Plainfield Public Schools
Mathematics
Unit Planning Organizer

Grade/Course	Geometry
Unit of Study	**Unit 4 Extending to Three Dimensions**
Pacing	7 week

Standards for Mathematical Practices
MP1. Make sense of problems and persevere in solving them. MP2. Reason abstractly and quantitatively. MP3. Construct viable arguments and critique the reasoning of others. MP4. Model with mathematics. MP5. Use appropriate tools strategically. MP6. Attend to precision. MP7. Look for and make use of structure. MP8. Look for and express regularity in repeated reasoning.

Hyperlinks are noted underlined in italics.

UNIT STANDARDS
G.MG. A1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★
G.MG.A.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★
G.MG.A.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). ★
G.GMD. A.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.
G.GMD. A.2 (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.
G.GMD. A.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. *

Hyperlinks are noted underlined in italics.

"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
FOCUS STANDARD: **G.MG.A.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★**		
Use	geometric shapes and properties	2

"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
FOCUS STANDARD: **G.MG.A.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★**		
Apply	area volume	2

"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
FOCUS STANDARD: **G.MG.A.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).**		
Apply	geometric methods ratios	2

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"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
ADDITIONAL STANDARD: **G.GMD.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.**		
Argue(Defend)	Area	3

"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
ADDITIONAL STANDARD: **G.GMD. A.2 (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.**		
Give	Volume	2

"Unwrapped" Skills (students need to be able to do)	"Unwrapped" Concepts (students need to know)	DOK Levels
ADDITIONAL STANDARD: **G.GMD. A.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ***		
Use	volume	2

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II. New Jersey Student Learning Standards and Mathematical Practices …. Explanations & Examples

Geometry: Modeling with Geometry (G-MG) **Apply geometric concepts in modeling situations.**		
Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
.G-MG.A.1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.	Students may use simulation software and modeling software to explore which model best describes a set of data or situation.
G-MG.A.2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.	Students may use simulation software and modeling software to explore which model best describes a set of data or situation.
G-MG.A.3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	Students may use simulation software and modeling software to explore which model best describes a set of data or situation.

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Geometry: Geometric Measurement and Dimension (G-GMD) **Explain volume formulas and use them to solve problems.**		
Standards *Students are expected to:*	*Mathematical Practices*	*Explanations and Examples*
G-GMD.A.1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.*	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	Cavalieri's principle is if two solids have the same height and the same cross-sectional area at every level, then they have the same volume.
G-GMD.A.2. Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. HS.MP.4. Model with mathematics. HS.MP.5. Use appropriate tools strategically.	Cavalieri's principle is if two solids have the same height and the same cross-sectional area at every level, then they have the same volume.
G-GMD.A.3. Use volume formulas for cylinders, pyramids, cones, and spheres to	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively.	Missing measures can include but are not limited to slant height, altitude, height, diagonal of a prism, edge length, and radius.

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III.Essential Questions ……. Corresponding Big Ideas

Essential Questions	Corresponding Big Ideas
How can geometry be applied to real world mathematical problems? How do the surface areas and volumes of similar solids compare? How does surface area and volume influence design? How can the formulas for volume, area and circumference be explained using various tools and visual or tactile representations?	A diagram s a sophisticated mathematical device for thinking and communication. A diagram is a built geometric artifact, with both a history - a narrative of successive construction - and a purpose. A diagram is not a picture. It needs to be interpreted: learning how to read a diagram can be like learning a new language. Empirical verification is an important part of the process of proving, but it can never, by itself, constitute a proof. Geometry uses a wide variety of kinds of proofs. The processes of proving include a variety of activities, such as developing conjectures, considering the general case, exploring with examples, looking for structural similarities across cases, and searching for counterexamples. Making sense of others' arguments and determining their validity are proof-related activities. A proof can have many different valid representational form, including narrative, picture, diagram, two-column presentation, or algebraic form. *Sources:* *Ellis, A., B., Bieda, K., & Knuth, E. (2012). Developing Essential Understanding of Proof and Proving. Reston, VA: The National Council of Teachers of Mathematics.* *Pimm, D., Sinclair, N., & Skelin, M. (2012). Developing Essential Understanding of Geometry. Reston, VA: The National Council of Teachers of Mathematics. Inc*

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IV. Student Learning Goals

Student Learning Goals	Concept / Skills	***Instructional Clarification as PARCC. Test Specific .Evidence Statement***	Mathematical Practices
Model real-world objects with geometric shapes based upon their measures and properties, and solve problems using volume formulas for cylinders, pyramids, cones, and spheres. Identify cross-sections, three-dimensional figures, and identify three-dimensional objects created by the rotation of two-dimensional objects. G.MG.A.1, G.GMD.A.3, G.GMD.A.4	**Concept(s):** • Real-world objects can be described, approximately, using geometric shapes, their measures, and their properties. **Students are able to:** • identify cross-sections of three dimensional objects. • identify three-dimensional objects generated by rotation of two-dimensional objects. • solve problems using volume formulas for cylinders, pyramids, cones, and spheres. • model real-world objects with geometric shapes. • describe the measures and properties of geometric shapes that best represent a real-world object.	• If the cross section is a conic section it will be limited to circles, ellipses, and parabolas. (It will not include hyperbolas.) • Tasks do not cue students to the type of equation or specific solution method involved in the task. For example: An artist wants to build a right-triangular frame in which one of the legs exceeds the other in length by 1 unit, and in which the hypotenuse exceeds the longer leg in length by 1 unit. Use algebra to show that there is one and only one such right triangle, and determine its side lengths.	MP.1 MP.2 MP.4. MP.5 MP.6 MP.7
Apply concepts of density based on area and volume in modeling situations. G.MG.A.2	**Concept(s): No new concept(s)** introduced **Students are able to:** • model real-world situations, applying density concepts based	• Tasks may have a real world or mathematical context. ii.) Tasks may involve coordinates (G-GPE.7). iii.) Refer to A-	MP.1 MP.2 MP.4 MP.5 MP.6

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	on area. • model real-world situations, applying density concepts based on volume.	REI.11 for some of the content knowledge from the previous course relevant to these tasks. • Cubic polynomials are limited to polynomials in which linear and quadratic factors are available. • To make the tasks involve strategic use of tools (MP.5), calculation and graphing aids are available but tasks do not prompt the student to use them.	
Solve design problems using geometric method G.MG.A.3	**Concept(s):** No new concept(s) introduced **Students are able to:** • design objects or structures satisfying physical constraints • design objects or structures to minimize cost. • solve design problems.		MP.1. MP.2 MP.4 MP.5 MP.6
Using dissection arguments, Cavalieri's principle, and informal limit arguments, develop informal arguments for formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid,	**Concept(s):** No new concept(s) introduced **Students are able to:** • construct viable dissection arguments and informal limit arguments. • apply Cavalieri's principle.		MP.3. MP.6 MP.7

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and cone. G.GMD.A.1	• construct an informal argument for the formula for the circumference of a circle. • construct an informal argument for the formula for the area of a circle. • construct an informal argument for the formula for the volume of a cylinder, pyramid, and cone.		

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v. Unit Vocabulary

Unit Vocabulary Terms		
Latitude	axis	parallelogram
base edge	composite solid	perpendicular Bisector
height lateral area	lateral edge	plain
lateral face	oblique cone	platonic solid
regular pyramid	right cone	point
slant height	centroid	polyhedron
circumcenter	collinear	point of concurrency
concurrent lines	cone	prism
coplanar	cylinder	pyramid
defined term	definition	regular polyhedron
edge	face	space
intersection	line	sphere
median		surface area
		Undefined Term
		volume
		vertex

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VI. Instructional Differentiated /Modification

Research Based Effective Teaching Strategies	Modifications	Strategies for Special Education	Strategies for English Language Learners
Task /Activities that solidifies mathematical concepts Use questioning techniques to facilitate learning Reinforcing Effort, Providing Recognition Practice, reinforce and connect to other ideas within mathematics Promotes linguistic and nonlinguistic representations Cooperative Learning Setting Objectives, Providing Feedback Varied opportunities for students to communicate mathematically	**Modifications** Before or after school tutorial program Leveled rubrics Increased intervention Small groups Change in pace Calculators Extended time Alternative assessments Tiered activities/products Color coded notes Use of movements ***use dynamic software to help guide students through the lesson* **Extension:** See McGraw-Hill : Glencoe Geometry Teachers Resource Chapter 10 Re-teaching and Enrichment Resources	Change in pace Calculators Alternative assessments Accommodations as per IEP Modifications as per IEP Use graphic organizer to clarify mathematical functions for students with processing and organizing difficulties'. Constant review of math concepts to strengthen understanding of prior concepts for difficulties recalling facts. Use self-regulations strategies for student to monitor and assess their thinking and performance for difficultly attending to task Cooperative learning (small group, teaming, peer assisted tutoring) to foster communication and strengthen confidence. Use technology and/or hands on devices to: clarify abstract concepts	*Whiteboards* *Small Group / Triads* *Word Walls* *Partially Completed Solution* *Gestures* *Native Language Supports* *Pictures / Photos* *Partner Work* *Work Banks* *Teacher Modeling* *Math Journals* See McGraw-Hill: Glencoe Geometry Teachers Resource Chapter 10 English as a Second Language Resources

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Use technological and /or physical tools. **<u>21st Century Learning Skills:</u>** Teamwork and Collaboration Initiative and Leadership Curiosity and Imagination Innovation and Creativity Critical thinking and Problem Solving Flexibility and Adaptability Effective Oral and Written Communication Accessing and Analyzing Information		and process for: 1. Difficulty interpreting pictures and diagram. 2. Difficulties with oral communications 3. Difficulty correctly identifying symbols of numeral 4. Difficulty maintaining attentions Simplify and reduces strategies / Goal structure to enhance motivation, foster independence and self-direction for: 1. Difficulty attending to task 2. Difficulty with following a sequence of steps to solution. 3. Difficulty processing and organizing Scaffolding math idea/concepts by guided practice and questioning strategies' to clarify and enhance understanding of math big ideas for: 1.Difficulty with process and organization 2.difficulty with oral and written communication Teacher models strategies' and	

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		think out aloud strategies to specify step by step process for 1.Difficulties processing and organization 2. Difficulty attending to tasks. Use bold numbers and/or words to draw students' attention to important information. See McGraw-Hill: Glencoe Geometry Teachers Resource Chapter 10 Special Needs Resources	

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V. Instructional Resources

<table>
<tr><th colspan="3">Instructional Resources and Materials</th></tr>
<tr><th>Formative Assessment</th><th colspan="2">Print</th></tr>
<tr><td rowspan="3">Short constructed responses
Extended responses
Checks for Understanding
Exit tickets
Teacher observation
Projects
Group
Timed Practice Test – Multiple Choice & Open-Ended Questions

<u>Performance Tasks:</u>
<u>G.MG.A.2 How many cells are in the human body?</u>
<u>G.MG.A.3 Ice Cream Cone</u>

<u>Additional Performance Tasks</u>
<u>G.MG.A.1Toilet Roll</u>
<u>G.GMD.A.3 The Great Egyptian Pyramids</u>
<u>G.GMD.B.4 Tennis Balls in a Can</u>
<u>G.GMD.A.1 Area of a circle</u>

<u>Project (optional)</u>

<u>TEACH 21 PROBLEM BASED LEARNNG PROJECT "Geodesic Greenhouse"</u></td><td colspan="2">Glencoe McGraw-Hill (2014): Geometry
● Chapter 11 Areas of Polygons and Circles
● Chapter 12 Extending Surface Area and Volume</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Resources for teachers
<u>Mathematics Assessment Projects</u>
<u>Illustrative Mathematics</u>
<u>Inside Mathmatics.org</u>
<u>Asia Pacific Economic Cooperation : :Lesson Study Videos</u>
<u>Genderchip.org</u>
<u>Interactive Geometry</u>
<u>Mathematical Association of America</u>
<u>National Council of Teachers of Mathematics</u>
<u>learner.org</u>
<u>Math Forum : Teacher Place</u>
<u>Shmoop /common core math</u>
<u>Geometer's Sketchpad</u></td><td>Resources for Students
<u>Khan Academy</u>
<u>Math world : Wolfram.com</u>
<u>Webmath.com</u>
<u>sosmath.com</u>
<u>Mathplanet.com</u>
<u>Interactive Mathematics.com</u>
<u>Mathexpression.com.algebra</u>
<u>SparksNotes :Geometry Proofs</u></td></tr>
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