

Examples of Tasks from CCSS Edition Course 1, Unit 6

Getting Started

The tasks below are selected with the intent of presenting key ideas and skills. **Not every answer is complete**, so that teachers can still assign these questions and expect students to finish the tasks. If you are working with your student on homework, please use these solutions with the intention of increasing student understanding and independence. A list of questions to use as you work together, prepared in [English](#) and [Spanish](#), is available. Encourage students to refer to their class notes and Math Toolkit entries for assistance. Comments in red type are not part of the solution.

As you read these selected homework tasks and solutions, you will notice that some very sophisticated communication skills are expected. Students develop these over time. This is the standard for which to strive. See [Research on Communication](#).

The [Geometry and Trigonometry](#) page might help you follow the conceptual development of the ideas you see in these examples.

Main Mathematical Goals for Unit 6

Upon completion of this unit, students should be able to:

- recognize and classify common two- and three-dimensional shapes.
- visualize and represent two- and three-dimensional shapes.
- analyze and apply properties of polygons and polyhedra.
- use rigid transformations to verify SSS, SAS, ASA conditions for congruence of triangles and use these conditions in solving problems.
- establish properties of shapes by careful reasoning from definitions and given or assumed facts.

What Solutions are Available?

- Lesson 1:** Investigation 1—Applications Task 1 (p. 383), Connections Task 14 (p. 389)
Investigation 2—Applications Task 4 (p. 384), Applications Task 6 (p. 385),
Review Task 37 (p. 397), Review Task 38 (p. 397)
Investigation 3—Applications Task 8 (p. 386), Connections Task 18 (p. 391),
Reflections Task 25 (p. 393)
Investigation 4—Applications Task 11 (p. 388), Connections Task 20 (p. 392)
- Lesson 2:** Investigation 1—Applications Task 1 (p. 412), Applications Task 3 (p. 413),
Connections Task 11 (p. 417)
Investigation 2—Applications Task 6 (p. 414), Extensions Task 24 (p. 420)
Investigation 3—Connections Task 16 (p. 419), Review Task 32 (p. 423),
Review Task 33 (p. 423)
- Lesson 3:** Investigation 1—Applications Task 1 (p. 443), Connections Task 11 (p. 446),
Review Task 29 (p. 454)
Investigation 2—Applications Task 4 (p. 444), Connections Task 12 (p. 447),
Extensions Task 23 (p. 452)
Investigation 3—Connections Task 14 (p. 449), Review Task 31 (p. 454)

Selected Homework Tasks and Expected Solutions

(These solutions are for tasks in the CCSS Edition book.
For homework tasks in books with earlier copyright dates, see [Helping with Homework](#).)

Lesson 1, Investigation 1, Applications Task 1 (p. 383)

- a. Students have learned about the Triangle Inequality Theorem, so they know that the sum of the lengths of any two sides of a triangle must be greater than the length of the third side.

The only triangle that can be built has sides of length 12 cm, 12 cm, and 5 cm. It is an isosceles triangle. A triangle cannot be built using lengths 5 cm, 5 cm, and 12 cm since $5 + 5 = 10$, which is less than 12.

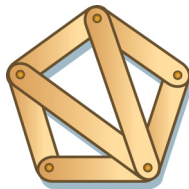
- b. To be completed by the student.
- c. The definition of a kite can be found on page R7 in the glossary to help with this task.
To be completed by the student.
- d. To be completed by the student.

Lesson 1, Investigation 1, Connections Task 14 (p. 389)

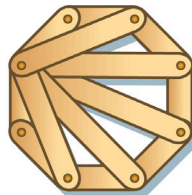
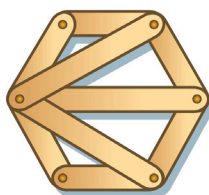
- a. The definition of a rigid shape can be found on page R13 in the glossary to help with this task.

To be completed by the student.

- b. Using 2 braces is the fewest number needed to make the linkage rigid.



- c. 3 braces; 5 braces. There are many different choices for the placement of the braces; in every case, the linkage is triangulated.



- d. To be completed by the student.

Lesson 1, Investigation 2, Applications Task 4 (p. 384)

In this task, it can be helpful if students draw a sketch of the new triangle $\triangle PQR$ so they can visualize the measurements on the new triangle. Students will need to recall the ways that they can be assured that they have congruent triangles. See student notes for the Summarize the Mathematics Part a (p. 373) or student Math Toolkits.

a. Sufficient by the SAS congruence condition

b–e. To be completed by the student.

Lesson 1, Investigation 2, Applications Task 6 (p. 385)

Students are learning to reason with congruent triangles, so one of the strategies they should be trying to use is getting a pair of triangles congruent so they can conclude that corresponding angles or sides are congruent. The questions in Applications Task 6 are designed to help students think hard about how they can use congruent triangles.

a. Since $BA = BC$, we know that truss ($\triangle ABC$) is an isosceles triangle, thus base angles $\angle A$ and $\angle C$ are congruent. $\triangle ADJ \cong \triangle CGH$ by the SAS congruence condition. So, \overline{DJ} and \overline{GH} must be the same length since they are corresponding parts of congruent triangles.

b–d. To be completed by the student.

Lesson 1, Investigation 2, Review Task 37 (p. 397)

a. -25

b. 22

c–e. To be completed by the student.

Lesson 1, Investigation 2, Review Task 38 (p. 397)

If students are having difficulty writing these in simplest form, ask them to think of a perfect square that divides evenly into the number under the square root (radical) sign. If they can rewrite the number under the radical sign as the product where one of the factors is a perfect square, then they can take the square root of the perfect square factor.

a, d–f. To be completed by the student.

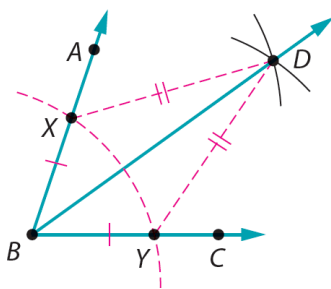
b. Rewrite as $\sqrt{4}\sqrt{11}$. Take the square root of 4 and your answer is $2\sqrt{11}$.

c. Combine them together first.

To be completed by the student.

Lesson 1, Investigation 3, Applications Task 8 (p. 386)

a.



- b. Step 1 of the algorithm assures that $BX = BY$. Step 2 of the algorithm assures that $XD = YD$. Of course, $BD = BD$. So by the SSS congruence condition, $\triangle BXD \cong \triangle BYD$. Thus, $\angle XBD \cong \angle YBD$, and so \overline{BD} bisects $\angle XBY$. Another name for $\angle XBY$ is $\angle ABC$, so \overline{BD} bisects $\angle ABC$.

The algorithms here and using the carpenter's square are essentially the same. You position the carpenter's square so that $BX = BY$ and $XD = YD$. Then connect the vertex B to the vertex of the carpenter's square to find the angle bisector.

- c. Yes, there is nothing about the algorithm that limits its use to acute angles.
 d–e. To be completed by the student.

Lesson 1, Investigation 3, Connections Task 18 (p. 391)

a, b, d. To be completed by the student.

- c. In this unit, a parallelogram has been defined as a quadrilateral with opposite sides the same length. In this task, students will show that opposite sides of a parallelogram must also be parallel. This task provides an example of indirect reasoning that is often employed by lawyers. This particular kind of argument involves proof by "elimination." Here there are only two possibilities: either \overline{BC} is parallel to \overline{AD} , or \overline{BC} is not parallel to \overline{AD} . The case that \overline{BC} is not parallel to \overline{AD} leads to a contradiction and so can be eliminated. The remaining case, \overline{BC} is parallel to \overline{AD} must be true.

To be completed by the student.

Lesson 1, Investigation 3, Reflections Task 25 (p. 393)

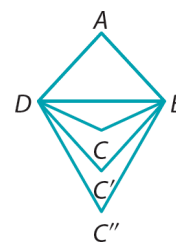
Why are opposite angles of a rhombus congruent?

To be completed by the student.

Are both pairs of opposite angles of a kite congruent?

The definition of a kite can be found on page R7 in the glossary to help with this task.

In a kite, both pairs of opposite angles may not be congruent. Students might observe that many different kites $ABCD$ can be formed using $\triangle ABD$ as one part; simply choose C as any point on the perpendicular bisector of \overline{DB} , below \overline{DB} . $\angle C$ does not have to be congruent to $\angle A$.

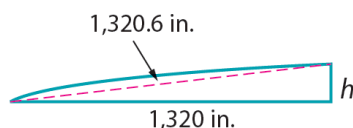


Lesson 1, Investigation 4, Applications Task 11 (p. 388)

This kind of application of fairly simple mathematics, which gives a surprising result, encourages students to think of mathematics as a useful subject, not confined to classrooms and homework assignments.

- a. The buckling will occur so that the middle of the 220-foot rail is under the highest point of the buckle.
 b. It is important for students to make conjectures. It doesn't matter that the conjecture is incorrect; what matters is that students check their conjectures using mathematics that makes sense to them. There is much more ownership in the result when students conjecture first.

- c. There are two figures that are approximately right-angle triangles in the sketch. We know that one side of the triangle measures 110 feet, or 1,320 inches. The hypotenuse of the triangle measures 1,320.6 inches. Using the Pythagorean Theorem, $(1,320.6)^2 = 1,320^2 + h^2$, so $h = 39.8$ inches.



- d. Since the railing is curved, the straight line from end to middle actually would be less than 1,320.6 inches. Our estimate of the height of the buckle is more than the actual value. Even if it were only half our estimate, a gym bag would easily fit under it!
- e. To be completed by the student.

Lesson 1, Investigation 4, Connections Task 20 (p. 392)

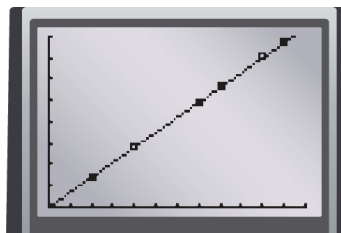
This task draws on data analysis ideas developed in Units 1, 2, and 3. The data in the table will vary some because students are asked to measure, not calculate, these lengths.

a.

Side Length (in cm)	Diagonal Length (in cm)
2	2.8
4	5.7
7	9.9
8	11.3
10	14.1
11	15.6

- b. The linear model shown at the right should be approximately $y = 1.4x$.

- i. The slope (1.4) gives the approximate ratio of diagonal to side length. It also means that for every 1-cm increase in side length, the diagonal length increases by 1.4 cm.
- ii. The y-intercept is (0, 0). Side length of a square must be a positive number.



- c. Yes, the plot appears to be linear. Students can draw in the line that best fits the points, or use the linear regression line from their calculators.
- d–e. To be completed by the student.

Lesson 2, Investigation 1, Applications Task 1 (p. 412)

- a. In the first investigation of Lesson 2, students learned the definition of a regular polygon: a polygon in which all sides are congruent and all angles are congruent. Use this information to get $\triangle AED \cong \triangle ABC$, then you can say that $\overline{AD} \cong \overline{CA}$ by corresponding parts of congruent triangles are congruent.

To be completed by the student.

- b. To be completed by the student.

Hint: Use a similar argument as in Part a to get $\triangle BCD \cong \triangle AED$.

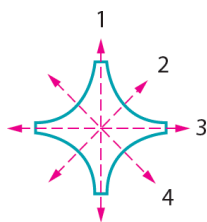
- c. To be completed by the student.
 d. Yes; reasoning to be completed by the student.

Lesson 2, Investigation 1, Applications Task 3 (p. 413)

- a. Listed here is the answer to Diatom C. Find the reflection and rotational symmetries for Diatoms A, B, and D. A sketch may be helpful.

Diatom C:

reflection symmetry (4 lines)
 rotational symmetry (90° , 180° , 270°)



- b. To be completed by the student.
 c. i. The snowflakes all have 6 symmetry lines and have rotational symmetry of (60° , 120° , 180° , 240° , 300°).
 ii. To be completed by the student.

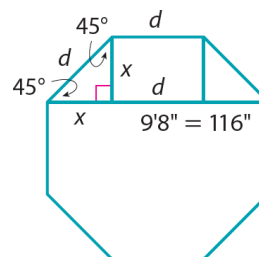
Lesson 2, Investigation 1, Connections Task 11 (p. 417)

Some students need a reminder that equations for vertical lines start with “ $x =$,” instead of “ $y =$.” Vertical lines have no horizontal change in “ x ,” so “ x ” always has the same value.

- a, c. To be completed by the student.
 b. Graph II: $x = -2$
 Graphs I, III, and IV: To be completed by the student.

Lesson 2, Investigation 2, Applications Task 6 (p. 414)

Each interior angle of the octagon measures 135° , so the smaller angles in the right triangle in the diagram are 45° . The width of the roof is $d + 2x = 116$ ". (This is the same as the perimeter of the right triangle.) Since $x^2 + x^2 = d^2$, $2x^2 = d^2$, and $\sqrt{2} x = d$. (You may wish to refer students to Connections Task 20 on page 392 to remind them of this relationship.) $\sqrt{2} x + 2x = 116$ ". The remainder of the solution is left for the student to complete.



Lesson 2, Investigation 2, Extensions Task 24 (p. 420)

- a. Students need to recall the definition of a central angle (glossary p. R2) of a polygon. Students are looking for a relationship between the central angle and the interior angle of a regular polygon. Draw a square and a regular hexagon. Note that the interior angle of a square is 90° and so is the central angle. For the hexagon, the interior angle is 120° and the central angle is 60° . Next try a pentagon and see if you see a relationship between them. You can see they are not always equal like the square, but what about the sum of them?

The explanation of why it is always the case is left for the student to do.

- b. To be completed by the student.

Lesson 2, Investigation 3, Connections Task 16 (p. 419)

Remind your student that they are looking for overall symmetry patterns, even though there are slight imperfections in the figures.

- a. To be completed by the student.

The student should have more than yes here for their answer. Their answer should also contain the fact that the pattern is the same size and that it repeats by sliding over the same distance and direction each time.

- b. *Hint:* Patterns C, F, and G can be grouped together.

Patterns E and G can be grouped together.

Patterns D, F, and G can be grouped together.

- c. To be completed by the student.

Lesson 2, Investigation 3, Review Task 32 (p. 423)

Working with the laws of exponents is something that students continue to review. Refer them back to their toolkit for examples and procedures. Remind them that exponents are repeated multiplication and have them expand them out if they are having difficulty.

$$\begin{aligned}
 \text{a. } (4x^3)^2 &= (4x^3)(4x^3) \\
 &= (4 \cdot x \cdot x \cdot x)(4 \cdot x \cdot x \cdot x) \\
 &= (4 \cdot x \cdot x \cdot x \cdot 4 \cdot x \cdot x \cdot x) \\
 &= (4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x) \\
 &= 16x^6
 \end{aligned}$$

The shorter way is to remember that if a power is on a product (answer to a multiplication problem) then the power goes on both factors. $(4x^3)^2 = 4^2x^3 \cdot 2 = 4^2x^6 = 16x^6$

- b. To be completed by the student.
- c. Refer to the student's toolkit, or Task 3 in Unit 5 (p. 332).

To be completed by the student.

- d. To be completed by the student.

e. $\frac{35}{9xy}$

Lesson 2, Investigation 3, Review Task 33 (p. 423)

- a. $-7x + 43$
- b. $25x - 14$
- c, d. To be completed by the student.

Lesson 3, Investigation 1, Applications Task 1 (p. 443)

Developing the ability to visualize is a skill that requires lots of opportunities to practice. Students used hands-on models in class and are asked to make sketches.

- a. The base of the tower is a square prism. It has a square base and rectangular sides. The next level is a square pyramid with the top cut off. Above that is another square prism. The top is another square pyramid.
- b. A regular tetrahedron would be formed by segments joining the 4 atoms.

Lesson 3, Investigation 1, Connections Task 11 (p. 446)

- a. A cube has 6 faces, 12 edges, and 8 vertices.
- b. *Hint:* Notice that every time a corner is removed, it creates a new triangular face, and three new vertices, but removes a vertex.
The new polyhedron has 7 faces, 15 edges, and 10 vertices.
- c. The table is partially completed the rest is left for the student. These results assume nonoverlapping slices, as indicated in the student text.

	Faces	Edges	Vertices
Cube	6	12	8
First Slice	7	15	10
Second Slice			
Third Slice			
Fourth Slice	10	24	16

- d. See the student text (pages 29–31) for the development of *NOW-NEXT* rules.
For faces, $NEXT = NOW + 1$.
For edges, $NEXT = NOW + 3$.
For vertices, $NEXT = NOW + 2$.
- e. Euler’s Formula should be in the math toolkit after Unit 6, Lesson 1, Investigation 1.
To be completed by the student.
- f. To be completed by the student.

Lesson 3, Investigation 1, Review Task 29 (p. 454)

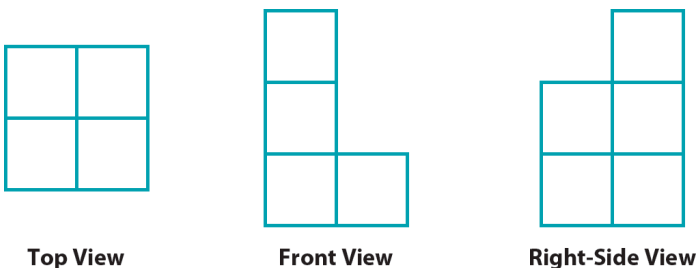
Hint: $m\angle ABD + m\angle DAB = 90^\circ$ since $\angle ABD$ and $\angle DAB$ are the two acute angles of a right triangle and the sum of the measures of angles of a triangle is 180° .

To be completed by the student.

Lesson 3, Investigation 2, Applications Task 4 (p. 444)

a. Seven cubes

b.



c. To be completed by the student.

Lesson 3, Investigation 2, Connections Task 12 (p. 447)

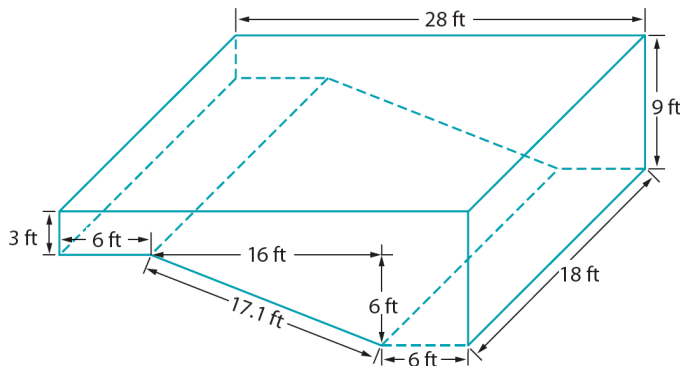
a, b, d, eii–iv. To be completed by the student.

c. The equilateral triangular base has sides of length 4 ft, so its height is $2\sqrt{3}$ ft. The area of the base is $\frac{1}{2}(4)(2\sqrt{3}) = 4\sqrt{3}$ ft². The volume of the prism is the area of the base times the height, which is $(4\sqrt{3})(4) = 16\sqrt{3} \approx 27.7$ ft³.

e. i. The volume of the square box is s^2h .

Lesson 3, Investigation 2, Extensions Task 23 (p. 452)

a. This is a hexagonal prism, the bases being the sides of the pool, and the height being the 18-foot width of the pool. Students should make a labeled sketch (like that which is started below). They will have to use the Pythagorean Theorem to find the length of the sloping edge.



- b. The base of the prism, or the front of the pool as shown here, is comprised of a 3×28 rectangle, a right triangle with legs 16 and 6, and a 6×6 square. The area of the base is 168 ft^2 .

Hint: Students might choose to do the volume computation by computing the volume of the pool totally filled and then subtracting the unfilled volume.

- c. In addition to the two side walls represented by the base, there are five more different rectangles to paint. When the total area is found, students should determine that they will need to purchase three 5-gallon cans of paint.
- d. 704 square feet
- e. 522 six-inch square tiles

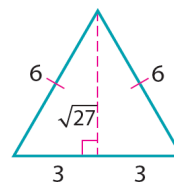
Lesson 3, Investigation 3, Connections Task 14 (p. 449)

- a. For each of the prisms shown, a right prism with the same base and height could be sketched next to the oblique prism. Then every plane parallel to the base that intersects the oblique prism will intersect the right prism also. The area of the cross sections formed by every plane and the two prisms would be equal. Thus, the prisms have the same volume. So, to find the volume for each oblique prism below, find the area of the base and multiply that by the height as we would for a right prism.

i. $V = 8 \times 5 \times 11 = 440$ cubic units

ii. $V = 5 \times \text{area of the triangular base} = 45\sqrt{3} \approx 78$ cubic units

iii. By the converse of the Pythagorean Theorem, the bases are right triangles. $V = \frac{1}{3} \times 6 \times 8 \times 15 = 360$ cubic units



- b. **Step 1.** The radius of the circular cross section of the sphere is $\sqrt{r^2 - d^2}$ since it is the length of the leg of the right triangle shown by the auxiliary lines that has one leg of length d and the hypotenuse of length r . Thus, the area of any cross section of the sphere can be represented by $A = \pi(r^2 - d^2)$.

The remainder of the solution is to be completed by the student.

Lesson 3, Investigation 3, Review Task 31 (p. 454)

Examples of solving these equations should be in the student's toolkit for Unit 3, *Linear Functions*.

- a, c, d. To be completed by the student.

b. $150 > 20 - 6x$

$$150 - 20 > 20 - 20 - 6x$$

$$130 > -6x$$

$$\frac{130}{-6} < \frac{-6x}{-6} \text{ (When you divide or multiply by a negative number, the inequality changes directions.)}$$

$$-21.67 < x$$