I2T2 Project
By Kelly Boaz

Project: Unit Perimeters and Areas

Grade: 10 - Geometry

Prerequisites: Much of the content of this chapter may have been studied by students in previous years. Most students coming into geometry from UCSMP Algebra, are familiar with formulas for the area and perimeter of a rectangle and with the Pythagorean Theorem. My students will just have finished covering the properties and the hierarchy of quadrilaterals which is necessary to proceed in this chapter. In this unit they will experience the logical development of these ideas. The main objective of this chapter is to help students understand how the different formulas are related and how they follow from each other and from relationships among figures.

Materials: USCMP Geometry book, Teacher’s Aid, Geoboards, rubber bands, Lesson Masters, Worksheets from previous chapter (explaining constructions), GeoSketchpad, Computer lab, scissors, and tape

• Standards:
  • 3A – Use addition, subtraction, multiplication, division, and exponentiation with real numbers and algebraic expressions.
  • 3C - Recognize and identify symmetry and transformations on figures.
  • 5A - Apply formulas to find measures such as length, area, volume, weight, time, and angle in real-world contexts.
  • 5I – Use geometric relationships in relevant measurement problems involving geometric concepts.

Pacing: All lessons in this chapter are designed to be covered in one day according to the UCSMP book. However, the use of technology will hinder that. I am allowing for 2 days for almost each section, allotting time for technology and some activities that involve manipulatives. I firmly believe the time will be well spent as this will be covered on their geometry exam and performance indicator 5 which is measurement is 15-20% of their Mathematics A examination. I am going to start with section 8-1 and end with 8-5. The chapter covers through section 8-8. At the end of 8-5 I will assess the students by giving a chapter test, allowing two days for review. The following week I will finish section 8-6 thru 8-8, reviewing briefly with a short test to follow. I would section the Chapter off because I feel there is too much material for the students to be responsible for in one test. Therefore I would test 8-1 thru 8-5 separately (perimeter and area of polygons) and 8-6 thru 8-8 (Pythagorean Theorem and area and circumference of circles). For their portfolios which is 1/3 of their grade, they will complete a project that will involve building a fence from toothpicks to partially or fully
(each student’s will be different) enclose a small garden they will plant in small rectanglular and square containers.

Resources:
- UCSMP Geometry 2nd Edition; Scott Foresman & Addison Wesley; 1997; Chapter 8 (8.1 – 8.5)
- Geometer’s Sketchpad Software
- MED307 notes and worksheets for GeoSketchpad constructions; I2T2 notes and worksheets for GeoSketchpad constructions; Eileen Schoaff
Objectives: Students will be able to calculate perimeters of polygons using technology.

Opening Activity: Students will come in and start on the warm-up on the board.

Would you measure the area or the perimeter to find the answer?

1. How many exhibits is a museum able to hold? (area)
2. How many signs could be placed around the inside or outside of the museum? (perimeter)
3. How much would a sidewalk surrounding the museum cost? (perimeter and area)
4. How many people are in a line that stretches around the museum? (perimeter)

Developmental Activity: After discussing the warm-up with the class the students should have a good idea of what the perimeter is. Ask students to define perimeter in their own words. Then give the students the book definition on a transparency.

Definition
The perimeter of a polygon is the sum of the lengths of its sides.

I will now introduce the use of Geometer’s Sketchpad to continue with this section.

Student’s will get into pairs to construct a quadrilateral. They will use their worksheets from the previous chapter when they used Geometer’s Sketchpad to explore sufficient and necessary conditions for each of the quadrilaterals that was studied. Once each pairs quadrilateral is constructed, each pair will go on to find the perimeter of their quadrilateral while I observe. Most students will be able to do this without further instruction. For those who can not I will continue to provide hints as how to do this by showing them a transparency of the one I completed previously. Student’s will provide a print out of their quadrilateral with the perimeter calculated to turn in at the end of class.
AB = 2.68 inches
BC = 2.21 inches
CD = 2.24 inches
DA = 1.69 inches
AB + BC + CD + DA = 8.82 inches

Closing Activity: Students will receive Lesson Master 8-1 B. As a class we will complete questions 1, 6,11, and 18. Students will now get into their pairs to work on questions 2,3,7,9,12,13,21, and 23. Each pair will receive a transparency the following day to present their question.

Homework: Students will be required to finish Lesson Master 8-1 B.

8 - 1 Perimeter Formulas cont.

Students will come in and be asked to complete the following questions before presenting their question.

1. A rectangular park is 500 ft long and 220 ft wide. What is the perimeter of the park? (1440 ft)
2. A flower garden is shaped like a kite and requires 50 feet of edging to surround it. If one side is 4 times as long as the other, what are the dimensions? (5 ft and 20 ft)
After the questions are discussed and answered the students in their pairs will be asked to present. For this presentation 2’s will be asked to present their question.

After the presentations students will be called on randomly to give the answers from the previous day’s homework.

As a closing for this section students will be asked to get out of their seats (explaining that each floor tile is 1ft by 1ft) they will be asked to find the perimeter of the classroom.


8 - 2 Fundamental Properties of Area

Objectives: Students will be able to calculate areas of squares and rectangles given relevant lengths of sides.

Opening Activity: Only two noncongruent rectangles with dimensions that are whole numbers have the same number of units in their perimeter as the number of square units in their area. Can you find these dimensions? (4 units by 4 units and 6 units by 3 units)

Developmental: Students will be asked to get out of their seats and asked to find the area of the classroom by counting the tiles or by counting the tiles lengthwise and the width and multiplying.

After discussing. We will go over example 1 page 443 (floor plan of a ranch house on a coordinate system, students have to find dimensions of rooms and the area of the house.)

Students will be given graph paper, they will get into pairs and each person will construct a basic floor plan of their house, approximating the dimensions and finding the area of each room and then the whole house (one floor). Each partner will share their floor plan.

Each pair will select a floor plan to give to me. I will then copy them onto transperancies to share with the class for the next day.

Homework: Page 445 – 446 questions 2,4,7,9-15

8 – 2 cont.
Homework will be checked from a transparency. Questions will be answered using the tally system. (students put tally marks when arriving to class for each problem question – the questions with the most tally marks get answered in a 5 to 10 minute period)

Students will come up when called to present and explain their floor plan.

Closing Activity: Students will answer the following questions individually from teaching aid 106 page 434C (teacher’s edition). Students will be asked to wrap-up 5-10 minutes before class ends. I will ask several students what they answered for question 1 and do the same for question 2, then discuss.

Homework: page446 questions 16 - 22

8 – 3 Areas of Irregular Regions

Objective: Students will be able to describe or apply a method for determining the area of an irregularly shaped region.

Opening Activity: Teaching Aid 104 (map of the U.S.) page 434C (teacher’s edition) will be used and handed to each student to answer the following questions on the board.

A map of the United States is shown on Teaching Aid 104.
1. Refer to a map of the United States. Which states seem to be most nearly rectangular? (Colorado and Wyoming)
2. Why do most states have boundaries that are not straight lines? (Often the boundaries are rivers or other bodies of water.)

Developmental: Go over activity on page 449 – estimating the area of the lake.

Students will receive Lesson Master 8 – 3 A. As a class we will complete (as I use a transparency of LM 8-3A) 1,4a, 5a, and 5b.

Students will be asked to get into pairs and complete the rest – 2, 3, 4b,4c,5c,5d.

Randomly calling on a few students to answer each question, I will assess their readiness to proceed.

Closing Activity: Students will remain in pairs to complete teaching aid 107 Page 434D (teacher’s edition). I will have it on a transparency and ask for a volunteer to present to the class.
Homework: Lesson Master 8 – 3B questions 4-13

8 – 4 Areas of Triangles and 8 – 5 Areas of Trapezoids

Objectives: Students will be able to relate various formulas for area.

This activity is a lead-in to Lessons 8-4 and 8-5.

Students will come into class and be grouped into groups of four by counting off when they come in the door. They should immediately get at their assigned table that will be numbered and ready with their materials (for each student): worksheets – rectangle, 2 parallelograms, triangle, trapezoid, kite, and activity 18 from page 434C (teacher’s edition); scissors; and tape.

Students will follow the directions with some guided practice to derive the area formulas for a rectangle, triangle, parallelogram, trapezoid, and kite. The whole lesson is based on discovery learning which will help them remember the various formulas for area that they are required to know.

The entire activity will extend into the next day. Five to ten minutes before the end of the class, the students will be asked to wrap-up, clean-up their work areas, and put their finished and un-finished materials into each groups vanilla folder to be completed the following class day.

Homework: no homework scheduled

8 – 4 cont.

Students will come in and immediately finish with activity 18. The students that finish early will help the others that haven’t.

After finishing the activity we will have a brief discussion, asking each group to contribute some of their findings.

Opening Activity (for 8 –4): Students will be given geoboards and rubberbands and asked – How many right triangles can you form by connecting different sets of three points on a 3 –by-3 geoboard? (44 right triangles)

Developmental: Students will recall and write down the formula for a right triangle.
Students will then work on the computers individually to construct a rectangle. (they will be asked to refer to their worksheets from the previous chapter if they do not recall how to). After the construction, they will be asked to split the rectangle into two triangles (just as they did in activity 18). Using the calculator, find the area of each triangle and verify that the sum of the areas of both triangles equals the area of the rectangle. A transparency of the one I completed will be displayed on the overhead.

\[
\begin{align*}
 m\angle FED &= 90^\circ \\
 m\angle DCF &= 90^\circ \\
 m\angle CFE &= 90^\circ \\
 CD &= 2.64 \text{ inches} \\
 DE &= 1.89 \text{ inches} \\
 FE &= 2.64 \text{ inches} \\
 FC &= 1.89 \text{ inches}
\end{align*}
\]

\[
\begin{align*}
 CD \cdot DE &= 5.00 \text{ inches}^2 \\
 \left(\frac{1}{2}\right) \cdot CD \cdot DE &= 2.50 \text{ inches}^2 \\
 \left(\frac{1}{2}\right) \cdot FE \cdot FC &= 2.50 \text{ inches}^2
\end{align*}
\]

After completing and printing their creations, Each student will be asked to construct a scalene triangle by selecting three random points and constructing a segment. They will then have to find the altitude of the triangle by splitting the triangle into two right triangles. They will be asked to refer to the book page 454 to follow along with the proof and prove the formula works for their triangle. A transparency of the one I completed will also be displayed on the overhead.
AB = 4.08 inches
DB = 0.97 inches
AD = 3.11 inches
CD = 2.17 inches

\[ \frac{1}{2} \cdot AD \cdot CD = 3.37 \text{ inches}^2 \]

\[ \frac{1}{2} \cdot DB \cdot CD = 1.06 \text{ inches}^2 \]

\[ \left( \frac{1}{2} \right) \cdot AD \cdot CD + \left( \frac{1}{2} \right) \cdot DB \cdot CD = 4.43 \text{ inches}^2 \]

\[ \left( \frac{1}{2} \right) \cdot CD \cdot AB = 4.43 \text{ inches}^2 \]

Closing Activity: Students can start on homework if time allows.

Homework: page 456 – 457 questions 4-6,8,11,13, 15-18

8 – 5 Areas of Trapezoids

Objectives: Students will be able to calculate areas of trapezoids and parallelograms given relevant lengths of sides.

Students will relate various formulas for area.

Students will apply formulas for areas of trapezoids and parallelograms to real-world situations.

Opening Activity: A builder has an unusual plot of land shaped as shown below. The builder wants to split the plot into four congruent lots. How could this be done?
Developmental: Have students recall and write down the area formula for a trapezoid.

\[ A = \frac{1}{2}h(b_1 + b_2) \]

Have students get into pairs and go to the computers with their books and also their worksheets explaining the constructions if need be. They should open their books to page 460 and look at the proof. They will construct a rectangle (outlined in blue) and then the trapezoid. Labeling as it is in the book. They should then find the appropriate lengths to compute the area of the two triangles sectioned off from the trapezoid. Following the proof in the book, they will verify that it works for their particular trapezoid. A transparency will be displayed on the overhead for the students to refer to.
\[ \begin{align*}
\angle FCD &= 90^\circ \\
\angle DEG &= 90^\circ \\
FG &= 4.75 \text{ inches} \\
HD &= 1.81 \text{ inches} \\
DE &= 1.90 \text{ inches} \\
CF &= 1.90 \text{ inches} \\
\frac{1}{2} CF \cdot HD &= 1.72 \text{ inches}^2 \\
\frac{1}{2} DE \cdot FG &= 4.51 \text{ inches}^2 \\
\frac{1}{2} DE \cdot (HD + FG) &= 6.23 \text{ inches}^2
\end{align*} \]

Closing Activity: Students will work on addition examples from page 462 – teaching aid 110. When students finish, they will be randomly called to the board to present their answers.

Homework: Page 462 questions 5-17

**Review 8 – 1 thru 8 – 5**

Students will be given test form A and asked to work on pairs in class to complete finishing remaining questions for homework (I will omit 8-6 thru 8-8) and test that separately. Each pair will be assigned a problem to be completed on the board the next day (having the student’s compare and check answers). I will alternate between the 1’s and 2’s to present their problem. The following day they will have their test. Again only testing 8-1 thru 8-5, using form B.