Polygon of the Day
Discovering Area Formulas

Utilizing Technology and Manipulatives
• Cuisenaire pop-cubes
• Geometry tiles
• GSP triangles tool
• Trapezoid magnets

Sixth Grade
6-day Unit Plan
(40 minute classes)
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Unit Overview

Day 1:

Objectives:
- Students will be able to determine the relationship between perimeter and area.
- Students will be able to calculate perimeters and areas of various figures.
- Students will be able to describe measurements in terms of units and square units.

Standards:
- NCTM- Geometry and Representation.

Materials:
- Graph paper
- Scissors
- Pencils
- Notebooks
- Overhead projector and markers

Day 2:

Objectives:
- Students will be able to identify strategies for calculating perimeter and area of rectangles.
- Students will be able to explain how area can change while perimeter remains constant.
- Students will be able to work cooperatively in pairs to discover and record all possible rectangles with a given perimeter.

Standards:

Materials:
- Cuisenaire pop-cubes
- Graph paper
- Activity handout
- Pencils
• Chart paper
• Overhead projector and markers
• Graph paper transparency

**Day 3:**

Objectives:
- Students will be able to derive the area formula for triangles.
- Students will be able to observe that the area of a triangle remains constant when the base and height are not changed.

Standards:
- NCTM- Geometry, Problem Solving, Reasoning & Proof, and Representation.

Materials:
- Geometry tiles
- Notebooks
- Overhead projector and markers
- Computer
- Computer projector and screen

**Day 4:**

Objectives:
- Students will be able to define the formulas for perimeter and area of a parallelogram.
- Students will be able to calculate the perimeter and area of parallelograms.

Standards:
- NCTM- Geometry and Representation.

Materials:
- Overhead projector and markers
- Notebooks
- Pencils

**Day 5:**

Objectives:
- Students will be able to derive the area formula for trapezoids using prior knowledge of the area formula for parallelograms.
• Students will be able to calculate the area of trapezoids given the formula and dimensions.

Standards:
• NCTM- Geometry, Measurement, Problem Solving, Reasoning & Proof, Representation, and Communication.

Materials:
• Overhead projector and markers
• Pencils
• Notebooks
• Graph paper
• Scissors
• Trapezoid magnets
• Markers

**Day 6:**

Objectives:
• Students will be able to estimate the area of irregular shapes.
• Students will be able to determine the area of an irregular polygon by adding the areas of the shapes it is composed of.
• Students will be able to determine the area of a shape inside a regular polygon.

Standards:
• NCTM- Geometry & Problem Solving

Materials:
• Scissors
• Pencils
• *Polygon Activity Sheet*
• Calculators
• Rulers

**Day 1: The Relationship Between Perimeter and Area of Rectangles**

Objectives:
• Students will be able to determine the relationship between perimeter and area.
• Students will be able to calculate perimeters and areas of various figures.
• Students will be able to describe measurements in terms of units and square units.

Opening:
• Teacher will write the definitions of perimeter and area on the overhead for the students to copy as reinforcement.
• Teacher will define the formula for perimeter and area of a rectangle noting the type of units used to measure each.

Main:
• Teacher will ask students to draw a rectangle on one centimeter graph paper that is 4 by 6 boxes.
• Teacher will ask students to calculate the perimeter and area of the rectangle.
• Teacher will ask students to cut out rectangle and cut it in half vertically.
• Teacher will ask students to calculate the perimeters of each piece and then add the perimeters together.
• Teacher will ask the following question:
  - Is the sum of the perimeter of the two pieces the same as the perimeter of the larger rectangle?
• Teacher will ask the students to find the areas of each piece and add the areas together.
• Teacher will ask the following questions:
  - Is the sum of the area of the two pieces the same as the area of the larger rectangle?
• Teacher will ask the students to rearrange the two pieces to form a new rectangle.
• Teacher will ask the following question:
  - How do the perimeter and area of the new rectangle compare with the original one?

Closing:
• Teacher will put the following problem on the overhead for the students to work on independently.

  The maintenance supervisor of the Cleveland Cavaliers is planning to refinish the basketball court. The width of the court is 50 feet and the length is 84 feet.
  - What is the perimeter of the court?
  - What is the area of the court?

Homework: From textbook Page 235 #1-5, 9, 10
Day 2: Area of Rectangles (Sandbox Activity)

Objectives:
- Students will be able to identify strategies for calculating perimeter and area of rectangles.
- Students will be able to explain how area can change while perimeter remains constant.
- Students will be able to work cooperatively in pairs to discover and record all possible rectangles with a given perimeter.
Opening:
• Teacher will hand out activity sheets Activity handout
• Teacher will read directions to class.
• Teacher will ask a student to model one possible rectangular sandbox on the overhead for the rest of the class.
• Teacher will draw a model of this sandbox on the overhead graph paper transparency, letting one square on the graph paper be one block from the pop-cubes.
• Teacher will model recording and calculating the length, width, perimeter and area of this rectangle on the drawing of the model on the overhead.

Main:
• Teacher will hand out Cuisenaire rods.
• Teacher will ask students to work with a partner to complete activity (find as many other possible rectangular sandboxes).
• Teacher will ask students to draw their possible rectangular sandboxes on graph paper and record and calculate the length, width, perimeter, and area the same way it was done in the example.

Closing:
• Teacher will record different possible rectangular sandbox dimensions, perimeters, and areas on class chart.
• Teacher and students will address discussion questions from activity sheet as a class.
• Students will record discussion responses on activity sheet.

Homework: Extend Your Thinking Worksheet 5-5 from textbook

Day 3: Area of Triangles

Objectives:
• Students will be able to calculate the area of triangles.
• Students will be able to derive the area formula for triangles.

Opening:
• Teacher will hand out select geometry tiles to each student (pairs of triangles that when put together form rectangles and squares).
• Teacher will ask students to form as many rectangles and squares as possible from the triangles they have.
• Teacher will model one example with overhead geometry tiles.

Main:
• Teacher will call a student to the overhead to show a rectangle/square they formed.
• Teacher will place one of the triangles directly over the other one and ask the following question:
  - What do you notice about the two triangles in relation to the rectangle/square?
• Since the triangle is one half of the rectangle/square we can use the formula for area of a rectangle to derive the formula for area of a triangle. \( A = \frac{1}{2}bh \)

Closing:
• Teacher will log on to the following website: http://illuminations.nctm.org/ActivityDetail.aspx?ID=106
• Teacher will ask the following questions for warm-up:
  1. What is side AC? BD?
  2. How does the area change when we move point B along the blue line?
  3. The blue line is ______________ to side AC?
• Teacher will follow instructions on screen for the two activities to show that the area does not change when the base and height remain constant.

Homework: From textbook Page 251 #1-9, 10-16 even

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**Day 4: Area of Parallelograms**

**Objectives:**
• Students will be able to define the formulas for perimeter and area of a parallelogram.
• Students will be able to calculate the perimeter and area of parallelograms.

**Opening:**
• Students will copy notes from the chalkboard.

**Properties of Parallelograms**
- Opposite sides of a parallelogram are congruent.
- Opposite sides of a parallelogram are parallel.
- Opposite angles of a parallelogram are congruent.
- The base and height of a parallelogram are perpendicular.

Main:
- Teacher will review Properties of Parallelograms from the board, paying attention to review vocabulary words.
- Teacher will give students the formula for area of a parallelogram; \( A=bh \).
- Teacher will give students the following examples to work on independently.

Ex. 1 Find the perimeter and area of the parallelogram.

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5 \hspace{1cm} h=4

b=20
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Ex. 2 Find the perimeter and area of the parallelogram.

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13 \hspace{1cm} h=12

b=25
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Closing (for review):
- Teacher will ask students to write the definition of perimeter and area.
- Teacher will ask students to write the formulas for the area of a:
  - Rectangle
  - Triangle
  - Parallelogram

Homework: *Extend Your Thinking Worksheet 5-9* from textbook
Day 5: Area of Trapezoids

Objectives:
- Students will be able to derive the area formula for trapezoids using prior knowledge of the area formula for parallelograms.
- Students will be able to calculate the area of trapezoids given the formula and dimensions.

Opening:
- Students will be instructed to copy notes from chalkboard into their source books which will include:
  - Definition of Trapezoid
  - Diagram of a trapezoid with bases and height labeled
• Students will be given graph paper on which they will be instructed to draw a trapezoid with \( h=8 \) in black, \( b_1=10 \) in blue, \( b_2=18 \) in red and connecting the bases with legs in green.
• Teacher will model drawing trapezoid on overhead (with the same colors), noting to label the dimensions on the inside of the figure since it will be cut out later.
• Students will be asked to estimate the area of the trapezoid any way they know how (hopefully by counting the squares inside the figure).
• Students will be asked their estimation and record it inside the figure.

Main:
• Teacher will ask students to cut out their trapezoids.
• Teacher will ask students to cut trapezoid horizontally in the middle of the figure.
• Teacher will put trapezoid magnets on the chalkboard.
• Teacher will ask students the following question:
  - Since we cut the trapezoid horizontally down the middle what shape do we form if we flip the top over so the green sides line up?
• Teacher will show how the cut trapezoid forms a parallelogram when flipped.
• Teacher will ask students to model the flip with their trapezoids.

Closing:
• Teacher will ask the following questions for discussion:
  1. What is the area formula for a parallelogram?
  2. Does the area of the figure change when we flip the cut piece over?
  3. What is the new base (of the parallelogram)?
  4. What fraction is the new height (of the parallelogram) in relation to the height of the trapezoid?
  5. Can you figure out the area formula for a trapezoid?

Homework: From textbook Page 256 #1-8, 9-17 odd
Day 6: Area of Irregular Polygons

Objectives:
• Students will be able to estimate the area of irregular shapes.
• Students will be able to determine the area of an irregular polygon by adding the areas of the shapes it is composed of.
• Students will be able to determine the area of a shape inside a regular polygon.

Opening:
• Students will be given a Polygons Activity Sheet: Polygons Activity sheet
• Students will be asked to cut out the polygons from the handout.
• Students will be asked to find the area of each polygon and write it on each shape (with teacher guidance and reminders of area formulas).
Main:
- Students will discuss in groups how to find the area of their irregular polygons.
- Students will use the shapes to cover their irregular polygon as much as possible.
- Students will then add the areas of the shapes used to find an approximate area of their irregular polygon.
- Students will be asked to create a design using the polygons.
- Students will discuss how to find the area of this design.
- Students will again add the areas of the shapes used to find an exact area of their design.

Closing:
- As a class, students and teacher will discuss the process of determining area of irregular shapes through composition and decomposition of irregular shapes.

Homework:
- Students will be asked to find the area of a state they choose.
- Students will be given the following guidelines for their homework:
  - Research the exact area of the state.
  - Draw (or print) a replica of the state, the size of one sheet of paper.
  - Use the polygons from class to determine an approximate area of their state, tracing each shape into the outline of the state.
  - Write a paragraph explaining the steps taken to find an approximate area of the state.
  - Be creative, decorate, and color the state and have fun!

Resources Used:
- www.nctm.org (Illuminations)
- Textbook: Middle School Math Course 1 by Foresman-Wesley, 1999.