Winslow Township School District

Mathematics Curriculum – Algebra 2

Unit 1

Overview	Standards for Mathematical Content		Unit Focus	Standards for Mathematical Practice
Unit 1 **Complex Solutions and Modeling with Rational Exponents**	• N.CN.A.1 • N.CN.A.2 • N.CN.C.7 • A.REI.B.4 • A.REI.C.7 • A.REI.C.6 • F.BF.A.2 • F.LE.A.2	• F.LE.B.5 • A.SSE.B.4 • N.RN.A.1 • N.RN.A.2 • A.SSE.B.3 • F.IF.C.8 • F.LE.A.4	• Perform arithmetic operations with complex numbers • Use complex numbers in polynomial identities and equations • Build a function that models a relationship between two quantities • Construct & compare linear, quadratic, & exponential models • Write expressions in equivalent forms to solve problems • Extend the properties of exponents to rational exponents • Analyze functions using different representations	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments & critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.
Unit 1: ***Suggested Open Educational Resources***	N.CN.A.1 Complex number patterns N.CN.A.2 Powers of a complex number N.CN.C.7, A.REI.B.4b Completing the square A.REI.C.7 Linear and Quadratic System A.REI.C.6 Pairs of Whole Numbers F.BF.A.2 Snake on a Plane F.LE.A.2 Rumors		F.LE.B.5, F.LE.A.2 Exponential Parameters A.SSE.B.4 Course of Antibiotics N.RN.A.1 Evaluating Exponential Expressions N.RN.A.2 Rational or Irrational? A.SSE.B.3c Forms of exponential expressions F.IF.C.8b Carbon 14 dating in practice I F.LE.A.4 Carbon 14 dating	

Major Supporting Additional (Identified by PARCC Model Content Frameworks).

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Curriculum Unit 1	Standards		Pacing	
			Days	Unit Days
Unit 1 **Complex Solutions and Modeling with Rational Exponents**	• N.CN.A.1 • N.CN.A.2 • N.CN.C.7 • A.REI.C.7 • A.REI.C.6 • F.LE.B.5	Add, subtract, and multiply complex numbers using the commutative, associative and distributive properties. Solve quadratic equations with real coefficients that have complex solutions. Solve simple systems consisting of a linear and quadratic equation in two variables algebraically and graphically. Solve algebraically a system of three linear equations. Interpret the parameters in a linear or exponential function in terms of a context.	13	45
	• A.REI.B.4 • F.LE.A.2 • F.IF.C.8 • F.LE.A.4	Solve quadratic equations in one variable. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	13	
	• F.BF.A.2 • A.SSE.B.4 • N.RN.A.1 • N.RN.A.2 • A.SSE.B.3	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. Use the formula for the sum of a finite geometric series to solve problems [*for example, calculate mortgage payments*; derive the formula for the sum of a finite geometric series (when the common ratio is not 1)]. Use properties of integer exponents to explain and convert between expressions involving radicals and rational exponents. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression	14	
		Assessment, Re-teach and Extension	5	

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Content Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills**
• 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. • N.CN.A.2. Use the relation $i^2 = –1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers	MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concepts: • Complex number i is defined such that $i^2 = –1$. • Every complex number has the form $a + bi$ with a and b real. Students are able to: • $i^2 = –1$ and the commutative, associative properties to add and subtract complex numbers are to be used. • determine that $i^2 = –1$ and the commutative, associative, and distributive properties to multiply complex numbers. Learning Goal 1: Add, subtract, and multiply complex numbers using the commutative, associative and distributive properties.
• N.CN.C.7. Solve quadratic equations with real coefficients that have complex solutions. • A.REI.B.4. Solve quadratic equations in one variable. A.REI.B.4b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.	MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure.	Concepts: • As with real solutions, complex solutions to quadratic equations may be determined by taking square roots, factoring, and completing the square. Students are able to: • solve quadratic equations in one variable that have complex solutions by taking square roots. • solve a quadratic equations in one variable that have complex solutions by completing the square. • solve a quadratic equations in one variable that have complex solutions by factoring. • write complex solutions in $a \pm bi$ form. Learning Goal 2: Solve quadratic equations with real coefficients that have complex solutions by taking square roots, completing the square and factoring.
• A.REI.C.7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line $y = –3x$ and the circle $x^2 + y^2 = 3$.*	MP.1 Make sense of problems and persevere in solving them.	Concepts: • Solutions of linear systems contain different function types. Students are able to: • solve a system containing one linear equation and one quadratic equation algebraically. • graph a system containing one linear equation and one quadratic equation to determine a solution. Learning Goal 3: Solve simple systems consisting of a linear and quadratic equation in two variables algebraically and graphically.

• A.REI.C.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	MP.1 Make sense of problems and persevere in solving them. MP.7 Look for and make use of structure.	Concepts: • Solving a system of linear equations containing *n* variables requires *n* equations. Students are able to: • use the substitution method and/or elimination method to find the solution of a system containing three linear equations. Learning Goal 4: Solve algebraically a system of three linear equations.
• F.BF.A.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. • F.LE.A.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). • F.LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP 4. Model with mathematics MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	Concepts: • Recursion Students are able to: • distinguish between recursive and explicit formulas. • represent geometric and arithmetic sequences recursively. • represent geometric and arithmetic sequences with explicit formulas. • translate between recursive form and explicit form of geometric and arithmetic sequences. • recognize explicit formula for geometric sequences as exponential functions containing a domain in the integers only. • interpret the parameters of an exponential function representing a geometric sequence. • interpret the parameters of a linear function representing an arithmetic sequence. Learning Goal 5: Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
• A.SSE.B.4. Derive and/or explain the derivation of the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*	MP.1 Make sense of problems and persevere in solving them. MP.7 Look for and make use of structure.	Concepts: • Series as a sum of a sequence Students are able to: • derive or explain the derivation of the formula for the sum of a finite geometric series. • use the formula for the sum of a finite geometric series to solve problems. Learning Goal 6: Use the formula for the sum of a finite geometric series to solve problems [*for example, calculate mortgage payments*; derive the formula for the sum of a finite geometric series (when the common ratio is not 1)].

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• 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. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)^3}$ to hold, so $(5^{1/3})^3$ must equal 5.* • N.RN.A.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.	MP.7 Look for and make use of structure.	Concepts: • Properties of integer exponents extends to rational exponents (*for example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)^3}$ to hold, so $(5^{1/3})^3$ must equal 5)* • Radical notation is a representation of rational exponents. Students are able to: • rewrite expressions containing rational exponents into radical form. • rewrite expressions containing radical notation into exponential expressions containing rational exponents. Learning Goal 7: Use properties of integer exponents to explain and convert between expressions involving radicals and rational exponents.
• A.SSE.B.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression A.SSE.B.3c: Use the properties of exponents to transform expressions for exponential functions. *For example the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.* • F.IF.C.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function F.IF.C.8b: Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.*	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.7 Look for and make use of structure.	Concepts: • Alternate, equivalent forms of an exponential expression containing rational exponents may reveal specific attributes of the function that it defines. Students are able to: • use properties of exponent transform/rewrite an exponential expression for an exponential function. • explain the properties of the quantity or the function. Learning Goal 8: Use the properties of exponents to transform expressions for exponential functions, explain properties of the quantity revealed in the transformed expression or different properties of the function.

• F.LE.A.4. Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics.	Concepts: • Exponents and logarithms have an inverse relationship. • Solutions to an exponential equation in one variable can be written as a logarithm. Students are able to: • transform an exponential model represented by $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e. • write the solution to $ab^{ct} = d$ as a logarithm. • use technology to evaluate logarithms having base 2, 10, or e. Learning Goal 9: Express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

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District/School Formative Assessment Plan	**District/School Summative Assessment Plan**
Pre-Assessment, Quizzes Exit Tickets Daily Monitoring Linkit!	Unit Benchmark Linkit! Diagnostic

Focus Mathematical Concepts

Prerequisite skills:

Students should be able to:

- Writes linear equations in Slope-Intercept form
- Graph a linear equation
- Solve systems of equations
- Simplify a radical expression
- Graph quadratic functions
- Factor quadratic expressions
- Simplify rational exponents

Common Misconceptions:

Some students may believe that factoring and completing the square are isolated techniques within a unit of quadratic equations. Teachers should help students to see the value of these skills in the context of solving higher degree equations and examining different families of functions.

Students may think that the minimum (the vertex) of the graph of $y = (x + 5)^2$ is shifted to the right of the minimum (the vertex) of the graph $y = x^2$ due to the addition sign. Students should explore examples both analytically and graphically to overcome this misconception.

Some students may believe that the minimum of the graph of a quadratic function always occur at the y-intercept

Some students cannot distinguish between arithmetic and geometric sequences, or between sequences and series. To avoid this confusion, students need to experience both types of sequences and series.

Students commonly do not understand what it means to find the sum of a series. For example, if a student is asked to find the sum of the first 17 terms of a series, they will only find the 17th term.

Students often do not recognize that there are multiple ways of finding sums of series. Although it is not always practical, students could use a conceptual method to find the sums rather than using a formula.

Fluency Recommendations:

A-SSE.A.2 The ability to see structure in expressions and to use this structure to rewrite expressions is a key skill in everything from advanced factoring (e.g., grouping) to summing series to the rewriting of rational expressions to examine the end behavior of the corresponding rational function.

F-IF.A.3 Fluency in translating between recursive definitions and closed forms is helpful when dealing with many problems involving sequences and series, with applications ranging from fitting functions to tables to problems in finance.

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District/School Tasks	District/School Primary and Supplementary Resources and Technology Integration
PARCC Released Items **http://www.parcc-assessment.org/released-items** **NJDOE Digital Item Library** **https://nj.digitalitemlibrary.com/home** **NJSLA Mathematics Evidence Statements** **https://docs.google.com/spreadsheets/d/18M5r1jk4P729fTpAlWAzrw1gE6tken233I-Yk0U712M/edit#gid=554025491** **LinkIt! Form A, B, & C**	**Textbook** **IXL** https://www.ixl.com/ **Khan Academy** https://www.khanacademy.org/ **HS Flip Book:** http://community.ksde.org/Default.aspx?tabid=5646 **North Carolina Dept of Ed. Wikispaces:** http://maccss.ncdpi.wikispaces.net/High+School **PARCC Resources:** http://www.parcc-assessment.org/assessments/test-design/mathematics/math-test-specifications-documents **101 Math Discourse Questions:** http://www.casamples.com/downloads/100MathDiscourseQuestions_Printable.pdf **Asking Effective Questions** http://www.edu.gov.on.ca/eng/literacynumeracy/inspire/research/CBS_AskingEffectiveQuestions.pdf **Diversity, Equity & Inclusion Educational Resources** https://www.nj.gov/education/standards/dei/
Instructional Best Practices and Exemplars	
1. Identifying similarities and differences 2. Summarizing and note taking 3. Reinforcing effort and providing recognition 4. Homework and practice 5. Nonlinguistic representations	6. Cooperative learning 7. Setting objectives and providing feedback 8. Generating and testing hypotheses 9. Cues, questions, and advance organizers 10. Manage response rate

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Vocabulary			
absolute value function complex numbers complex roots function	exponential inverse function Laws of Logarithms logarithmic	relative maximums relative minimums Step function	symmetries transformations trigonometric

9.1 Personal Financial Literacy, 9.2 Career Awareness, Exploration, Preparation and Training & 9.4 Life Literacies and Key Skills

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.

The implementation of the 21st Century skills and standards for students of the Winslow Township District is infused in an interdisciplinary format in a variety of curriculum areas that include, English language Arts, Mathematics, School Guidance, Social Studies, Technology, Visual and Performing Arts, Science, Physical Education and Health, and World Language.

Additional opportunities to address 9.1, 9.2 & 9.4:

Philadelphia Mint

https://www.usmint.gov/learn/kids/resources/educational-standards

Different ways to teach Financial Literacy.

https://www.makeuseof.com/tag/10-interactive-financial-websites-teach-kids-money-management-skills/

Suggested Modifications for Special Education/504

Students with special needs: The students' needs will be addressed on an individual and grade level using a variety of modalities. Accommodations will be made for those students who need extra time to complete assignments. Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

☐ Provide the opportunity to re-take tests
☐Modify activities/assignments/projects/assessments
☐ Breakdown activities/assignments/projects/assessments into manageable units
☐Additional time to complete activities/assignments/projects/assessments
☐ Provide an option for alternative activities/assignments/projects/assessments
☐ Modify Content
☐ Modify Amount
☐ Small Group Intervention/Remediation
☐ Individual Intervention/Remediation
☐ Additional Support Materials
☐ Guided Notes
☐ Graphic Organizers
☐ Adjust Pacing of Content
☐ Increase one on one time
☐ Peer Support
☐ Other Modifications for Special Education:

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Suggested Modifications for At-Risk Students

Formative and summative data will be used to monitor student success. At first signs of failure, student work will be reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations

☐ Provide the opportunity to re-take tests
☐ Increase one on one time
☐ Oral prompts can be given
☐ Using visual demonstrations, illustrations, and models
☐ Give directions/instructions verbally and in simple written format
☐ Peer Support
☐ Modify activities/assignments/projects/assessments
☐ Additional time to complete activities/assignments/projects/assessments
☐ Provide an option for alternative activities/assignments/projects/assessments
☐ Modify Content
☐ Modify Amount
☐ Adjust Pacing of Content
☐ Small Group Intervention/Remediation
☐ Individual Intervention/Remediation
☐ Additional Support Materials
☐ Guided Notes
☐ Graphic Organizers
☐ Other Modifications for Students At-Risk:

Suggested for English Language Learners

All WIDA Can Do Descriptors can be found at this link:
https://wida.wisc.edu/teach/can-do/descriptors

☐ Grades 9-12 WIDA Can Do Descriptors:
- ☐ Listening ☐ Speaking
- ☐ Reading ☐ Writing
- ☐ Oral Language

Students will be provided with accommodations and modifications that may include:

- Relate to and identify commonalities in mathematics studies in student's home country
- Assist with organization
- Use of computer
- Emphasize/highlight key concepts
- Teacher Modeling
- Peer Modeling
- Label Classroom Materials - Word Walls

Suggested Modifications for Gifted Students

Students excelling in mastery of standards will be challenged with complex, high level challenges related to the topic.

- Raise levels of intellectual demands
- Require higher order thinking, communication, and leadership skills
- Differentiate content, process, or product according to student's readiness, interests, and/or learning styles
- Provide higher level texts
- Expand use of open-ended, abstract questions
- Critical and creative thinking activities that provide an emphasis on research and in-depth study
- Enrichment Activities/Project-Based Learning/ Independent Study

Additional Strategies may be located at the links:

- Gifted Programming Standards
- Webb's Depth of Knowledge Levels and/or Revised Bloom's Taxonomy
- REVISED Bloom's Taxonomy Action Verbs

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Suggested Activities	
☐ Do Now/Warm-Up ☐ Whole Group ☐ Small Groups ☐ Guided Practice ☐ Independent Practice	☐ Centers ☐ Intervention/Remediation ☐ Projects ☐Academic Games ☐ Other Suggested Activities:

Interdisciplinary Connections

Big Ideas Real-Life STEM Videos and Performance Tasks

Interdisciplinary Connections: ELA

NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content

NJSLSA.L1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking

SL.9-10.4: Present information, findings and supporting evidence clearly, concisely and logically. The content, organization, development and style are appropriate to task, purpose and audience.

NJSLSA.L6: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

Integration of Computer Science and Design Thinking NJSLS 8

8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.

8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment. • 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution.