Lesson Plan: What a Square
Provided by the Art Institute of Chicago Department of Museum Education

Suggested Grade Level: 3–8
Estimated Time: One to two class periods

Introduction
Artists often use simple geometric forms to plan their compositions when beginning a new painting. After sketching in their subject in squares, rectangles, triangles, and circles, they then define their forms by creating more detailed contours and adding shading. If you look closely at Rembrandt’s Old Man with a Gold Chain you'll find that his figure is made up of three, simple geometric forms: a large triangle for the body, an oval or rectangle for the face, and another smaller triangle for the hat.

At the elementary level (grades 3–5), students practice measuring, estimating, and adding lengths. They build upon these basic math skills next, adding and subtracting decimals and dividing whole numbers. At the middle school level (grades 6–8), students convert the Rembrandt painting into simple geometric forms to calculate areas and ratios. Then, students use their geometric conversion of the painting to create a cubist portrait.

Lesson Objectives
- Practice making measurements and adding, subtracting, and dividing (younger students)
- Practice calculating averages and finding areas (older students)
- Use basic geometry as the foundation for an artistic assignment

Key Terms
- polygon
- centimeter
- width
- length
- rounding
- decimal
- difference
- median
- mode
• range
• average/mean
• rectangle
• right triangle
• area
• ratio
• gray scale
• shade
• contour
• Baroque
• Cubism

Instructional Materials
• Printouts of the Rembrandt’s *Old Man with a Gold Chain* for each student
• Rulers with centimeters
• Watercolors (or another medium in which multiple shades of one color can be produced by adding water or white)
• Tracing paper
• Photocopier

Procedures

Activity One (Elementary):
This activity allows students to practice taking measurements in the metric system; rounding to the nearest whole number; finding median, mode, and range; and adding and dividing simple decimals.

Step 1
• Pass out a printout of Rembrandt’s *Old Man with a Gold Chain* to each student. Discuss with students the main polygons that comprise the image. Ask:
  o What is the main shape of the body?
  o The main shape of the head?
  o The hat?
• Have students use the centimeter side of a ruler, and take five measurements across the width of the man’s body, four across the width of his face, and four across the width of his hat (all parallel with the bottom of the page). (Younger students should round their measurements to the nearest whole number; older students should work with exact widths.)
• Have students then measure the width of the entire image on the printout. Then ask them to estimate the difference, through subtraction, between the measured widths for the body parts and the width of the entire image.

• Ask students to check their estimated differences by measuring the space on either side of the man’s form. (Younger students should again use rounded measurements and older students exact measurements.)

• If estimates and exact measurements of the spaces outside the man’s form are different, have students calculate by how much by subtracting one number from the other.

Step 2
• Ask students to arrange the measured widths of the man’s body, head, and hat in increasing order to find the median, mode and range of lengths. Then have them find the average/mean width of the man’s form using the rounded numbers (from Step 1) or the exact widths.

• Have students find at least one place on the man’s form that matches the average from the exact widths.

Activity Two (Middle School):
This activity for older students allows them to practice recognizing and creating simple, regular polygons, finding areas, and calculating ratios.

Step 1
• Have students complete the exercise above for review.
• Ask them to calculate the total area of the image using the outer dimensions of the printout.
• Then have students convert the man’s body into simple geometric polygons (rectangles and right triangles only), making sure to incorporate as much as the man’s body as possible into a geometric shape.
• Students should then find the area of each of the polygons that make up the man’s body (length times width for rectangles or length times width divided by two for right triangles). Have them use the centimeter side of the ruler and round to the nearest half-centimeter.
• Have students add the areas of each polygon together to find the total area of the man’s body. Then have them figure the ratio of the area of the man’s body to the total area of the image.
• Ask students to convert the background into simple polygons in a similar manner, making sure that anything not already incorporated into the body is incorporated into a background shape. Students should then find the area of each of these polygons.
polygons, and add them together to find the total area of the background. Have students then:

- Figure the ratio of the background area to the total image area.
- Add the area of the body and the area of the background together to find the total area of the image.
- Compare the actual area of the entire image to the area found by dividing the image into geometric shapes. How accurate were your measurements?

**Step 2**

- Have students lay a piece of tracing paper over their image and trace the polygons. Teacher should then photocopy this traced image onto white paper so that students see a large square divided into smaller rectangles and right triangles.
- Encourage students to look at the original printout and divide the image into five different values on the gray-scale by placing a number between 1 and 5 inside the shape. The number one will correspond to black; 2 to dark gray; 3 to medium gray; 4 to light gray; and number 5 to lightest gray or white.
- Have students choose one color from a watercolor palette and create five shades of that color ranging from dark to light by adding increasing amounts of water to the pigment. Ask them to assign each shade to one of the values (i.e. dark blue = 1; lightest blue = 5)
- On the white photocopied sheet of paper, have students use the color shades to fill in the shapes that correspond to the numbered shapes on the photocopied image.
- Compare all the images in the classroom and discuss. Ask:
  - Which looks most like the original image? Which looks least like it?
  - Which is most colorful? Which has the most detail?

**Evaluation**

Converting the figure into geometric forms is the first step in creating a Cubist portrait, although Cubist artists like Pablo Picasso made their portraits more complex by overlapping their geometric forms and depicting their fragmented figures from many different view-points simultaneously. Have students follow the lesson plan Finding Polygons in Cubist Art to create Cubist portrait. Base students’ evaluation on their ability to measure accurately, round correctly, and complete more complex math functions.

**Illinois Learning Standards**

Math: 6, 8, 9