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

Grade	*CCSS Domain*	*CCSS Cluster*
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*	• 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

	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 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?*	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 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.