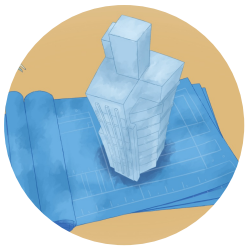

Composite Figures in Architecture

Perimeter and Area of Composite Figures

Amber Stokes, Brittany VanCleave
Published by *K20 Center*

Grade Level	7th Grade	**Time Frame**	2-3 class period(s)
Subject	Mathematics	**Duration**	120 minutes
Course	Middle School Mathematics		

Essential Question

How can you use formulas to find the perimeter and area of an object with an unusual shape? How do the dimensions of a figure affect the perimeter and area?

Summary

This lesson challenges students to determine the perimeter and area of composite figures. Students begin the lesson by using pattern blocks to create unusual shapes and exploring methods to calculate the area of these shapes. Students also explore the real-life application of perimeter and area by watching a video about the work of an architect. Students then step into the role of an architect and create floor plans of their dream homes using basic shapes. Finally, students share their floor plans with their classmates and calculate the area and perimeter of their peers' floor plans.

Snapshot

Engage

Students use a KWL Graphic Organizer to record their prior knowledge and questions about area and perimeter.

Explore

Students use pattern blocks to find the area and perimeter of one of three unusual shapes.

Explain

Students explain how they found the area and perimeter of each unusual shape, then learn and use the formula for determining the area of a trapezoid.

Extend

Students create house floor plans using rectangles, triangles, circles, and trapezoids, then calculate the perimeter and area of their floor plans.

Evaluate

Students find the perimeter and area of their classmates' floor plans and evaluate the calculations of their peers.

Standards

ACT College and Career Readiness Standards - Mathematics (6-12)

G403: Compute the area and perimeter of triangles and rectangles in simple problems
G505: Compute the perimeter of simple composite geometric figures with unknown side lengths

Oklahoma Academic Standards for Mathematics (Grade 7)

7.GM.2.1: Develop and use the formula to determine the area of a trapezoid to solve problems.
7.GM.2.2: Find the area and perimeter of composite figures to solve real-world and mathematical problems.

Attachments

- Design a House—Composite Figures in Architecture - Spanish.docx
- Design a House—Composite Figures in Architecture - Spanish.pdf
- Design a House—Composite Figures in Architecture.docx
- Design a House—Composite Figures in Architecture.pdf
- KWL Chart—Composite Figures in Architecture - Spanish.docx
- KWL Chart—Composite Figures in Architecture - Spanish.pdf
- KWL Chart—Composite Figures in Architecture.docx
- KWL Chart—Composite Figures in Architecture.pdf
- Lesson Slides—Composite Figures in Architecture.pptx
- Student Record Sheet—Composite Figures in Architecture - Spanish.docx
- Student Record Sheet—Composite Figures in Architecture - Spanish.pdf
- Student Record Sheet—Composite Figures in Architecture.docx
- Student Record Sheet—Composite Figures in Architecture.pdf

Materials

- Lesson Slides (attached)
- KWL Chart handout (attached; one per student)
- Student Record Sheet handout (attached; one per pair of students)
- Design a House handout (attached; print two-sided; one per student)
- Rulers
- Sticky notes
- Pattern blocks (optional)
- Colored pencils or similar art supplies (optional)
- Lego Architecture kit or other Lego kit (optional)
- iPad with drawing app (optional)

10 minutes

Engage

Use the attached **Lesson Slides** to guide the lesson. Display **slide 2** and introduce the title and topic of the lesson. Move through **slides 3–4** and share the essential questions and lesson objective with students.

Display **slide 5** and give each student a copy of the attached **KWL Chart** handout. Introduce students to the KWL Graphic Organizer strategy and have students fill in the K column with what they **know** and the W column with what they **want** to know. As students complete their charts, draw a copy of the KWL Chart on a large piece of paper or whiteboard. Invite students to share out information from their charts and record their prior knowledge and questions on the class chart.

Conclude the activity by inviting students to set aside their KWL Charts for later use in the Explain portion of the lesson.

20 minutes

Explore

Display **slide 6** and organize students into pairs. Give each pair one set of pattern blocks, one of the attached **Student Record Sheet** handouts, and a ruler. Tell students that they should use the blocks to create the figures displayed on their handouts: a butterfly, a lollipop, and a fish. After they create the figures, have them use the rulers to measure the figures then use those measurements to calculate the perimeter and area of each figure.

Draw students' attention to the "Area Formulas" portion of slide 6 to remind them of the formulas for calculating the area of a triangle, square, rectangle, and circle. Inform students that there may be a couple of shapes within each image that they don't have a formula for and encourage them to attempt to calculate the area of those shapes using what they already know.

Have students record the perimeter and area of each figure on their handouts as they work.

Teacher's Note: Pattern Blocks and Alternatives

Pattern blocks may make this activity more tactile and manipulable for students, but the calculations can be completed without the blocks as well. You may choose to have students measure the shapes within each image on their handout, or you may choose to cut out the shapes of each image if you do not have pattern blocks.

Teacher's Note: Student Approaches

Students may take incorrect approaches to finding the area of each figure at this point in the lesson. Encourage students to continue trying methods, even if they are wrong, to prompt further exploration. Encourage students to think critically and discover a method that works for them. More formal processes and explanations are presented later in the lesson.

20 minutes

Explain

Teacher's Note: Student Responses

The correct values of the perimeter and area of each shape on **slides 7–9** will vary depending on whether you had students measure the images on the handout, pattern blocks, or cut-outs of the shapes on the handout. Prior to this portion of the lesson, calculate the area and perimeter of each shape using the same methods your students should use to obtain the correct values.

Display **slide 7** and draw students' attention to the butterfly shape on the slide. Invite students to share out the method they used to find the perimeter and area of each picture. Solicit a few answers from different members of the class and invite students to compare their methods. Repeat this process for the lollipop and fish shapes on **slides 8–9**.

Transition to **slide 10** and draw students' attention to the area formula for a trapezoid. Choose numbers to represent *a*, *b*, and *h* on the diagram then demonstrate how to determine the area of a trapezoid using the provided formula. Encourage students to assist you in solving for the area of the shape using the formula. Remind students that they previously determined their own method for calculating the area of a trapezoid, but this method should be faster.

Display **slide 11** and have students retrieve their KWL Chart handouts. Have students complete the L column with what they **learned** about perimeter and area. Invite volunteers to share out what they wrote in the column and record student responses on the class KWL Chart you completed during the Engage phase of the lesson.

Ask students if they can think of a real-life scenario in which they could use their knowledge of area and perimeter. Invite students to share out their ideas. Transition into the next activity by encouraging students to consider how perimeter and area are used in architecture. Encourage them to think of ways they could use perimeter and area to design a dream home.

20 minutes

Extend

Teacher's Note: Educational Requirements in Video

The video presented in this section is from Australia, where the educational requirements to become an architect may be different from your location. Consider addressing this difference with students and providing information about the requirements to become an architect in your area.

Display **slide 12** and show students the video *I Wanna Be an Architect—A Day In The Life of An Architect*.

Embedded video
https://www.youtube.com/watch?v=asdgRAjGK-M

Show **slide 13**. Give each student one copy of the attached **Design a House** handout and one sticky note. Set the scene for the activity by telling students they are now the architect tasked with designing a floor plan for their dream house. They must create a floor plan that includes shapes like rectangles, squares, triangles, trapezoids, and circles.

Optional Activity Variation

Instead of having students draw original floor plans, consider having students construct buildings using Legos or a Lego kit, such as a Lego Architecture set. Have students construct their buildings then have them trace around the base of the buildings on a piece of paper to find the area. If students are using general Legos instead of a kit, encourage them to incorporate a variety of shapes into their design, rather than only rectangles and squares.

Optional Tech Integration

Instead of having students draw original floor plans, consider having students use an iPad with a drawing program, such as Procreate, to design a floor plan. Encourage students to include additional details, like color and decoration. After students complete their plans, consider printing them out and having students measure the paper plans, or have them measure their plans directly on the iPad screen.

Allow students time to create their floor plans on the handout. After they finish creating their designs, have each student find the perimeter and area of their entire floor plan and record the two values on the sticky note.

Teacher's Note: Floor Plans

Consider showing students examples of floor plans, as some students may be unfamiliar with floor plans. An example is included on slide 13, but you may choose to provide additional examples. Encourage students to be creative with their designs, and stress that there are many ways they can create floor plans.

15 minutes

Evaluate

Move to **slide 14** and organize students into groups of three. Introduce the Pass the Problem strategy for solving problems and tell students that they must calculate the dimensions of their group members' floor plans.

During the first round, have students pass their floor plans to the group member to their right and find the perimeter of the design they received. Have students record their name in the box on the left, show their work in the box in the center, and record the value of the perimeter in the box on the right.

Allow students time to work then initiate a second round. Have students pass their floor plans to the right once more and find the area of the new design they received. Ask them to record their name in the box on the left of the second row, then solve for the area of the design, once again showing their work and recording the value of the area of the design.

Initiate a third round by asking students to pass to the right once more. Ensure that each student has received their original design. Have students check the answers of their group members against the perimeter and area values of they recorded on their sticky notes.

Resources

Floor plan of first floor home [Photograph]. (1873). Library of Congress. https://www.loc.gov/item/2006682529/

K20 Center. (n.d.). KWHL graphic organizer. Strategies. https://learn.k20center.ou.edu/strategy/127

K20 Center. (n.d.). Pass the problem. Strategies. https://learn.k20center.ou.edu/strategy/151

Student Edge. (2014, May 13). *I wanna be an architect - A day in the life of an architect* [Video]. YouTube. https://www.youtube.com/watch?v=asdgRAjGK-M