Winslow Township School District

Mathematics Curriculum – Geometry

Unit 3

<table>
<tr><th>Overview</th><th colspan="3">Standards for Mathematical Content</th><th>Unit Focus</th><th>Standards for Mathematical Practice</th></tr>
<tr><td>Unit 3

Trigonometric Ratios & Geometric

Equations</td><td>● G.GPE.B.4
● G.GPE.B.5
● G.GPE.B.6
● G.GPE.B.7
● G.SRT.C.6
● G.SRT.C.7</td><td>● G.SRT.C.8
● G.GPE.A.1
● G.C.A.1
● G.C.A.2
● G.C.A.3
● G.C.B.5</td><td>● Use coordinates to prove simple geometric theorems
● Define trigonometric ratios and solve problems involving right triangles
● Translate between the geometric description and the equation for a conic section
● Understand and apply theorems about circles
● Find arc lengths and areas of sectors of circles</td><td rowspan="2">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.</td></tr>
<tr><td>Unit 3: Suggested Open Educational Resources</td><td colspan="2">G.GPE.B.4,5 A Midpoint Miracle
G.GPE.B.5 Slope Criterion for Perpendicular
G.GPE.B.7 Triangle Perimeters
G.SRT.C.6 Defining Trigonometric Ratio
G.SRT.C.7 Sine and Cosine of Complimentary Angles</td><td colspan="2">G.SRT.C.8 Constructing Special Angles
G.GPE.A.1 Explaining the equation for a circle
G.C.A.1 Similar circles
G.C.A.2 Right triangles inscribed in circles I
G.C.A.3 Circumscribed Triangles</td></tr>
</table>

Winslow Township School District

Mathematics Curriculum – Geometry

Unit 3

Curriculum Unit 3	Standards		Pacing	
			Days	Unit Days
Unit 3 **Trigonometric Ratios & Geometric** **Equations**	• G.GPE.B.4 • G.GPE.B.5 • G.GPE.B.6 • G.GPE.B.7 • G.C.A.3	Use coordinates to prove simple geometric theorems algebraically. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems Find the point on a directed line segment between two given points that partitions the segment in a given ratio and use coordinates to compute perimeters of polygons and areas of triangles and rectangles. Prove the properties of angles for a quadrilateral inscribed in a circle and construct inscribed and circumscribed circles of a triangle using geometric tools and geometric software.	13	45
	• G.GPE.B.5 • G.GPE.B.6 • G.SRT.C.7 • G.SRT.C.8	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems. Find the point on a directed line segment between two given points that partitions the segment in a given ratio. Explain and use the relationship between the sine and cosine of complementary angles; use trigonometric ratios and the Pythagorean Theorem to compute all angle measures and side lengths of triangles in applied problems.	9	
	• G.GPE.B.7 • G.C.A.1 • G.C.A.2 • G.C.B.5	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. Prove that all circles are similar Identify and describe relationships among inscribed angles, radii, and chords; use these relationships to solve problems. Find arc lengths and areas of sectors of circles; use similarity to show that the length of the arc intercepted by an angle is proportional to the radius. Derive the formula for the area of a sector.	9	
	• G.C.A.2 • G.C.A.3	Identify and describe relationships among inscribed angles, radii, and chords; use these relationships to solve problems. Prove the properties of angles for a quadrilateral inscribed in a circle and construct inscribed and circumscribed circles of a triangle using geometric tools and geometric software.	9	
	Assessment, Re-teach and Extension		5	

Winslow Township School District

Mathematics Curriculum – Geometry

Unit 3

Unit 3 Geometry		
Content Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills**
• G.GPE.B.4. Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).*	MP.3 Construct viable arguments and critique the reasoning of others.	Concept(s): No new concept(s) introduced Students are able to: • Use coordinates to prove geometric theorems including: – prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle (or other quadrilateral); – and prove or disprove that a given point lies on a circle of a given center and radius or point on the circle. Learning Goal 1: Use coordinates to prove simple geometric theorems algebraically.
• G.GPE.B.5. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).	MP.3 Construct viable arguments and critique the reasoning of others. MP.8 Look for and express regularity in repeated reasoning	Concept(s): No new concept(s) introduced Students are able to: • prove the slope criteria for parallel lines (parallel lines have equivalent slopes). • prove the slope criteria for perpendicular lines (the product of the slopes of perpendicular lines equals -1). • solve problems using the slope criteria for parallel and perpendicular lines. Learning Goal 2: Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.
• G.GPE.B.6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio. • G.GPE.B.7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.	Concept(s): No new concept(s) introduced Students are able to: • locate the point on a directed line segment that creates two segments of a given ratio. • find perimeters of polygons using coordinates, the Pythagorean theorem and the distance formula. • find areas of triangle and rectangles using coordinates. Learning Goal 3: Find the point on a directed line segment between two given points that partitions the segment in a given ratio and use coordinates to compute perimeters of polygons and areas of triangles and rectangles.
• G.SRT.C.6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.	MP.7 Look for and make use of structure.	Concept(s): • Side ratios in right triangles are properties of the angles in the triangle. Students are able to: • show and explain that definitions for trigonometric ratios derive from similarity of right triangles. Learning Goal 4: Show and explain that definitions for trigonometric ratios derive from similarity of right triangles.

Winslow Township School District

Mathematics Curriculum – Geometry

Unit 3

• G.SRT.C.7. Explain and use the relationship between the sine and cosine of complementary angles • G.SRT.C.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): • Relationship between sine and cosine of complementary angles Students are able to: • determine and compare sine and cosine ratios of complementary angles in a right triangle. • solve right triangles (determine all angle measures and all side lengths) using trigonometric ratios and the Pythagorean Theorem. Learning Goal 5: Explain and use the relationship between the sine and cosine of complementary angles; use trigonometric ratios and the Pythagorean Theorem to compute all angle measures and side lengths of triangles in applied problems.
• G.GPE.A.1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.	MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): No new concept(s) introduced Students are able to: • given the center and radius, derive the equation of a circle (using the Pythagorean Theorem). • given an equation of a circle in any form, use the method of completing the square to determine the center and radius of the circle. Learning Goal 6: Derive the equation of a circle of given the center and radius using the Pythagorean Theorem. Given an equation, complete the square to find the center and radius of the circle.
• G.C.A.1. Prove that all circles are similar.	MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.	Concept(s): • Similarity of all circles Students are able to: • construct a formal proof of the similarity of all circles. Learning Goal 7: Prove that all circles are similar
• G.C.A.2. Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle*.	MP.1 Make sense of problems and persevere in solving them. MP.5 Use appropriate tools strategically.	Concept(s): No new concept(s) introduced Students are able to: • use the relationship between inscribed angles, radii and chords to solve problems. • use the relationship between central, inscribed, and circumscribed angles to solve problems. • identify inscribed angles on a diameter as right angles. • identify the radius of a circle as perpendicular to the tangent where the radius intersects the circle. Learning Goal 8: Identify and describe relationships among inscribed angles, radii, and chords; use these relationships to solve problems.

• G.C.B.5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.	MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique he reasoning of others.	Concept(s): • A proportional relationship exists between the length of an arc that is intercepted by an angle and the radius of the circle. Students are able to: • use similarity to derive the fact that the length of the arc intercepted by an angle is proportional to the radius. • define radian measure of an angle as the constant of proportionality when the length of the arc intercepted by an angle is proportional to the radius. • derive the formula for the area of a sector. • compute arc lengths and areas of sectors of circles. Learning Goal 7: Find arc lengths and areas of sectors of circles; use similarity to show that the length of the arc intercepted by an angle is proportional to the radius. Derive the formula for the area of a sector.
• G.C.A.3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically	Concept(s): No new concept(s) introduced Students are able to: • construct the inscribed circle of a triangle. • construct the circumscribed circle of a triangle. • prove properties of the angles of a quadrilateral that is inscribed in a circle. Learning Goal 9: Prove the properties of angles for a quadrilateral inscribed in a circle and construct inscribed and circumscribed circles of a triangle using geometric tools and geometric software.

Winslow Township School District

Mathematics Curriculum – Geometry

Unit 3

Unit 3 Geometry	
District/School Formative Assessment Plan	**District/School Summative Assessment Plan**
Pre-Assessment, Quizzes Exit Tickets Daily Monitoring Linkit!	Unit Benchmark Linkit! PARCC Diagnostic

Focus Mathematical Concepts

Common Misconceptions:

- G.GPE.B.4, G.GPE.B.5, G.GPE.B.6, G.GPE.B.7

Students may claim that a vertical line has infinite slopes. This suggests that infinity is a number. Since applying the slope formula to a vertical line leads to division by zero, we say that the slope of a vertical line is undefined.
Also, the slope of a horizontal line is 0. Students often say that the slope of vertical and/or horizontal lines is "no slope," which is incorrect.

- G.SRT.C.6, G.SRT.C.7, G.SRT.C.8

Some students believe that right triangles must be oriented a particular way.
Some students do not realize that opposite and adjacent sides need to be identified with reference to a particular acute angle in a right triangle.
Some students believe that the trigonometric ratios defined in this cluster apply to all triangles, but they are only defined for acute angles in right triangles.

- G.GPE.A.1

Because new vocabulary is being introduced in this cluster, remembering the names of the conic sections can be problematic for some students.
The Euclidean distance formula involves squared, subscripted variables whose differences are added.
The notation and multiplicity of steps can be a serious stumbling block for some students.
The method of completing the square is a multi-step process that takes time to assimilate. A geometric demonstration of completing the square can be helpful in promoting conceptual understanding.

- G.C.A.1, G.C.A.2, G.C.A.3

Students sometimes confuse inscribed angles and central angles. For example they will assume that the inscribed angle is equal to the arc like a central angle.
Students may think they can tell by inspection whether a line intersects a circle in exactly one point. It may be beneficial to formally define a tangent line as the line perpendicular to a radius at the point where the radius intersects the circle.
Students may confuse the segment theorems. For example, they will assume that the inscribed angle is equal to the arc like a central angle.

- G.C.B.5

Sectors and segments are often used interchangeably in everyday conversation. Care should be taken to distinguish these two geometric concepts.
The formulas for converting radians to degrees and vice versa are easily confused. Knowing that the degree measure of given angle is always a number larger than the radian measure can help students use the correct unit.

Winslow Township School District

Mathematics Curriculum – Geometry

Unit 3

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 Wikispaces** http://maccss.ncdpi.wikispaces.net/ **PARCC Educational Resources** http://www.parcc-assessment.org/assessments/test-design/mathematics/math-test-specifications-documents **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

Winslow Township School District

Mathematics Curriculum – Geometry

Unit 3

Vocabulary				
Arc length	Construct	Intercepted	Polygon	Right angle
Area	Coordinate plane	Intersects	Proportional relationship	Right triangle
Center	Coordinates	Length	Pythagorean Theorem	Similarity
Central angle	Cosine	Length of an arc	Quadrilateral	Sine
Chords	Diameter	Line segment	Radian	Slope criteria
Circle	Distance formula	Parallel lines	Radii	Tangent
Circumscribed angle	Equation of a circle	Perimeter	Radius	Trigonometric ratio
Complementary angles	Equivalent slopes	Perpendicular lines	Ratio	
Completing the square	Inscribed angle	Point on the circle	Rectangle	

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:

Winslow Township School District

Mathematics Curriculum – Geometry

Unit 3

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

Suggested for English Language Learners	Suggested Modifications for Gifted Students
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	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

Winslow Township School District

Mathematics Curriculum – Geometry

Unit 3

Suggested Activities	
☐ Do Now/Warm-Up	☐ Centers
☐ Whole Group	☐ Intervention/Remediation
☐ Small Groups	☐ Projects
☐ Guided Practice	☐Academic Games
☐ Independent Practice	☐ 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.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.

8.1.12.AP.2: Create generalized computational solutions using collections instead of repeatedly using simple variables.

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

8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

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.