be able to:

- Explain the concepts of explicit expression and recursive sequence.
- Use explicit expression and recursive sequence to model situations and translate between the two forms.
- Solve arithmetic and geometric problems using explicit expression, and a recursive process.

Guiding Question(s): How do we identify and express arithmetic sequences and geometric sequences?

TN Curriculum Standard(s):

A2. F.BF.A.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. For example, given cost and revenue functions, create a profit function.

A2. F.BF.A.2 Know and write arithmetic and geometric sequences with an explicit formula and use them to model situations.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

- **Arithmetic sequence:** Sequence in which the difference between any two consecutive terms is constant.
- **Common difference:** The difference between two consecutive terms in an arithmetic sequence.
- **Common ratio:** The ratio between two consecutive terms in a geometric sequence.
- **Explicit expression:** An expression that allows to calculate the term of a sequence directly.
- **Expression:** A combination of arithmetic operators, numbers, and variables.
- **Geometric sequence:** Sequence in which the ratio between two consecutive terms is constant.
- **Recursive sequence:** An expression that allows to find the terms of a sequence using the previous term and the common ratio/difference.
- **Sequence:** Set of numbers that are placed in an order.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (35 min) Students will be working on identifying and expressing arithmetic and geometric sequences. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Monthly salary, Quick check, Drag and Drop, and Finding the n^{th} term of a geometric sequence drag and drop activity. Videos include Introduction of Sequence and Determining the Formula for a Sequence.

- **Slide 1** - Have student read the objective(s).
- **Slide 2**- Introduction Kathy opens a bank account with an initial deposit of \$200. Additionally, she deposits \$200 every month for a year. How can Kathy determine the balance after 12th month?
- **Slide 3** – Discuss video - Introduction of Sequence
- **Slide 4**- Discuss Explicit Method and examples.
- **Slide 5**-Discuss Recursive Method and examples.
- **Slide 6** Discuss Explicit and Recursive Formulas of Arithmetic Sequence and examples.
- **Slide 7**-Complete Examples 1-2 Finding n^{th} Term in Arithmetic Sequence Using Explicit and Recursive Formulas
- **Slide 8**- Complete Example 3 Finding Common Difference in Arithmetic Sequence
- **Slide 9**- Complete Example 4 Finding n^{th} Term in Arithmetic Sequence

- **Slide 11**-Discuss Explicit and Recursive Formulas of Geometric Sequence and examples
- **Slide 12**-Complete Examples 5-6 Finding n^{th} Term of a Geometric Sequence Using Explicit and Recursive Formulae
- **Slides 13, 15**-Complete Examples 7-8 Finding n^{th} Term of a Geometric Sequence
- **Slide 16**-Complete Example 9 Translating Recursive Form to Explicit Form and Vice Versa
- **Slides 17-18**-Complete Examples 10-11 Translating Recursive Form to Explicit Form

Lesson Activities (We Do): (30 min) As a whole group, students will complete the guided activities. Guided activities include Monthly salary, Quick check, Drag and Drop, and Finding the n^{th} term of a Geometric sequence drag and drop activity. These activities will be discussed as a whole group.

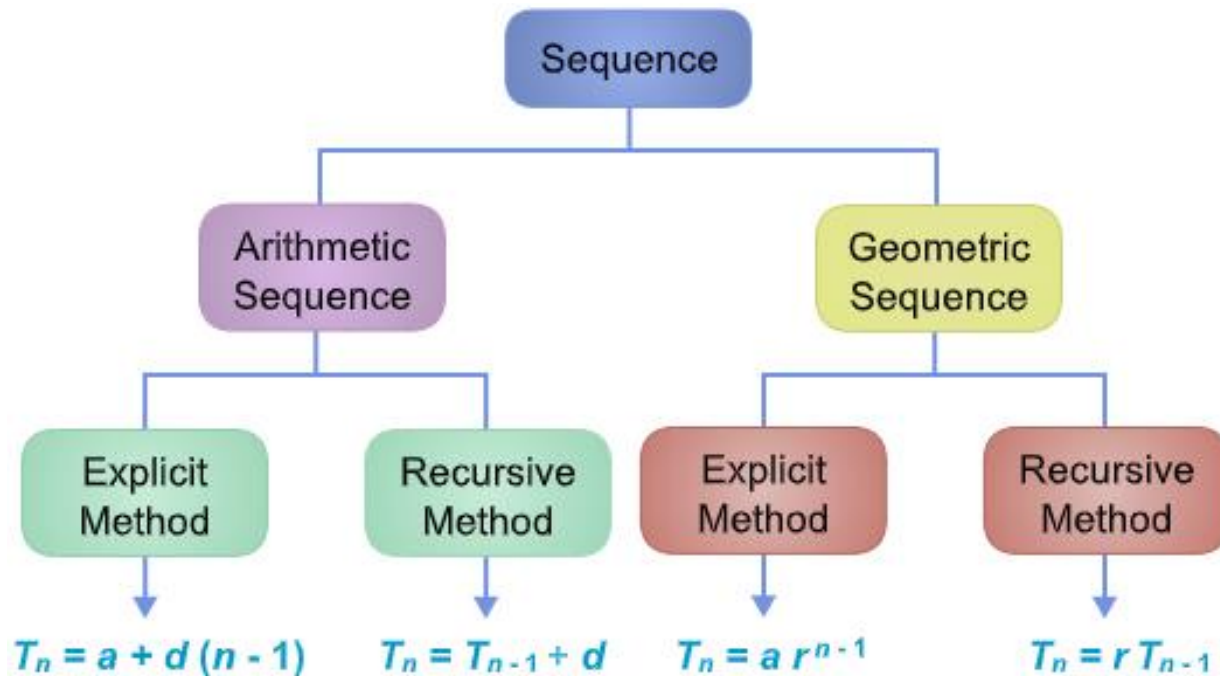
- **Slide 7**- Monthly salary Activity
- **Slide 9**-Quick Check Activity
- **Slide 10**-Finding n^{th} Term of an Arithmetic Sequence Activity
- **Slide 13**-Quick Check Activity
- **Slide 14** – Watch video – Determining the Formula for a Sequence if students are still unsure about topic.
- **Slide 19**- Finding n^{th} Term of a Geometric Sequence Drag and Drop Activity

Supplemental: (As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson: Arithmetic and Geometric Sequences, Determining the formula for a sequence, Finding the formula for a geometric sequence (2 videos), Finding the formula for an arithmetic sequence, Geometric Sequences, Arithmetic Sequences, Using a Recursive Sequence Formula.

Additional Teacher Resources: See Supplemental Resources

Lesson Review: (10 min)

Slide 20 Lesson Review



- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the posttest. Encourage them to think critically and do their best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students
- Validate students home address

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 15

Topic/Lesson Title & Grade Results #: Lesson 5 - Expressing Exponential Models as Logarithms

Objective(s): Students will be able to:

- Define exponential and logarithmic functions.
- Explain the relationship between exponential and logarithmic functions.
- Convert an exponential function into a logarithmic function.
- Use logs of base 2, 10, and e to solve real life problems.

Guiding Question(s): How do you construct and compare exponential models and solve problems?

TN Curriculum Standard(s):

A2.F.LE.A.2 For exponential models, express as a logarithm the solution to $abct = d$ where a , c , and d are numbers and the base b is 2, 10, or e ; evaluate the logarithm using technology.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Key Vocabulary/Terms:

- **Base:** The number raised to a power.
- **Exponent:** A mathematical notation that indicated the number of times that the base is to be multiplied by itself.
- **Logarithm:** The power to which a number must be raised to produce a given number.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (35 min) Students will be working on constructing and comparing exponential models as logarithms. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Quick Check, Finding the Values, Finding the value of x , Matching, Exponential Growth and Decay, Drag and Drop, and Conversion of Exponential/Logarithmic Expression. Video included: Evaluating Logarithmic Function using Technology

- **Slide 1** - Have student read the objective(s).
- **Slide 2**- Introduction Play video and look at the tables. Ask students what they infer from the tables.
- **Slide 3** – Discuss Definition of Exponential and Logarithmic Functions
- **Slide 4**- Discuss Relation Between Exponential and Logarithmic Functions and examples
- **Slides 5-7**-Complete Examples 1-4 Rewriting Exponential as Logarithmic Form
- **Slides 8-9**-Complete Examples 5-6 Evaluating Logarithmic Expressions
- **Slide 10**-Complete Examples 7-8 Solving Exponential Equations Using Logarithmic Form
- **Slide 11**– Complete Example 9 Convert Exponential Function into Logarithmic Form
- **Slide 12**– Complete Example 10 Solve Exponential Function Using Logarithmic Form
- **Slide 13**– Complete Example 11 Convert Exponential Function into Logarithmic Form
- **Slide 14**– Complete Example 12 Solve Exponential Function Using Logarithmic Form
- **Slide 15**– Complete Example 13 Logarithms in Real-Life Problems
- **Slide 16**– Complete Example 14 Use of Logarithms in Real-Life Situations

Lesson Activities (We Do): (30 min) As a whole group, students will complete the guided activities. Guided activities include Quick Check, Finding the Values, Finding the value of x , Matching, Exponential Growth and Decay, Drag and Drop, and Conversion of Exponential/Logarithmic Expression. These activities will be discussed as a whole group.

- **Slides 5-7-** Rewrite the equation in logarithmic form Quick Check Activity
- **Slide 10-** Quick Check Activity
- **Slide 11-** Matching Activity
- **Slides 12-16-** Quick Check Activity
- **Slide 17** – Video – Evaluating Logarithmic Function Using Technology – watch video if students are still unsure about topic.
- **Slide 18** – Video – Evaluating Logarithmic Function Using Technology – watch video if students are still unsure about topic.
- **Slide 19-** Go over Conversion of Exponential/Logarithm Expressions Activity with students.

Supplemental: (As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson: Exponential Function Application Using Logs.

Additional Teacher Resources: None

Lesson Review: (5 min)

Slide 20 Lesson Review

- Exponential model can be written as $b^y = x$, where b , y , and x are numbers.
- Exponential model can be expressed as logarithm $\log_b x = y$, where x and b are positive numbers and $b \neq 1$.
- $b^y = x$ is equivalent to $\log_b x = y$, where x and b are positive numbers and $b \neq 1$.
- Logarithmic functions are the inverse of exponential functions.
- Natural logarithm is written as "ln," i.e., $\ln x = \log_e x$.
- $e^y = x$ can be written as $\ln x = y$.
- Change of base formula is $\log_a x = \frac{\log_b x}{\log_b a}$ (or) $\log_a x = \frac{\ln x}{\ln a}$.
- Exponential growth or decay formula is given as $A = Pe^{rt}$, where A is the final quantity, P is the initial quantity, r is the growth or decay rate, and t is the time.
- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the posttest. Encourage them to think critically and do their best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students
- Validate students home address

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 16

Topic/Lesson Title & Grade Results #: Lesson 6 - Probability of Independent and Dependent Events

Objective(s): Students will be able to:

- Define probability.
- Explain dependent and independent events with examples.
- Find the probability of independent and dependent events.

Guiding Question(s): What is the difference between independent and dependent events?

TN Curriculum Standard(s):

A2. S.CP.A.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.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results.

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

- **Compound events:** Two or more single events happening at the same time.
- **Dependent events:** The outcome of the first event does have an effect on the probability of the second event.
- **Event:** An outcome or set of outcomes (a subset of the sample space) of an experiment or situation.
- **Experiment:** In probability, any activity based on chance.
- **Independent event:** The outcome of one event does not affect the probability of a second event.
- **Outcome:** A possible result of a probability experiment.
- **Probability:** How likely an event is to occur.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (30 min) Students will be working on probability of dependent and independent events. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Terms, Matching, Finding the Probability of Independent/Dependent Events, and Drag and Drop. Videos include Independent and Dependent Events, Independent Events, and Probability of Independent/Dependent Events.

- **Slide 1** - Have student read the objective(s).
- **Slide 2**- Introduction on Probability. Play video. Is picking a fruit from a bowl an example of probability? Find the probability.
- **Slide 3** – Discuss Compound Events and examples
- **Slide 4**- Discuss Types of Compound Events
- **Slide 5**-Discuss video on Dependent and Independent Events
- **Slide 6**- Go over Tossing a coin and rolling a single 6-sided die example.
- **Slides 8, 10, 12, 14, 17** – See We Do below regarding videos.
- **Slide 9** -Go over Example 1 Finding the probability of tossing a coin landing on head and getting 3 on rolling a die independent event.
- **Slide 11**- Go over Example 2 Determining the Probability of Independent Events
- **Slide 15**- Discuss Dependent Events and examples
- **Slide 16**- Complete Example 4 Finding the Probability of Dependent Events

- **Slide 18-** Complete Example 5 Finding the Probability of Dependent Events

Lesson Activities (We Do): (35 min) As a whole group, students will complete the guided activities. Guided activities include Terms, Matching, Finding the Probability of Independent/Dependent Events, and Drag and Drop. These activities will be discussed as a whole group.

- **Slide 7-**Terms Activity
- **Slides 8, 10, 12, 14, 17-** Watch any of the videos on Independent Events & Probability of Independent/Dependent Events if students are still unsure about the topic.
- **Slide 9-**Matching Activity
- **Slide 13-** Finding the Probability of Independent Events Matching Activity
- **Slide 19-** Finding the Probability of Dependent Drag and Drop Activity
- **Slide 20-** Finding the Probability of Independent and Dependent Drag and Drop Activity

Supplemental:(As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson: Probability of Independent and Dependent Events (4 videos).

Additional Teacher Resources: See Supplemental Resources

Lesson Review: (5 min)

Slide 21 Lesson Review

- A compound event is a combination of two or more simple events. It may be dependent or independent events.
- When the outcome of one event does not affect the outcome of another event, then the two events are said to be independent.
- If A and B are independent events, then the probability that both the events occur is given by $P(A \text{ and } B) = P(A) \times P(B)$.
- When the outcome of one event affects the outcome of another event, then the two events are said to be dependent.
- If A and B are dependent events, then the probability that both the events occur is given by $P(A \text{ and } B) = P(A) \times P(B|A)$, where $P(B|A)$ is the probability of the second event given that event A has occurred.
- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the post-test. Encourage them to think critically and do their best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students
- Validate students home address

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 17

Topic/Lesson Title & Grade Results #: Lesson 7 - Conditional Probability

Objective(s): Students will be able to:

- Define conditional probability.
- Find the conditional probability of an event.
- Interpret the problems on conditional probability in terms of a model.

Guiding Question(s): What makes a probability conditional?

TN Curriculum Standard(s):

A2. S.CP.A.3 Know and 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.

A2. S.CP.B.5 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.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results.

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

- **Compound events:** Events which consist of more than one event.
- **Dependent event:** An event which is affected by one or more events.
- **Event:** The subset of sample space or a single outcome of a trial.
- **Independent event:** An event which is not affected by any other events.
- **Probability:** The chance to get the desired event.
- **Simple event:** An event of a single outcome.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (30 min) Students will be working on conditional probability. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Probability, Drag and Drop, Matching, Quiz me, Conditional Probability Using Venn Diagram, and Interpretation of Venn Diagram. Videos include Finding Conditional Probability and Conditional Probability Using Venn Diagram.

- **Slide 1** - Have student read the objective(s).
- **Slide 2** - Introduction on Conditional Probability. Play video. What color ball will Austin pick?
- **Slide 3** – Discuss Basic Definitions in Probability. Play video.
- **Slide 4** - Discuss the Probability of an Event
- **Slide 5** - Complete Example 1, Finding the Probability of an Event
- **Slide 6** - Go over 2 examples on Probability of One Event Occurring When the Other Event Has Already Occurred. Play video.
- **Slides 7-10** - Discuss Conditional Probability and complete Examples 2 -8
- **Slide 13** – Discuss Multiplicative Events or Compound Events.
- **Slides 14-15** – Complete Examples 7-8 Finding the Probability of Compound Events
- **Slides 16** – Discuss Interpretation of Conditional Probability Using a Model...uses Venn Diagram. Watch the video if necessary.

- **Slide 17** – Complete Example 9 Interpretation of Conditional Probability
- **Slide 18** – Complete Example 10 Conditional Probability Using Venn Diagram

Lesson Activities (We Do): (35 min) As a whole group, students will complete the guided activities. Guided activities include Probability, Drag and Drop, Matching, Quiz me, Conditional Probability Using Venn Diagram, and Interpretation of Venn Diagram. These activities will be discussed as a whole group.

- **Slide 4**- What is the probability of getting three heads while tossing a coin Activity
- **Slide 5**-Rolling a die drag and drop Activity
- **Slide 8**- Matching Activity
- **Slide 9**- What is the probability that a student takes English test, given that the student is also taking Math?
- **Slide 11**-Matching Conditional probability Activity
- **Slide 12**- Video - Finding Conditional Probability – watch video if students are still unsure about this topic.
- **Slide 15**- What is the probability of choosing a queen and then a king card with replacement?
- **Slide 19**- Video - Conditional Probability Using Venn Diagram – watch video if students are still unsure about this topic.
- **Slide 20**- Matching Activity
- **Slide 21**- Interpretation of Venn Diagram Activity
- **Slide 22**- Drag and Drop Activity

Supplemental: (As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson: Conditional Probability using a table, Conditional Probability using a Venn diagram (2 videos).

Additional Teacher Resources: See Supplemental Resources

Lesson Review: (5 min)

Slide 23-Lesson Review

- A conditional probability is the probability of an event occurring, given that some other event has already occurred.
- If A and B are two dependent events, then their conditional probabilities are given as:
 - $P(A|B) = \frac{P(A \cap B)}{P(B)}$, [A given B]
 - $P(B|A) = \frac{P(A \cap B)}{P(A)}$, [B given A]
- If A and B are two independent events, $P(A \cap B) = P(A) \times P(B)$.
- Have students review the slides and their notes to prepare for the Post-test.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the post-test. Encourage them to think critically and do their best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students
- Validate students home address

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 18

Topic/Lesson Title & Grade Results #: Lesson 8 - Evaluating Trigonometric Functions using Unit Circle; Lesson A- Evaluating Trigonometric Functions using Unit Circle; Lesson B-Radian Measure

Objective(s): Students will be able to:

Lesson A

- Describe unit circle.
- Define co-terminal angle and reference angle.
- Find the values of trigonometric functions using the unit circle.

Lesson B

- Define angle and units to measure it.
- Identify the relationship between radian and degree.
- Convert radian into degree measures and vice versa.
- Create a reference triangle on a unit circle using right triangle trigonometry.

Guiding Question(s):

Lesson A

What does the unit circle have to do with trigonometric functions? How can this help solve real-world problems?

Lesson B

What is meant by the radian measure of an angle? What is the connection between the radian measure of an angle and the length of the arc on the unit circle the angle intercepts?

TN Curriculum Standard(s):

Lesson A

A2. F.TF.A.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

Lesson B

A2. F.TF.A.1 Understand and use radian measure of an angle. a. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

Lesson A

- **Periodic function:** Function that repeats its values in regular intervals or periods.
- **Radians:** Standard unit of angular measure. Periodic function: Function that repeats its values in regular intervals or periods.
- **Unit Circle:** Circle with a radius of one unit.

Lesson B

- **Degree Measure of an Angle:** A unit of angle measure equal to $\frac{1}{360}$ of a complete revolution.
- **Radian Measure of an Angle:** A unit of angle measure made by the arc that has the equal measure of the radius at the center of the unit circle.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (35 min total) In Lesson A, students will be working the unit circle and finding the values of trigonometric functions. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Matching, Find the Values, Equivalent Measure, Quick Check, and Drag and Drop. Videos include Find exact value of sine and cosine in degrees, Determining Trig Function Values using the Unit Circle and Find exact values of sine and cosine in radians. In Lesson B, students will be working on radian and degree measurements. The teacher will explain this by providing examples and guided activities throughout the lesson. Guided activities include Quick Check, Drag and Drop, and Matching Conversion of Radian/Degrees. Videos include Radians and Degrees, Conversion of Degrees into Radians, Conversion of Radians into Degrees, Radian Measure and Conversion, and Create a Reference Triangle on a Unit Circle.

Lesson A (20 min)

- **Slide 1** - Have student read the objective(s).
- **Slide 2**- Introduction on Trig functions and the unit circle. Ask students to consider a cow tied with a rope at the center of a garden and describe what that looks like.
- **Slide 3** – Discuss the Unit Circle. Play video. Ask students how to determine the distance from the origin to point P? Watch the first 6 minutes of unit circle video to further enhance the definition of the unit circle.
- **Slide 4**- Discuss Trigonometric Functions
- **Slides 5-6** -Complete Examples 1-2 Finding the Function Values of an Angle and describe how to find the function values of an angle by defining the 6 trigonometric functions. Have students find the values of x , y , and r by using the trig functions.
- **Slide 7**- Complete Examples 3-4 on Radian measurement.
- **Slide 9**-Discuss Angles on Unit Circle. Go over examples with students and play videos if students are still unsure about this topic.
- **Slide 10**-Discuss Coterminal Angle and complete Example 5. Play videos if students are still unsure about this topic.
- **Slide 11**-Discuss Reference Angle. Go over examples with students and play videos if students are still unsure about this topic. Complete activity at end of slide.
- **Slides 12-13**- Complete Examples 6-7 Finding Values of Angles in Periodic Functions. If students are still unsure about this topic, watch the videos on how to determine trig function values using the unit circle.
- **Slides 14-17**- Complete Examples 8 (Additional Properties of Trigonometric Functions), 9-11 (Finding the Value of Trigonometric Functions). Have students watch videos.

Lesson B (15 min)

- **Slide 1** - Have student read the objective(s).
- **Slide 2**- Introduction on Trig functions and radian measurement. Ask students to consider opening a door and if that could be an example of formation of angle? Play videos so students can get a visual representation of the question. Define angles.
- **Slide 3** – Discuss Measure of Angle (measurement of positive and negative angles. Play video. Ask students if there is such a thing as a negative angle. If so or if not, ask why.
- **Slide 4**- Discuss Unit to Measure Angle...the two different units of measuring angles.
- **Slide 5** -Discuss Radian Measure. Have students watch the video.
- **Slide 6**- Complete Example 1 Conversion of Degrees into Radians.
- **Slide 7**-Complete Example 2 Conversion of Degrees into Radians. Play video if students are still unsure about the topic.
- **Slide 8**- Complete Example 3 Conversion of Radians into Degrees.
- **Slide 9**- Complete Example 4 Conversion of Radians into Degrees and play video if students are still unsure about this topic
- **Slide 10**-Complete Example 5 Finding Function Values for Angles in Radians
- **Slide 11**-Complete Example 6 Determine Function Values for Angles in Radians
- **Slide 12**- If students are still unsure about this topic, have them watch the video - Radian Measure and Conversion

- **Slide 13-** If students are still unsure about this topic, have them watch the video – Create a Reference Triangle on a Unit Circle

Lesson Activities (We Do): (30 min total) As a whole group, students will complete the guided activities. Guided activities in Lesson A include Matching, Find the Values, Equivalent Measure, Quick Check, and Drag and Drop. These activities will be discussed as a whole group. Guided activities in Lesson B include Quick Check, Drag and Drop, and Matching Conversion of Radian/Degrees. These activities will be discussed as a whole group.

Lesson A (15 min)

- **Slide 3-** What are $\cos \vartheta$ and $\sin \vartheta$ when the angle, ϑ , is 0° Activity
- **Slides 4-5-** Matching Activity
- **Slide 8-**Equivalent Measure Activity
- **Slide 9 -** Quick Check Activity
- **Slide 12 -**Find the value of $\sin(\pi/3)$.
- **Slide 13 –** Answer question: What is the value of $\sin(5\pi/6)$? Complete Quick Check: Evaluate $\cos(7\pi/3)$ by unit circle.
- **Slide 18 –** Drag and Drop Activity

Lesson B (15 min)

- **Slide 6-**Quick Check Activity Convert 150° into radians
- **Slide 7-**Quick Check Activity Convert 120° into radians
- **Slide 8-** Quick Check Activity Convert $(\pi/3)$ radians into degrees
- **Slide 9-** Quick Check Activity Convert $(7\pi / 5)$ radians into degrees.
- **Slide 14-**Drag and Drop Terminologies Activity
- **Slide 15-**Conversion of Radian/Degrees Matching Activity

Supplemental: (As time permits) If the students are still unsure about this topic, then refer to the videos listed under the Supplemental part of the lesson.

Supplemental A – Unit Circle Definition of Trigonometric Functions (2 videos), Find exact values of sine and cosine in degrees, Find exact values of Trigonometric functions in degrees, Evaluating Trigonometric Functions (The Unit Circle), and Trigonometric Unit Circle Functions – Definitions.

Supplemental B – Finding the angle that subtends a given arc length.

Additional Teacher Resources: See Supplemental Resources

Lesson Review: (5 min)

Lesson A

Slide 19-Lesson Review

- A unit circle is a circle with the radius of one unit.
- Converting between radians and degrees

i) To convert degree to radians:

$$\vartheta^c = \vartheta^\circ \times \frac{\pi}{180}$$

ii) To convert radians to degree:

$$\vartheta^\circ = \vartheta^c \times \frac{180}{\pi}$$

- For all real numbers t ,

$$\cos\left(\frac{\pi}{2} - t\right) = \sin t$$

$$\sin\left(\frac{\pi}{2} - t\right) = \cos t$$

$$\tan\left(\frac{\pi}{2} - t\right) = \cot t$$

$$\cos(t + \pi) = -\cos t$$

$$\sin(t + \pi) = -\sin t$$

$$\tan(t + \pi) = \tan t$$

$$\cos(\pi - t) = -\cos t$$

$$\sin(\pi - t) = \sin t$$

$$\tan(\pi - t) = -\tan t$$

- Have students review the slides and their notes to prepare for the Posttest.

Lesson B

Slide 16 Lesson Review

- Radian measure is a unit of measure of angles, where $2\pi = 360^\circ$.
- To convert a degree measure into radians, multiply by $\frac{\pi}{180}$.
- To convert a radian measure into degrees, multiply by $\frac{180}{\pi}$.
- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the posttest. Encourage them to think critically and do their best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

Closing/Wrap Up/Notes Review: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 19

Topic/Lesson Title & Grade Results #: Lesson 9 – Trigonometric Identities

Objective(s): Students will be able to:

- Define basic trigonometric ratios.
- Derive different trigonometric identities using the Pythagorean Theorem.
- Find the measure of the angle and quadrant of the angle using trigonometric identities.

Guiding Question(s): How is the unit circle related to trigonometric functions?

TN Curriculum Standard(s):

A2.F.TF.B.3 Know and use trigonometric identities to find values of trig functions.

- a. Given a point on a circle centered at the origin, recognize, and use the right triangle ratio definitions of $\sin \theta$, $\cos \theta$, and $\tan \theta$ to evaluate the trigonometric functions.
- b. Given the quadrant of the angle use the identity to find $\sin \theta$ given $\cos \theta$, or vice versa.

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMS meeting (if applicable)

Key Vocabulary/Terms:

- **Legs:** The sides that form a right angle in a triangle.
- **Opposite Side:** The side opposite to the angle θ .
- **Adjacent Side:** The side that connects θ with the right angle.
- **Hypotenuse:** The side opposite to the right angle.
- **Identity Equation:** An equation that is true for all the possible values of its variables.
- **Trigonometric Equation:** An equation involving a trigonometric function.
- **Trigonometric Identity:** An equation which contains a trigonometric function and is true for all the values of the variables.

Attendance in PowerSchool (5 min)

Lesson Introduction (I Do): (30 min) Students will be working on trigonometric identities. The teacher will explain this by providing examples and guided activities throughout the lesson.... Guided activities include Cofunction Identities and Simplifying Trigonometric Expressions Using Trigonometric Identities. Videos include Pythagorean Identities 1, 2 and 3.

- **Slide 1** - Have student read the objective(s).
- **Slide 2** – Introduction (Watch animation and begin discussion of first 4 vocabulary terms (leg, opposite leg, adjacent leg, and hypotenuse) as they define the six trigonometric ratios ()).
- **Slide 3** – Review Identity Equation with examples of algebraic identities; Define Trigonometric Equation and show examples
- **Slide 4** – Review Trigonometric Identity, Reciprocal Identities, Tangent Identity and Cotangent Identity
- **Slide 5** – Review Pythagorean Identities 1, 2 and 3; If needed, show, or have students watch the video
- **Slide 6** – Review Cofunction Identities: review all six before completing matching activity
- **Slide 7** – Complete Example 1 Simplifying Trigonometric Expressions Using Trigonometric Identities then do Quick Check together (see below)
- **Slide 8** – Complete Example 2 Simplifying Trigonometric Expressions Using Trigonometric Identities then do Quick Check together (see below)

- **Slide 9** – Complete Example 3 Simplifying Trigonometric Expressions Using Trigonometric Identities then do Activity (see below)
- **Slide 10** – Complete Example 4 Simplifying Trigonometric Expressions Using Trigonometric Identities then do Quick Check together (see below)
- **Slide 11** – Complete Example 5 Simplifying Trigonometric Expressions Using Trigonometric Identities then do Activity (see below)
- **Slide 12** – Review Trigonometric Functions of a General Angle: pairing activity at the end
- **Slide 13** – Review Trigonometric Functions in Four Quadrants
- **Slide 14** – If needed, show, or have students watch the video. Complete Example 6 before completing matching activity
- **Slide 15** – Complete Example 7 before completing matching activity
- **Slide 16** – Complete Example 8 Coordinate Plane in Finding Quadrant and Measure of Angle

Lesson Activities and Review (We Do): (35 min) As a whole group, students will complete the guided activities. Guided activities include Quick Check, Drag and Drop, and Matching Conversion of Trigonometric Identities, Simplifying Trigonometric Expressions Using Trigonometric Identities, and Trigonometric Functions. These activities will be discussed as a whole group. Check Grade Results and have students review activities/lesson that they have not completed or need assistance with. Hold an open Q&A for students to ask questions regarding the activities/lessons they are reviewing.

- **Slide 6** – Activity Cofunction Identities matching activity
- **Slide 7** – Quick Check Simplifying Trigonometric Expressions Using Trigonometric Identities
- **Slide 8** – Quick Check Simplifying Trigonometric Expressions Using Trigonometric Identities
- **Slide 9** – Activity Simplifying Trigonometric Expressions Using Trigonometric Identities
- **Slide 10** – Quick Check Simplifying Trigonometric Expressions Using Trigonometric Identities
- **Slide 11** – Activity Simplifying Trigonometric Expressions Using Trigonometric Identities
- **Slide 17** – Activity Trigonometric Ratios
- **Slide 18** – Drag and Drop Activity

Supplemental: (As time permits) If the students are still unsure about this topic, then refer to the video listed under the Supplemental part of the lesson: Reciprocal, Quotient and Pythagorean Identities.

Additional Teacher Resources: See Supplemental Resources

Lesson Review: (5 min)

Slide 19 Lesson Review

- A trigonometric identity is an equation which contains a trigonometric function and is true for all the values of the variables.
- Pythagorean Identities

$$\sin^2 \vartheta + \cos^2 \vartheta = 1$$

$$1 + \cot^2 \vartheta = \csc^2 \vartheta$$

$$\sec^2 \vartheta - \tan^2 \vartheta = 1$$

- Reciprocal Identities

$$\sin \vartheta = \frac{1}{\csc \vartheta}$$

$$\csc \vartheta = \frac{1}{\sin \vartheta}$$

$$\cos \vartheta = \frac{1}{\sec \vartheta}$$

$$\sec \vartheta = \frac{1}{\cos \vartheta}$$

$$\tan \vartheta = \frac{1}{\cot \vartheta}$$

$$\cot \vartheta = \frac{1}{\tan \vartheta}$$

- Tangent and Cotangent Identities

$$\tan \theta = \frac{\sin \theta}{\cos \theta} \text{ and } \cot \theta = \frac{\cos \theta}{\sin \theta}$$

- Cofunction Identities

$$\sin (90^\circ - \theta) = \cos \theta$$

$$\csc (90^\circ - \theta) = \sec \theta$$

$$\cos (90^\circ - \theta) = \sin \theta$$

$$\sec (90^\circ - \theta) = \csc \theta$$

$$\tan (90^\circ - \theta) = \cot \theta$$

$$\cot (90^\circ - \theta) = \tan \theta$$

- Have students review the slides and their notes to prepare for the Posttest.

Independent Work – Posttest (They Do): (40 min) Explain that students will work independently to complete the posttest. Encourage them to think critically and do their best on the Posttest. The Posttest will count as the grade for the daily lesson. All students are required to complete student activities as part of their class assignments.

While students are working on independent work, teachers can:

- Validate all posttests are completed and remind students of missing/incomplete lessons
- Update and resolve any discrepancies in Parent Contact Logs and Communication Notes
- Validate all supporting documentation for Special Education and ESL students
- Validate students home address

Closing/Wrap Up: (5 min) 3-2-1 Activity

List 3 things you learned today, List 2 things you want to know more about, and Ask 1 clarifying question.

Summer School Lesson Plan

Subject/Grade: Algebra II

Day: 20

Topic/Lesson Title & Grade Results #: Final Post-Test Review & Post-Test

Objective(s):

- Students will review lessons to prepare for the final Post-Test.
- Final Post-test will open. All students must complete the final Post-Test

Materials/Resources Needed: Grade Results Online Platform, Grade Results video, paper, pencil, or notes in Grade Results

Technology: Computer, Whiteboard, TEAMs meeting (if applicable)

Attendance in PowerSchool: 5 minutes

Lesson Introduction (I Do): 5 minutes

Identify the purpose of the course

Connect the course to missing or future coursework and Post-test

Lesson Activities/Supplemental (We Do)

Lesson Activities and Review (We Do): 40 minutes

Check Grade Results and have students review activities/lesson that they have not completed or need assistance with.

Hold an open Q&A for students to ask questions regarding the activities/lessons they are reviewing.

Independent Work – Posttest (They Do): 80 minutes

Students will review and complete any incomplete/missed/failed coursework.

Closing/Wrap Up: