Geometric Art: Lesson Plan

Overview:
Students will learn about the rich history of Islamic Mathematics, and will gain an understanding of the relationship of Islamic mathematics to modern mathematics. This unit requires some basic knowledge of geometry, and so is geared towards high school students or middle-school students learning about perpendicular lines, circumscribed shapes, etc. Students will learn some of the methods used by Muslim mathematicians in geometric art. Using the history intertwined with the mathematics lesson, students will be more interested in the lesson and have a better understanding of geometric constructions.

Objectives:
Students will be able to:
1. Recount a brief history of Islamic mathematics and the expansion of Greek mathematics in the Arab world
2. Constructing perpendicular lines
3. Divide lines into equal segments
4. Construct circumscribed squares
5. *Optional*: Construct geometric proofs

Activity:
Opening / Hook:
1. Preparation: Ask students to research Islamic geometrical art to get an idea of the shapes and designs common in the designs.
2. Discuss the background of Islamic geometry (pp 1-2, 9 in "Islamic Mathematics" information packet).

Introduce New Material:
1. Pass out the "Geometric Art" worksheet.
2. Show the method for constructing perpendiculars without extending lines (pp 10-11, "Islamic Mathematics").
3. Show the method for dividing segments into equal parts (example: three equal parts, pp 11-12 "Islamic Mathematics").
4. Show the method for constructing a square inside a circle (pp 13-15, "Islamic Mathematics").

Guided Practice:
1. Have students construct perpendiculars once on their own (or in groups of 2-3 people), using the worksheet provided. *Optional*: for upper-level students learning proofs, prove (or ask them to prove) that the angle is a right angle; i.e. that the construction is correct.

2. Have students divide segments into equal parts once on their own (or in groups of 2-3 people), using the worksheet provided. *Optional*: for upper-level students learning proofs, prove (or ask them to prove) that the segments are equal; i.e. that the construction is correct.
3. Have students construct a square inside a circle once on their own (or in groups of 2-3 people), using the worksheet provided. *Optional*: for upper-level students learning proofs, prove (or ask them to prove) that the figure is a square; i.e. that the construction is correct.

Independent Practice:

1. Review the uses of these constructions in Islamic geometric designs (pp 16-22, "Islamic Mathematics"). You may wish to copy some of these pages for handouts for the students, or show them on transparencies on an overhead, so students can see the designs.

Closing / Assessment:

1. Have the students create their own geometric designs, using each of the taught constructions at least once in their work. This activity can either be assigned as homework or done in class. If done in class, markers, colored pencils, and construction paper or paper plates should be provided for this activity.

Teachers: Please contact Angela Williams, CSAMES Outreach Coordinator, at aswillms@illinois.edu for the answer key to the worksheet.