NEW MEXICO
Public Education Department

New Mexico Instructional Scope
Modeling with Geometry Guide

The purpose of this tool is to help educators understand each of the grade level standards and how those standards connect to the students' overall preparation for college and career readiness.

The NMIS is a teacher-influenced tool, designed to provide instructional planning support at the programmatic level for districts and instructional level for teachers. Its foundation stems from the vision and mission of the PED and came into existence to assure that students in NM will be engaged in a culturally and linguistically responsive educational system that meets the social, emotional, and academic needs of ALL students. This is also rooted in the belief that all students must have access to on-grade-level standards, focusing on acceleration. The purpose of this tool is to help educators understand each of the grade level standards and how those standards connect to the students' overall preparation for college and career readiness.

Standards are defined as the most critical prerequisite skills and knowledge. This document is color-coded to reflect both anchor and priority standards. Though previous emphasis was placed on priority standards to address lost learning due to COVID-19, New Mexico teachers should note that moving forward, while priority standards allow for acceleration of learning, **all** standards should be addressed in instruction throughout the school year.

In this guide you will find:

- A breakdown of each of the grade level standards within the cluster, including:
  - Standards of Mathematical Practice
  - Common Misconceptions
  - Identification of Priority Standards, as identified by NMPED.
  - Level of Rigor Identification
- Sample aligned assessment items
- Suggested Student Discourse Guide
- A multilayered system of supports (MLSS) and culturally and linguistically responsive instruction (CLR) guide

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Key		
	Priority Standard	Priority standards, as identified by NMPED, are denoted with red highlighting. Priority standards are the most critical prerequisite skills and knowledge a student needs. This does not mean that these are only standards required to be taught, just these are the standards that will allow for the acceleration the students of New Mexico need during this time.
	*Conceptual Understanding*	Conceptual Understanding standards help students build a deep understanding of the **how** and **why** of mathematics.
	*Application*	Application standards help students identify the appropriate concepts and skills to tackle **novel real-world problems.**
	*Procedural Skill and Fluency*	Procedural standards help students develop **efficiency** and **accuracy** in computations.

Standards Breakdown

- Apply geometric concepts in modeling situations
  - HSG.MG.A.1
  - HSG.MG.A.2
  - HSG.MG.A.3

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Grade	*CCSS Domain*	*CCSS Cluster*
G	**MODELING WITH GEOMETRY**	**Apply geometric concepts in modeling situations**

Cluster Standard: HSG.MG.A.1

Standard	**Standards for Mathematical Practice**
Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).	• **SMP1:** Make sense of problems and persevere in solving them. • **SMP4:** Make sense of problems and persevere in solving them.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Modeling is the process of choosing and using appropriate mathematics to analyze situations, to understand them better, and to improve decisions. Modeling links classroom mathematics to everyday life, work, and decision making. Mathematical objects that represent a situation from outside mathematics can be used to model and solve problems. Modeling often involves making simplifying assumptions and sometimes minimizes or disregards some features of the situation being modeled. Modeling is best interpreted not as a collection of isolated topics, but in relation to other standards as well.	• Recognize the geometric shape that corresponds to a real object. • Utilize geometric shapes, measures, and properties to describe objects.
DOK	**Blooms**
1-2	Understand, Apply

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Grade	*CCSS Domain*	*CCSS Cluster*
G	**MODELING WITH GEOMETRY**	**Apply geometric concepts in modeling situations**

Cluster Standard: HSG.MG.A.2

Standard	**Standards for Mathematical Practice**
Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).	• **SMP1:** Make sense of problems and persevere in solving them. • **SMP4:** Make sense of problems and persevere in solving them.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
Modeling is the process of choosing and using appropriate mathematics to analyze situations, to understand them better, and to improve decisions. Modeling links classroom mathematics to everyday life, work, and decision making. Mathematical objects that represent a situation from outside mathematics can be used to model and solve problems. Modeling often involves making simplifying assumptions and sometimes minimizes or disregards some features of the situation being modeled. Modeling is best interpreted not as a collection of isolated topics, but in relation to other standards as well.	• Construct the different volume and area formulas for shapes and figures. • Explain how to find density for different types of information. • Apply formulas to find density for different types of information.
DOK	**Blooms**
1-2	Understand, Apply

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Grade	*CCSS Domain*	*CCSS Cluster*
G	**MODELING WITH GEOMETRY**	**Apply geometric concepts in modeling situations**

Cluster Standard: HSG.MG.A.3

Standard	Standards for Mathematical Practice
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).	• **SMP1:** Make sense of problems and persevere in solving them. • **SMP4:** Make sense of problems and persevere in solving them.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
Modeling is the process of choosing and using appropriate mathematics to analyze situations, to understand them better, and to improve decisions. Modeling links classroom mathematics to everyday life, work, and decision making. Mathematical objects that represent a situation from outside mathematics can be used to model and solve problems. Modeling often involves making simplifying assumptions and sometimes minimizes or disregards some features of the situation being modeled. Modeling is best interpreted not as a collection of isolated topics, but in relation to other standards as well.	• Determine which geometric concepts/figures best model a given situation. • Apply an array of formulas to determine the appropriate geometric solutions. • Design a model of a real-life object using geometric figures.
DOK	**Blooms**
1-3	Understand, Apply, Create

Common Misconceptions

• Students may struggle identifying approximate shapes to model scenarios. • Students may struggle breaking complex shapes into a combination of simpler shapes.	• Students may struggle applying concepts like volume and surface area to language and contexts such as "has a capacity of" or "wraps around."

Student Discourse Guide

- **Purposeful, rich classroom discourse offers students the opportunity to express their ideas, thinking, and to critique the reasoning of others in a variety of ways (writing, drawing, verbal). Purposeful implementation of classroom discourse allows students to activate funds of knowledge and to refine their mathematical understanding. When students have frequent opportunities for discourse they find various paths to solutions and reveal knowledge or misunderstandings to educators. The process also allows educators to honor students' culture, lived experiences and evolving math identities.**
- **Discourse that focuses on tasks that promote reasoning and problem solving is a primary mechanism for developing conceptual understanding and meaningful learning of mathematics (Michaels, O'Connor, and Resnick, 2008)**

Domain: **Modeling with Geometry**	Strand: **Apply geometric concepts in modeling situations**

Suggested Student Discourse Questions

- Share the process you used to solve the problem with your shoulder partner. What feedback do you have for them?
- How can you use basic geometric shapes to represent real-life objects when solving problems? How accurate and precise can your answers be using this technique?
- Compare the strategies used to solve the problem. Are there other shapes that could have been used in the process?
- When finding the area or volume of a specific object, are you limited to the shapes you can use? Why or why not?

ASSESSMENT GUIDE

- Apply geometric concepts in modeling situations

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Grade	*CCSS Domain*	*CCSS Strand*
G	**Modeling with Geometry**	**Apply geometric concepts in modeling situations**

Sample Task #1 (Constructed Response)

CollegeBoard **Question ID 1053899**

SAT	Math	Additional Topics in Math	Medium	Additional Topics in Math	Area and volume	1. Solve real-world and mathematical problems about a geometric figure or an object that can be modeled by a geometric figure using given information such as length, area, surface area, or volume.	No Calculator

A cube has a surface area of 54 square meters. What is the volume, in cubic meters, of the cube?

Question Difficulty: Medium

A. 18

B. 27

C. 36

D. 81

Choice B is correct. The surface area of a cube with side length s is equal to $6s^2$. Since the surface area is given as 54 square meters, the equation $54 = 6s^2$ can be used to solve for s. Dividing both sides of the equation by 6 yields $9 = s^2$. Taking the square root of both sides of this equation yields $3 = s$ and $-3 = s$. Since the side length of a cube must be a positive value, $s = -3$ can be discarded as a possible solution, leaving $s = 3$. The volume of a cube with side length s is equal to s^3. Therefore, the volume of this cube, in cubic meters, is 3^3, or 27.

Choices A, C, and D are incorrect and may result from calculation errors.

Additional Assessment: This question provides a good opportunity for students to address multiple content within one question. Students will need to consider the relationship of the multiple content.

	http://tasks.illustrativemathematics.org/content-standards/HSG/MG/A/2/tasks/1146 The linked assessment question addresses G-MG.A, specifically the question requires students to apply the relationship among density, volume and mass to reasonably estimate the number of cells in a human body. In this approach, we assume that a cell is a sphere and use that fact, along with the provided density of a cell to determine the mass of a cell. We then divide an individual's mass by the mass of a single cell. This assessment should be given to students after they've had the opportunity to work with this relationship as well as had time to work with numbers in scientific notation. Students will engage in SMP1 and SMP6.

MLSS AND CLR GUIDE

- Apply geometric concepts in modeling situation

CCSS Domain	*CCSS Cluster*
Modeling with Geometry	**Apply geometric concepts in modeling situations**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on applications of geometric concepts in a modeling situation, consider options for learning from your families and communities the cultural and linguistic ways mathematics exists outside of school to create stronger home to school connections for students. For example, learning the different geometric figures in school, home, and community can be a great way to connect school task with home task, such as letting the students identify geometric figures around them in school, home, or community. Let them describe the use and how helpful that shape is to the structure or building.	
Cross-Curricular Connections	Business: Connect to minimizing waste, maximizing volume. Social Studies: Connect to census data/population density	
Validate/Affirm/Build/Bridge	• *How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?* • *How can you create connections between the cultural and linguistic behaviors of your students' home*	• Using and Connecting Mathematical Representations: The standard for mathematical practice, use appropriate tools strategically, provides a strong foundation to validate and bridge concepts for students. Mathematical representations are mathematical tools. The linguistic and cultural experiences of students provide different and varied types of representations for solving mathematical problems. By explicitly encouraging students to use multiple mathematical representations students can draw on their "mathematical, social, and cultural competence". By valuing these representations and discussing them we can connect student representations to the representations of school mathematics and build a bridge for students to position them as competent and capable mathematicians. For example, when studying applications of geometric concepts in modeling situations the use of mathematical representations

	culture and language, the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?	within the classroom is critical because of the diverse cultural representation of every single student; however, if we let our students draw their own understanding on specific problems, where students can relate and they can justify their claim mathematically then we can say that learning took place by making connections.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• In grades 7 and 8, learners worked with formulas for area, perimeter, surface area and volume, solving real world and mathematical problems.	• Students have been modeling throughout the Geometry course with many of the clusters with focus on using skills to model the real-world situations in this cluster.	• More complex modeling will be used in statistics, physics, trigonometry, and calculus when approaching real-world problems analytically.

Suggested Instructional Strategies

Pre-Teach

Level of Intensity	*Essential Question*	*Examples*
Targeted	*What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*	Some learners may benefit from targeted pre-teaching that introduces new representations when applying geometric concepts in modeling situations because students need a strong foundation on geometric methods. For example, solve for the area and volume and use to solve for the density of a given shape.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	7.G.B.4 Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. This standard provides a foundation for work with applications of geometric concepts in modeling situation because students need to have a strong foundation on

		basic formulas and how to properly use it to solve problems and use it to justify their answers. If students have unfinished learning within this standard, based on assessment data, consider ways to provide intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.
Re-Teach		
Level of Intensity	***Essential Question***	***Examples***
Targeted	What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisiting during a unit?	For example, students may benefit from re-engaging with content during a unit on applications of geometric concepts in modeling situations by critiquing student approaches/solutions to make connections through a short mini-lesson because you want to highlight and model how to decompose a problem and/or image to the apply characteristics of geometric figures. This initial step may be the hardest for students in solving real world problems.
Intensive	What assessment data will help identify content needing to be revisited for intensive interventions?	For example, some students may benefit from intensive extra time during and after a unit on applications of geometric concepts in modeling situations by offering opportunities to understand and explore different strategies because it is very important that before moving to the next lesson, students must demonstrate understanding on the wide range of application of geometric shape and use in real world, such as solving for volume, area, and density specifically population density of a given area.
Extension		
Essential Question		***Examples***
What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?		Some learners may benefit from an extension to understand concepts more quickly and explore them in greater depth than other students when studying applications of geometric concepts in modeling situations. Students will have the opportunity to use their own foundation on solving geometric shapes the way they understand it as long as they can justify it mathematically.