Supporting STAAR™ Achievement: Targeting the TEKS and Readiness Standards

Geometry

Teacher Edition

Product ID:
407-1667

Table of Contents

What Is *Supporting STAAR™ Achievement: Targeting the TEKS and Readiness Standards*?

1. A resource that focuses on the TEKS identified as readiness standards while integrating appropriate supporting standards and mathematical processes and skills

2. A resource that provides opportunities for rigorous mathematical conversations while providing supports for students at varying levels of readiness

3. A resource that provides support for English language learners and students struggling to learn mathematics through Tier I differentiated activities, preteaching experiences, scaffolds for activities such as hint cards and graphic organizers, and facilitation questions

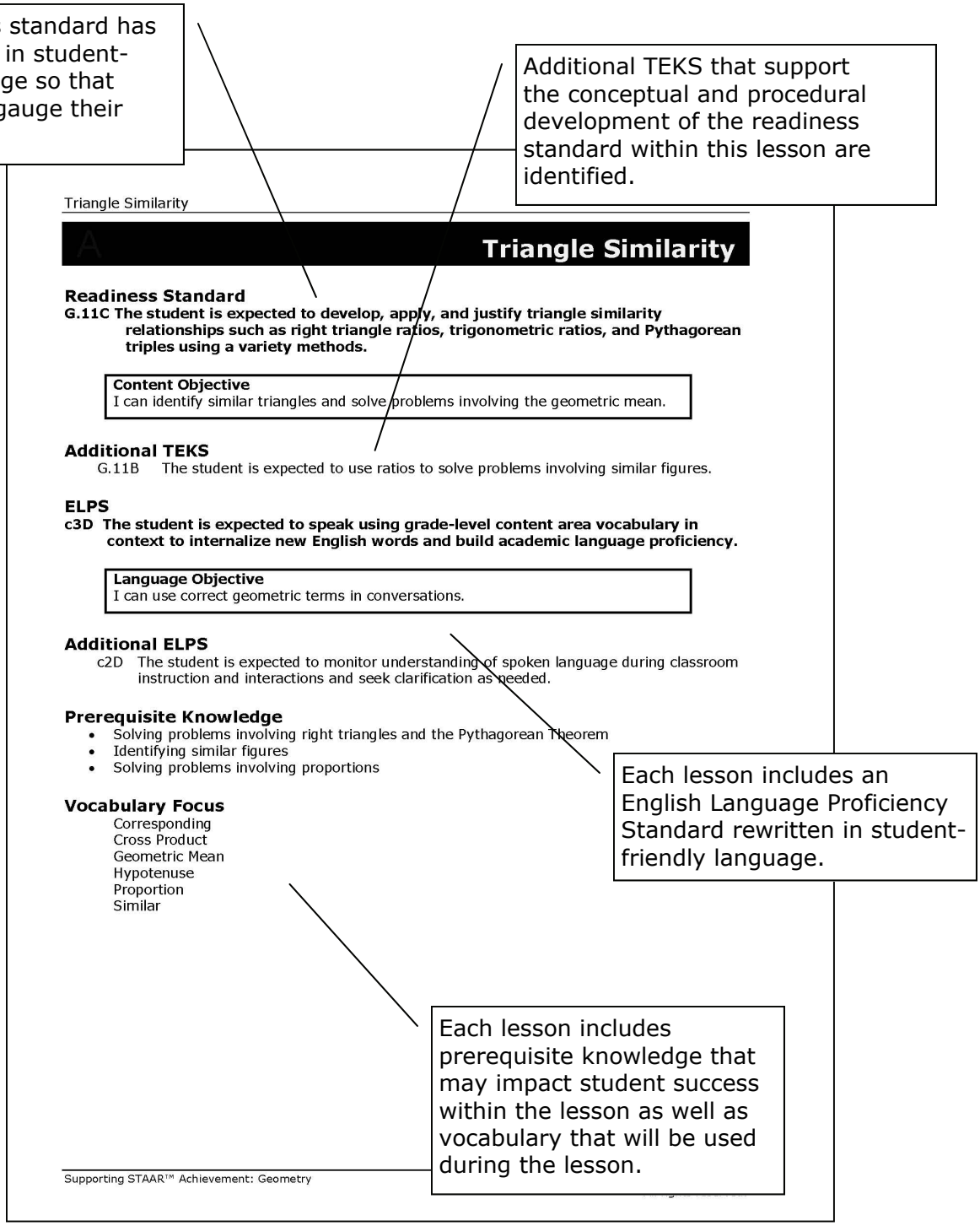
4. A resource that supports beginning as well as experienced teachers through clear instructions and facilitation questions that focus on potential stumbling blocks for students in the effort to bridge to formal understanding of mathematics

5. A resource of classroom-ready 5E lessons. The Engage phase of each lesson consists of a student-centered activity that either bridges from students' prior knowledge or encourages interest in deeper exploration of the concepts in the lesson. The Explore phase of each lesson provides students with an opportunity to "do mathematics" and begin to formulate ideas and conjectures. In the Explain phase of each lesson, students formalize the mathematical ideas from the Explore phase with a focus on academic vocabulary, as well as procedures related to the concepts. The Elaborate phase of each lesson allows students to apply or extend their understanding of the concepts in the lesson. The Evaluate phase consists of four selected-response or griddable items that can be used to assess student understanding.

What Is in a Lesson Found in *Supporting STAAR™ Achievement: Targeting the TEKS and Readiness Standards*?

Each readiness standard has been rewritten in student-friendly language so that students may gauge their learning.

Additional TEKS that support the conceptual and procedural development of the readiness standard within this lesson are identified.



Triangle Similarity

A **Triangle Similarity**

Readiness Standard
G.11C The student is expected to develop, apply, and justify triangle similarity relationships such as right triangle ratios, trigonometric ratios, and Pythagorean triples using a variety methods.

Content Objective
I can identify similar triangles and solve problems involving the geometric mean.

Additional TEKS
G.11B The student is expected to use ratios to solve problems involving similar figures.

ELPS
c3D The student is expected to speak using grade-level content area vocabulary in context to internalize new English words and build academic language proficiency.

Language Objective
I can use correct geometric terms in conversations.

Additional ELPS
c2D The student is expected to monitor understanding of spoken language during classroom instruction and interactions and seek clarification as needed.

Prerequisite Knowledge
- Solving problems involving right triangles and the Pythagorean Theorem
- Identifying similar figures
- Solving problems involving proportions

Vocabulary Focus
Corresponding
Cross Product
Geometric Mean
Hypotenuse
Proportion
Similar

Supporting STAAR™ Achievement: Geometry

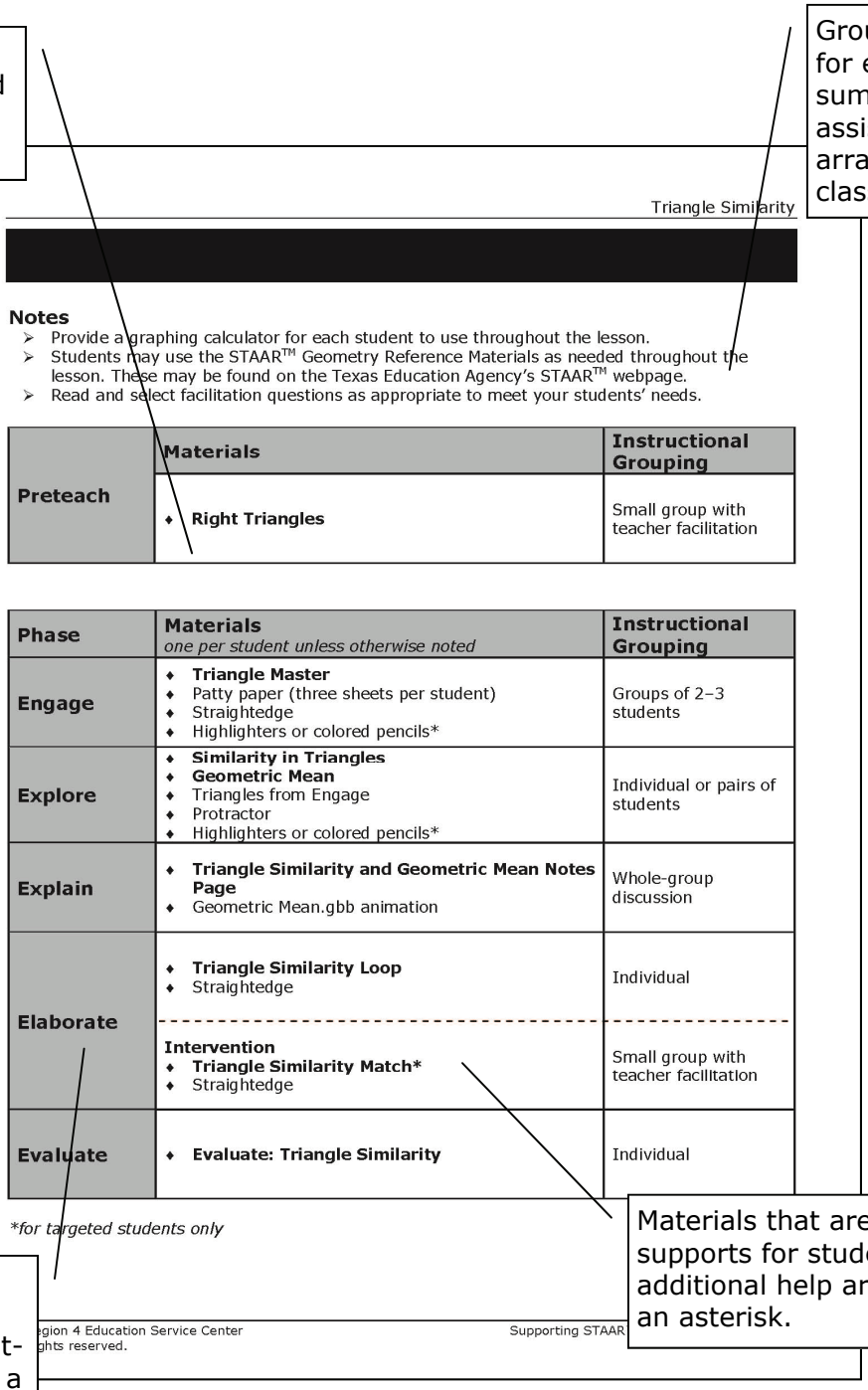
Each lesson includes an English Language Proficiency Standard rewritten in student-friendly language.

Each lesson includes prerequisite knowledge that may impact student success within the lesson as well as vocabulary that will be used during the lesson.

What Is in a Lesson Found in *Supporting STAAR™ Achievement: Targeting the TEKS and Readiness Standards*?

Materials for each phase are summarized on one page for ease in preparation.

Grouping strategies for each phase are summarized to assist in the arrangement of the classroom.



Triangle Similarity

Notes
- Provide a graphing calculator for each student to use throughout the lesson.
- Students may use the STAAR™ Geometry Reference Materials as needed throughout the lesson. These may be found on the Texas Education Agency's STAAR™ webpage.
- Read and select facilitation questions as appropriate to meet your students' needs.

	Materials	Instructional Grouping
Preteach	♦ **Right Triangles**	Small group with teacher facilitation

Phase	Materials *one per student unless otherwise noted*	Instructional Grouping
Engage	♦ **Triangle Master** ♦ Patty paper (three sheets per student) ♦ Straightedge ♦ Highlighters or colored pencils*	Groups of 2–3 students
Explore	♦ **Similarity in Triangles** ♦ **Geometric Mean** ♦ Triangles from Engage ♦ Protractor ♦ Highlighters or colored pencils*	Individual or pairs of students
Explain	♦ **Triangle Similarity and Geometric Mean Notes Page** ♦ Geometric Mean.gbb animation	Whole-group discussion
Elaborate	♦ **Triangle Similarity Loop** ♦ Straightedge	Individual
	Intervention ♦ **Triangle Similarity Match*** ♦ Straightedge	Small group with teacher facilitation
Evaluate	♦ **Evaluate: Triangle Similarity**	Individual

**for targeted students only*

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Materials that are provided as supports for students in need of additional help are labeled with an asterisk.

The Elaborate phase has two concurrent components: a student-facilitated activity and a teacher-facilitated activity that focuses on the needs of students struggling with the content.

What Is in a Lesson Found in *Supporting STAAR™ Achievement: Targeting the TEKS and Readiness Standards*?

Each lesson includes a preteach activity that teachers may use with students who might benefit from exposure to related concepts prior to the lesson.

Triangle Similarity

Preteach

1. Distribute **Right Triangles** and graphing calculators to each student.
2. Draw 4 or 5 right triangles with varied orientations so that they are visible to all students. Prompt the students to identify the legs and the hypotenuse of each triangle. Ask, "*What angle best helps us determine which side length is the hypotenuse? Why?*"
   - *What are the characteristics of a right triangle?*
   - *How could you identify the legs of a right triangle?*
   - *How could you identify the hypotenuse of a right triangle?*
3. Prompt students to work with a partner to identify the legs and the hypotenuses for each triangle on **Right Triangles**.
4. Ask, "*How could you find the length of the hypotenuse when given the lengths of the legs?*" Review the Pythagorean Theorem as needed and prompt students to use the STAAR™ Geometry Reference Materials when necessary.
5. Prompt students to work in pairs to complete the first problem.
   - *Is 12 an appropriate length for the other leg given in the drawing? Why?*
   - *What equation can we write that will help us find the length of the hypotenuse with the leg length you provided?*
   - *How would you solve that equation using your graphing calculator as a supporting tool?*
6. Prompt students to work in pairs to complete the second problem.
   - *Which angle is across from z? What does that imply?*
   - *What equation can we write that will help us find the length of the hypotenuse for a triangle with leg lengths of 16 and 30?*
   - *Does your equation match the equation provided? How are the equations similar? How are they different?*
   - *Why is 25.4 units an unreasonable length for the hypotenuse of this triangle?*

Engage

1. Distribute **Triangle Master** and patty paper to each student.
2. Prompt students to complete **Triangle Master**.

Supports
Use colored pencils or highlighters to trace the outline of each of the three distinct triangles.

Facilitation Questions
- **How many unique triangles are in the diagram?**
- **How would you classify *ΔADB*?**
- **What is the name of the segment drawn from point *D* to point *C*?**
- **What types of triangles are in the sketch?**
- **How can you compare the measures of the angles for the triangles?**

Listen for . . .
- *Identification of relationships between congruent angles and their corresponding sides*
- *Use of correct terminology such as right angle, congruent angle, correspond*

Supporting STAAR™ Achievement: Geometry

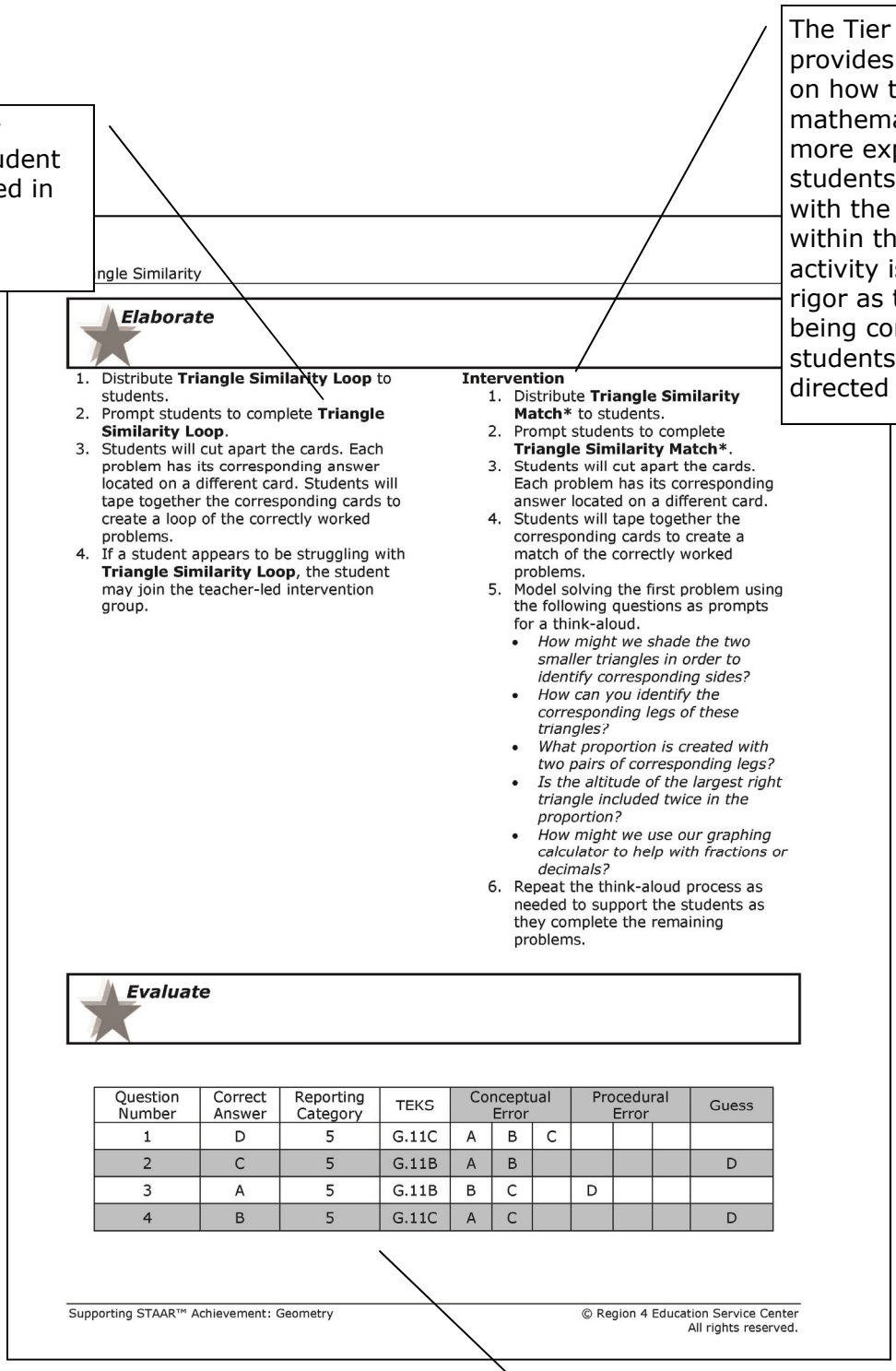
Each phase includes directions to implement the activity and the identification of additional student supports for the activity.

Each phase includes facilitation questions to help students who may be struggling to interpret or process components of the activity.

What Is in a Lesson Found in *Supporting STAAR™ Achievement: Targeting the TEKS and Readiness Standards*?

Titles of activity masters and student pages are printed in bold for ease of reference.

The Tier I intervention provides instructions on how to make the mathematics content more explicit for students struggling with the concepts within the lesson. The activity is at the same rigor as the activity being completed by the students in a self-directed environment.



ngle Similarity

Elaborate

1. Distribute **Triangle Similarity Loop** to students.
2. Prompt students to complete **Triangle Similarity Loop**.
3. Students will cut apart the cards. Each problem has its corresponding answer located on a different card. Students will tape together the corresponding cards to create a loop of the correctly worked problems.
4. If a student appears to be struggling with **Triangle Similarity Loop**, the student may join the teacher-led intervention group.

Intervention

1. Distribute **Triangle Similarity Match*** to students.
2. Prompt students to complete **Triangle Similarity Match***.
3. Students will cut apart the cards. Each problem has its corresponding answer located on a different card.
4. Students will tape together the corresponding cards to create a match of the correctly worked problems.
5. Model solving the first problem using the following questions as prompts for a think-aloud.
   - *How might we shade the two smaller triangles in order to identify corresponding sides?*
   - *How can you identify the corresponding legs of these triangles?*
   - *What proportion is created with two pairs of corresponding legs?*
   - *Is the altitude of the largest right triangle included twice in the proportion?*
   - *How might we use our graphing calculator to help with fractions or decimals?*
6. Repeat the think-aloud process as needed to support the students as they complete the remaining problems.

Evaluate

Question Number	Correct Answer	Reporting Category	TEKS	Conceptual Error			Procedural Error			Guess
1	D	5	G.11C	A	B	C				
2	C	5	G.11B	A	B					D
3	A	5	G.11B	B	C		D			
4	B	5	G.11C	A	C					D

Supporting STAAR™ Achievement: Geometry

Each selected-response item is labeled with the STAAR™ reporting category and student expectation. Incorrect answer choices are classified according to type.

Composite Volume

Readiness Standard

G.8D The student is expected to find surface areas and volumes of prisms, pyramids, spheres, cones, cylinders, and composites of these figures in problem situations.

Content Objective
I can find the volume of solids in problem situations using models and formulas.

Additional TEKS

G.6B The student is expected to use nets to represent and construct three-dimensional geometric figures.

G.8A The student is expected to find areas of regular polygons, circles, and composite figures.

ELPS

c3D The student is expected to speak using grade-level content area vocabulary in context to internalize new English words and build academic language proficiency.

Language Objective
I can speak about the volume of composite solids using appropriate vocabulary.

Additional ELPS

c5B The student is expected to write using newly acquired basic vocabulary and content-based grade-level vocabulary.

c5G The student is expected to narrate, describe, and explain with increasing specificity and detail to fulfill content area writing needs as more English is acquired.

Prerequisite Knowledge

- Apply formulas to find the volume of solids
- Apply formulas to find the area of geometric figures

Vocabulary Focus

Volume of Composite Solids

Notes

- Provide a graphing calculator and ruler for each student to use throughout the lesson.
- Students may use the STAAR™ Geometry Reference Materials as needed throughout the lesson. These may be found be on the Texas Education Agency's STAAR™ webpage.
- Read and select facilitation questions as appropriate to meet your students' needs.

	Materials	Instructional Grouping
Preteach	♦ **Solid Riddles**	Small group with teacher facilitation

Phase	Materials *one per student unless otherwise noted*	Instructional Grouping
Engage	♦ **Let's Build It: Solid A–E** ♦ **Volume Recording Sheet*** ♦ Ruler ♦ Scissors ♦ Tape ♦ Colored pencils or highlighters (optional)	Groups of 2–3 students
Explore	♦ **What Can It Hold?**	Individual or pairs of students
Explain	♦ **Composite Volume Notes Page** ♦ **Composite Volume Sentence Starters***	Individual or pairs of students
Elaborate	♦ **Applying Composite Volume**	Individual
	Intervention ♦ **Applying Composite Volume***	Small group with teacher facilitation
Evaluate	♦ **Evaluate: Composite Volume**	Individual

** for targeted students only*

Preteach

1. Display a cube so that students may see it and touch it if needed.
   - *What words can be used to describe this cube?*
   - *Where is the base of the cube?*
   - *Where are the lateral faces of the cube?*
   - *Where are the vertices of the cube?*
   - *Does the cube have a slant height?*
2. Read Riddle 1 from **Solid Riddles** aloud to the group.
   - *Which of the solids have only one base?*
   - *Which of the solids have only three lateral faces? How do you know?*
3. Repeat guided questioning for each riddle as needed.
4. Prompt students to name the solids using academic language.
   - *What determines if a solid is a pyramid or a prism?*
   - *How can you identify the base of a solid?*
   - *What is the difference between an altitude and a slant height of a pyramid?*

Engage

1. Distribute a set of **Let's Build It: Solid A–E** to each group of 2–3 students.
2. For each solid, prompt students to—
   - Identify the base.
   - Measure and record the dimensions of the base on the solid.
   - Cut out and build each solid so that the recorded measurements are visible. Note: Tabs have been provided on the nets for ease of building.
3. Check student volumes for solids A–E for accuracy. Note: For solid E, the apothem could be measured or calculated, which may cause variation in answers.

Supports

Students may complete **Volume Recording Sheet*** to receive additional support in determining the volume of solids A–E. The face with the letter printed on it can be considered the base. Students may also shade the base of the solid on the net. Students may cut out and build the net first, without taping, to help visualize the base and its dimensions.

Facilitation Questions

- **What is true about the base of a solid?**
- **Which edge on the net will represent the height of the solid? Is this confirmed by folding the net into a solid?**
- **How could you determine the height of a prism? A pyramid?**
- **How could you find the area of a triangle? Rectangle? Hexagon?**

Listen for . . .

- *Correct reasoning in identifying the base of the solid*
- *Connections between the lengths on the net and the edges of the solid*
- *Student understanding of the differences between height of a triangle, height of a triangular prism, and slant height of a triangular pyramid*
- *Correct use of the formulas for volume of a prism, a cylinder, and a pyramid*

Explore

1. Prompt students to use solids A–E and their calculated volumes to complete **What Can It Hold?** Upon completion, debrief **What Can It Hold?**
   - *What process did you use to determine the volume of the composite figure?*
   - *When might you need to use subtraction to determine the volume?*

Supports
The face with the letter printed on it can be considered the base. Students may also shade the base of the solid on the net. Provide students with an extra cut copy of the net, without the tabs, to refer to when determining any additional measurements that may be needed. A set of built solids could also be provided.

Facilitation Questions
- **What solids were used to create the composite figure?**
- **How are you able to determine whether to use addition or subtraction to determine the volume of the composite figure?**

Listen for . . .
- *Student understanding of when to add volumes together and when to subtract volumes*

Explain

1. During this phase of the lesson, students should complete **Composite Volume Notes Page**.
2. Prompt students to share their explanations with a partner.
3. Prompt students to volunteer to share their partner's explanation with the whole class. Listen for understanding and use of correct terminology for solids, knowledge of when to use addition or subtraction to find composite volumes, and references to using appropriate units.

Supports
Provide students with **Composite Volume Sentence Starters***.

Elaborate

1. Prompt students to complete **Applying Composite Volume**.
2. If a student appears to be struggling with **Applying Composite Volume**, the student may complete **Applying Composite Volume*** independently or join the teacher-led intervention group.

Intervention
1. Distribute **Applying Composite Volume*** to each student.
2. Use a teacher think-aloud process to solve the first problem.
   - *What is the problem asking us to do?*
   - *What information do we have?*
   - *What information is missing? Which figure should we call Solid 1?*
   - *What formula allows us to calculate the volume of this solid?*
   - *What formula allows us to calculate the volume of Solid 2?*

3. If needed, use a teacher think-aloud process to solve the second problem. Students may choose to work independently.

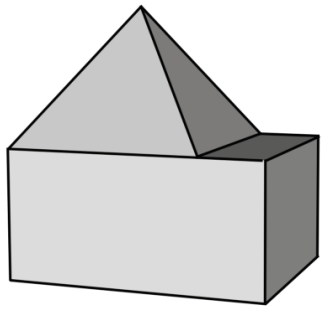
Evaluate

Question Number	Correct Answer	Reporting Category	TEKS	Conceptual Error			Procedural Error			Guess
1	A	4	G8.D	B	D		C			
2	C	4	G8.D	A	B	D				
3	C	4	G8.D	A	B					D
4	B	4	G8.D				D	C		A

What Can It Hold? (Answer Key)

Use the information from the table you created to find the following composite volumes.

1. What is the volume of the composite solid?



$V = (192 + 36\sqrt{2})$ cm^3
or $V \approx 242.91$ cm^3

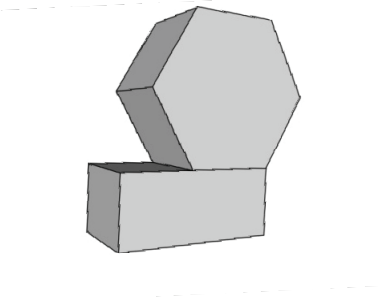
2. The triangular prism is placed adjacent to the rectangular prism A to create a ramp with a platform. What is the volume of the composite solid?

$V = 288$ cm^3

3. The rectangular prism and the triangular prism are placed side by side with the square pyramid on top. What is the volume of the composite solid?

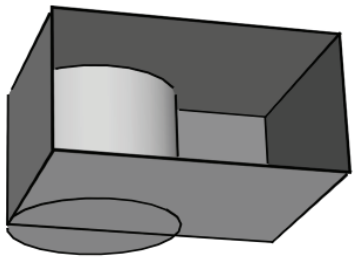
$V = (288 + 36\sqrt{2})$ cm^3
or $V \approx 338.91$ cm^3

4. What percentage of the volume of the composite solid is represented by the hexagonal prism? Round answers to the nearest whole number.



46%

5. What is the volume of the box not occupied by the half cylinder?



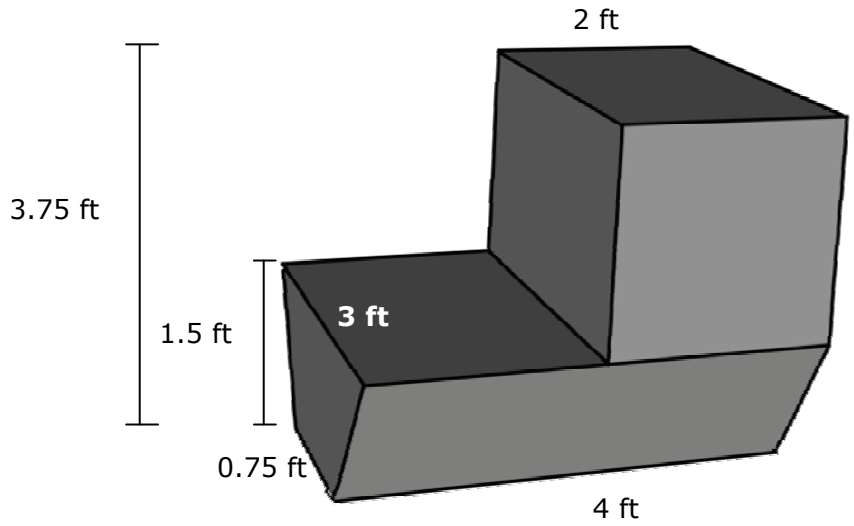
$V \approx 152.74$ cm^3

6. Determine the amount of space remaining in solid E when solid D is placed inside.

$V \approx 87.76$ cm^3

Applying Composite Volume

1. The picture below shows a feeding and storage structure used to feed sheep or goats. What is the maximum amount of grain the structure could hold?



2. Mr. Qualrem has a box that is in the shape of a square prism with a base with side lengths of 2.5 feet and a height of 3 feet. He is packing several gifts in the box to mail to his relatives. The shapes and dimensions of the gifts are listed below.

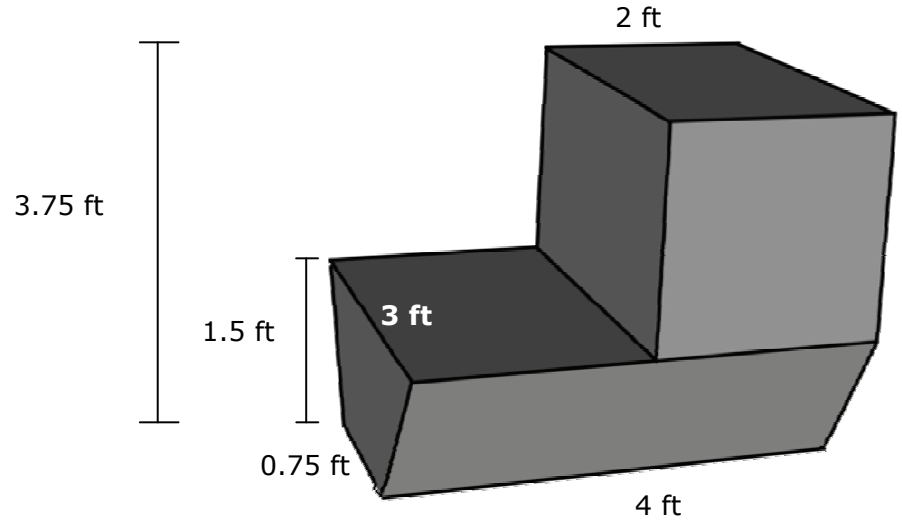
   - One cube with a side length of 1 foot 9 inches
   - A triangular prism with a height of 3 feet and a base that is a right triangle with leg lengths of 18 inches and 9 inches
   - One cylinder with a diameter of 1 foot and a height of 2.75 feet
   - A rectangular prism with a base with a length of 1.5 feet, a width of 0.75 feet, and a height of 3 feet

   If he is planning to fill the extra space in the box with packing peanuts, approximately how many cubic feet of packing peanuts does he need?

Name: _____ Composite Volume

Applying Composite Volume*

1. The picture below shows a feeding and storage structure used to feed sheep or goats. What is the maximum amount of grain the structure could hold?



a. What two solids create the feeding and storage structure?

b. Calculate the volume of the two solids.

Solid 1 _____	$V =$ _____ where $B =$ _____	Area of Base: Height of Solid:	Volume:
Solid 2 _____	$V =$ _____ where $B =$ _____	Area of Base: Height of Solid:	Volume:

c. What is the volume of the composite figure?

2. Mr. Qualrem has a box that is in the shape of a square prism with a base with side lengths of 2.5 feet and a height of 3 feet. He is packing several gifts in the box to mail to his relatives. The shapes and dimensions of the gifts are listed below.

   - One cube with a side length of 1 foot 9 inches
   - A triangular prism with a height of 3 feet and a base that is a right triangle with leg lengths of 18 inches and 9 inches
   - One cylinder with a diameter of 1 foot and a height of 2.75 feet
   - A rectangular prism with a base with a length of 1.5 feet, a width of 0.75 feet, and a height of 3 feet

   If he is planning to fill the extra space in the box with packing peanuts, approximately how many cubic feet of packing peanuts does he need?

   a. What is the volume of the box?

   b. List the shapes of the gifts that are going to be placed in the box.

   c. What is the volume in cubic feet of each of the gifts?

   d. What is the total amount of space occupied by the gifts?

   e. What is the amount of space remaining in the box?