

ARTFUL CONNECTIONS WITH MATH GRADE 3

Multiplication Array Prints

2 Sessions – 90 minutes each

Essential Question: How are inverse relationships used in math and art?

Lesson Goal: Students explore positive and negative space and create a stamp. They repeatedly print the stamp as an array on top of a watercolor wash.

Lesson Objectives:

Students will be able to:

- create an array representing a fact family of multiplication and division number sentences.
- recognize positive and negative space as a visual art concept and apply it in their own artwork.
- design and create a stamp and create an artwork that uses a printmaking technique.

Common Core State Standards

Represent and solve problems involving multiplication and division.

1. Interpret products of whole numbers.
2. Interpret whole-number quotients of whole numbers,
3. Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities.
4. Determine the unknown whole number in a multiplication or division equation relating three whole numbers.

California State Visual Art Content Standards

ARTISTIC PERCEPTION 1.1: *Perceive and describe rhythm and movement in works of art and in the environment.*

CREATIVE EXPRESSION 2.6: *Create an original work of art emphasizing rhythm and movement, using a selected printing process.*

HISTORICAL & CULTURAL CONTEXT 3.1: *Compare and describe various works of art that have a similar theme and were created at different time periods.*

AESTHETIC VALUING 4.3: *Select an artist's work and, using appropriate vocabulary of art, explain its successful compositional and communicative qualities.*

Materials

- | | | |
|------------------------|----------------------|--------------------|
| • Watercolor paints | • Black printing ink | • Scrap paper |
| • Scissors | • Brushes | • Brayers |
| • Wonder Foam | • Tacky Glue | • Styrofoam plates |
| • Cardboard 2" squares | • Water cups | • Watercolor paper |

Preparation: Cut cardboard and Wonder foam into 2" squares for each student.



Key Vocabulary

Art: Horizontal; vertical; wash; rhythm (optional: complementary colors)

Math: Array; multiplication (multiply); row; column

PRE-SESSION MATH LESSON

Prior to Session 1 for this lesson, review the math concepts of multiplication and division.

- **Focus Question 1:** What does it mean to multiply? Explain.
- **Focus Question 2:** What does it mean to divide a number? Explain.

Students can do this in cooperative groups, Think-Pair-Share, or using A Kagan Strategy, such as Rally Robin or Rally Table. Students groups can present their findings on a poster.

Sample group poster:

What is multiplication?

Multiplication is a number of groups with the same number of items inside each group.

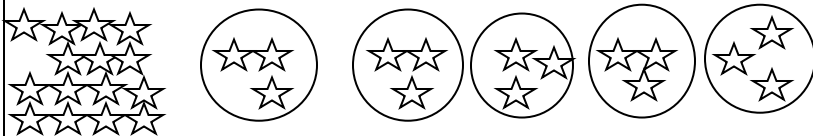


Three groups of six equals eighteen.

What is division?

Division is taking a large number and separating it into groups with each group containing the same amount of items.

15 stars divided into 5 equal groups.



There are three stars in each group.

Session 1 – Discuss Art, Create Wash & Geometric Stamp

ACCESS PRIOR KNOWLEDGE (5 min)

- What is the relationship between addition and subtraction? Multiplication and division?
- Tell students that we also have inverse relationships in visual art: positive/negative space. Ask students to recall the circles they cut out during the place value lesson and discuss positive and negative space that was created from the construction paper.

WARM UP ACTIVITY (15 min)

- Instruct students to fold a small piece of construction paper, leaving a small space at the top and bottom of the paper, cut out a shape along the folded edge. Pull apart to reveal a shape (positive space) and the area around the shape (negative space). Glue in journals.

ART OBSERVATION (15 min)

Show image of Allan McCollum

- What do you notice?
- What is repeated? Explain that repetition provides visual rhythm. Try to clap the rhythm that the repetition of this image creates.
- What kind of shapes do you see? How do the shapes differ?
- How are the repeated shapes arranged? (have students notice rotation)
- What part of this image pops out at you? Where is the background? (Review positive/negative space).
- How do you think this work was made?

Tell students about the work of Allan McCollum.

ART ACTIVITY (40 min)

1. Students cut the 2" WonderFoam square in half (either diagonally or horizontally).
2. Leave space at the top and bottom of the half and draw a shape. Cut out shape.
3. Glue both the positive and negative parts of the shape onto 2" square pieces of cardboard.
4. While waiting for stamps to dry, teach students how to create washes. Paint water on the paper first. Then add watercolor paint to the wet surface.
Note: Decide whether students will use sets of complementary colors or alternating warm/cool colors (depending on their experience with color theory). Practice in journal.
5. Use the two chosen watercolors to create alternating vertical or horizontal stripes about 2" wide on the watercolor paper.

CLOSURE (15 min)

- How did you decide what shape to make for your stamp?
- What did you learn about using watercolor?

Session 2 – Print Stamps, Reflect

ACCESS PRIOR KNOWLEDGE (5 min)

- What are some inverse relationships we know about in math? In art?

ART ACTIVITY (40 min)

1. Use a brayer to distribute black ink onto Styrofoam plates.
2. Instruct students to dip stamp in ink, making sure to press hard enough to cover the Wonderfoam, but not so hard that ink gets on the cardboard background. Once stamp is saturated in ink, it doesn't need to be dipped every time. Have students practice creating a small array in their journals.
3. When finished practicing, stamp onto watercolor wash.
Note: Teacher can give students a multiplication number sentence to demonstrate an array (e.g. everyone make 9×7) or can allow students to stamp on their own and have each student create a different multiplication number sentence (students whose stamps have a lot of negative space might be able to fit more stamps on the page and thus have a different array). Teachers can also give each student a different sized paper, so they will fit different amounts of arrays.
4. After students have created one row of their array, have them estimate how many stamps would fit on their whole page.
5. When finished, students write a fact family of multiplication and division number sentences that describe their array.

Extension: To emphasize division, students can draw an array (using the same design as their stamp) and then cut the drawing in groups and paste on a piece of colored construction paper.

CLOSURE (20 min)

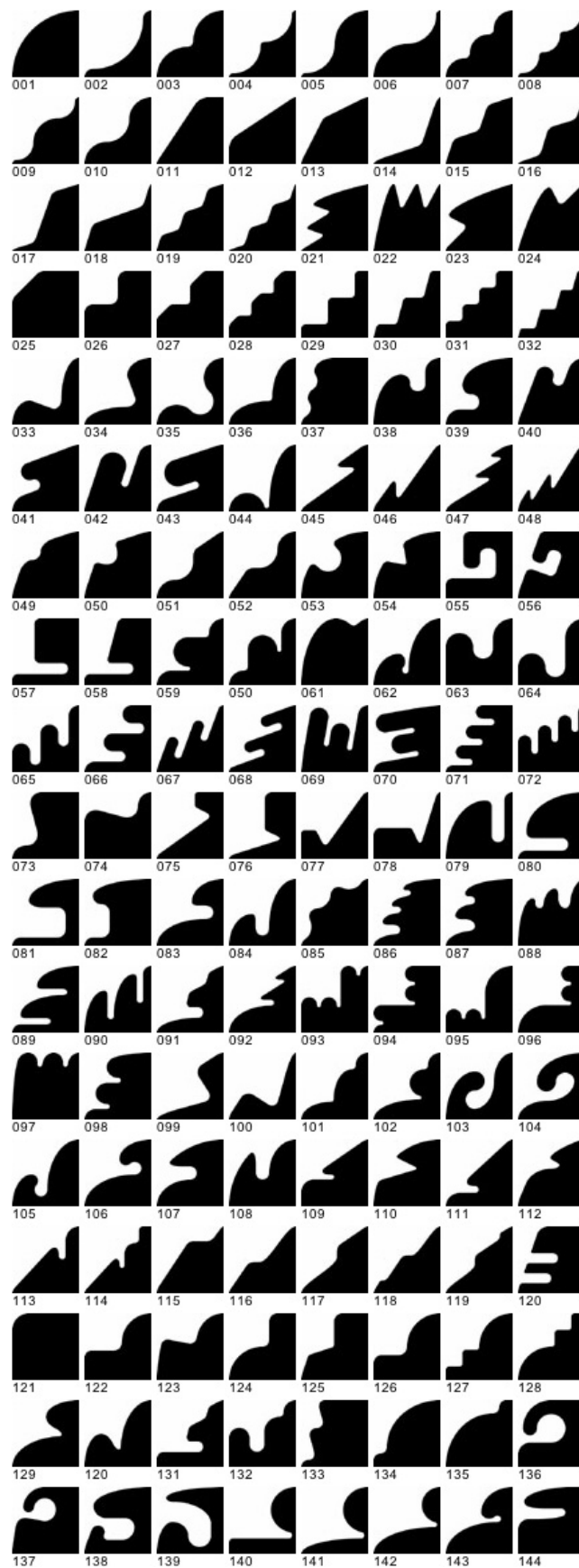
- Have students clap out the “rhythm” of their array to make a beat.
- What shapes and patterns are created in the negative space?
- What did you notice when you rotated your stamp?
- Have students estimate how many times the entire class stamped.
- Then have students figure out how they could find how many total stamps are in the class? (Students can start by adding the amounts at their table and then add all the tables together. Or students could compile all the arrays of the same value and multiply them together).
Note: If all students did not create the same array, they will have to add or subtract to compensate.

POST-SESSION DEBRIEF:

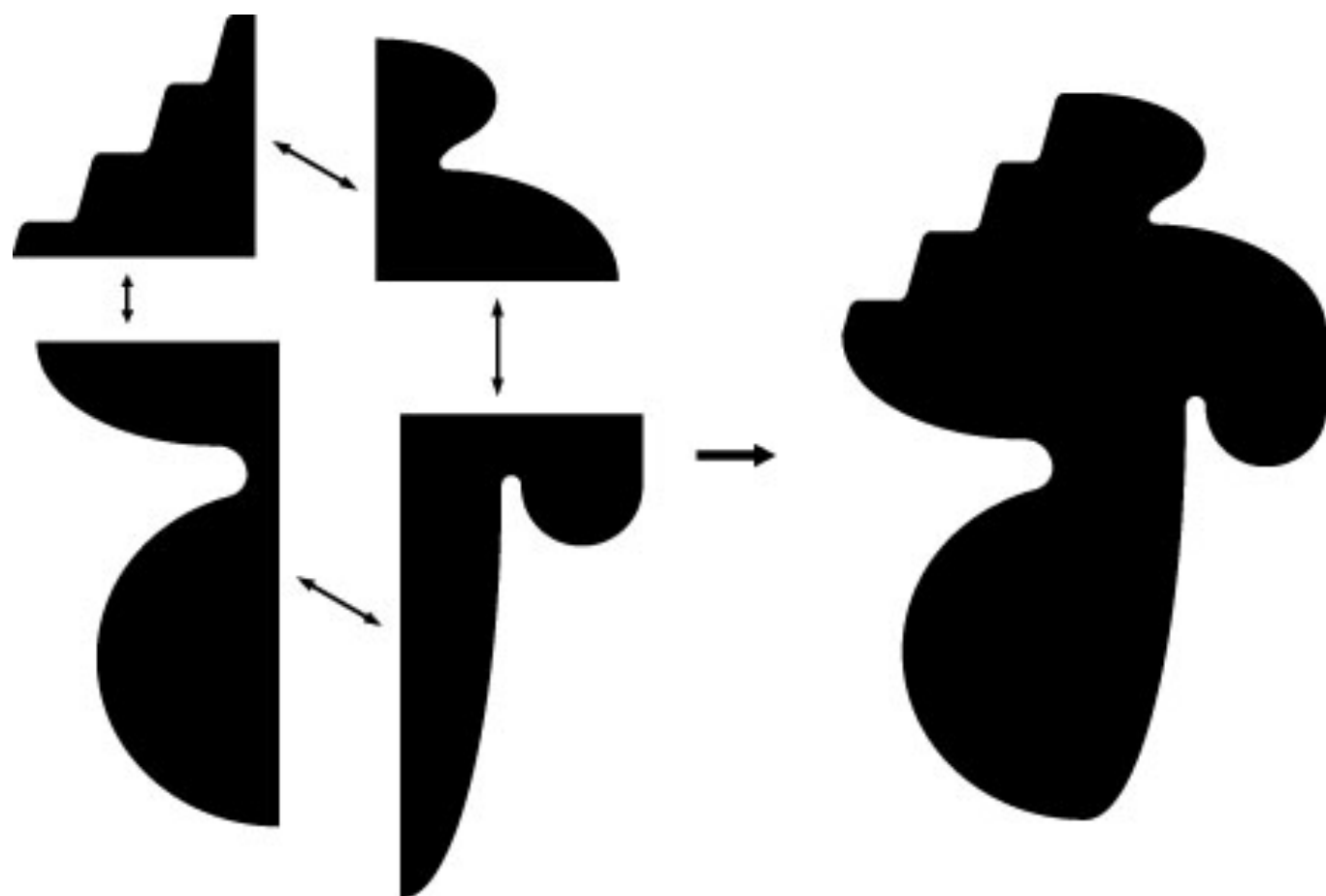
The day after this session, review what the students have learned about inverse operations while doing the printmaking.

- **Focus Question 3:** How are multiplication and division related? How can we use multiplication or division to check math work? Explain.

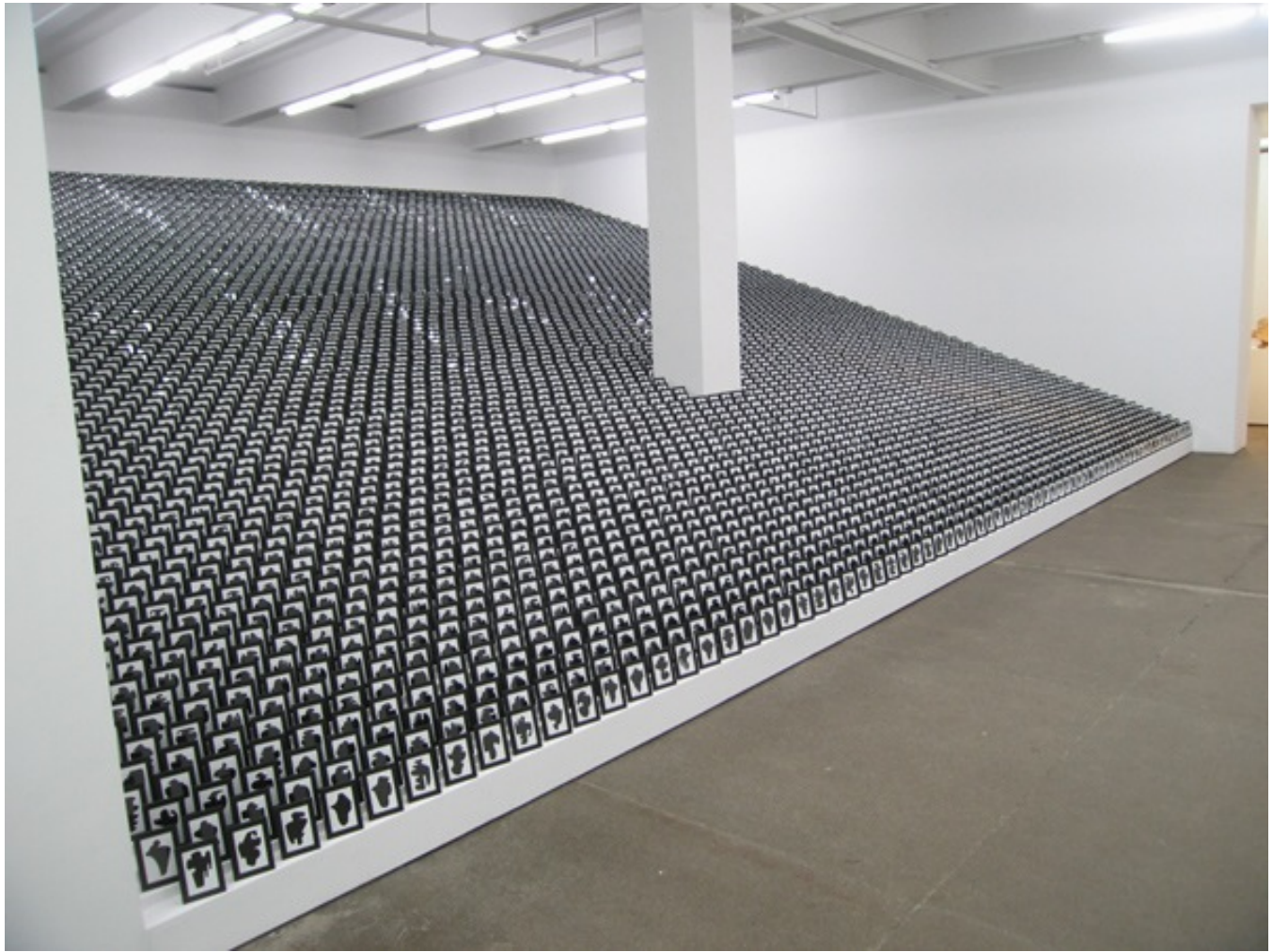
Answers can be brainstormed by the class as a whole and then recorded in art journals with pictures to help clarify students' understanding.







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Allan McCollum

Allan McCollum is a contemporary American artist who was born in Los Angeles, California in 1944, and now lives and works in New York City.

McCollum's family history, his experiences and training at working in industrial kitchens, and his interest in theater and Fluxus, including "task-oriented" performance art, offered him a unique take on labor and art, and the methods and systems of quantity-production showed themselves in his artwork from the very beginning. He is known for utilizing the methods of mass production in his work in many different ways, often creating thousands of objects that, while produced in large quantity, are each unique.

In 2005, McCollum designed *The Shapes Project*, a combinatorial system to produce "a completely unique shape for every person on the planet, without repeating."^[7] The system involves organizing a basic vocabulary of 300 "parts" which can be combined in over 30 billion different ways, created as "vector files" in a computer drawing program. McCollum has used the system in collaborations with a community library, schoolchildren, home craftworkers, writers, architects, and other artists, as the *Shapes* are created to be used for many different kinds of projects, and so far have been produced in the form of both prints and sculpture, in Plexiglas, Corian, plywood, hardwoods, metals, rubber, and fabric, in a variety of sizes. In 2010, he published "The Book of Shapes", in collaboration with mfc-michèle didier. This book makes the *Shapes Project* complete: The first volume contains the 300 shapes "parts," and the second one includes the guides and instructions for creating all possible combinations with these components. That same year, he organized the *Shapes for Hamilton* project, in which a unique signed and dated *Shapes* print was made for each of the 6,000+ residents of the town of Hamilton, New York.^[8]

Selection from http://en.wikipedia.org/wiki/Allan_McCollum

Malian *bogolanfini* cloth (courtesy *African Textiles*)

Bogolanfini is generally defined as the cloth made by Bamana women in the rural areas of Mali, according to a centuries-old, labor-intensive dyeing process that requires local materials and specific methods. It is fashioned into specific tribal garments.

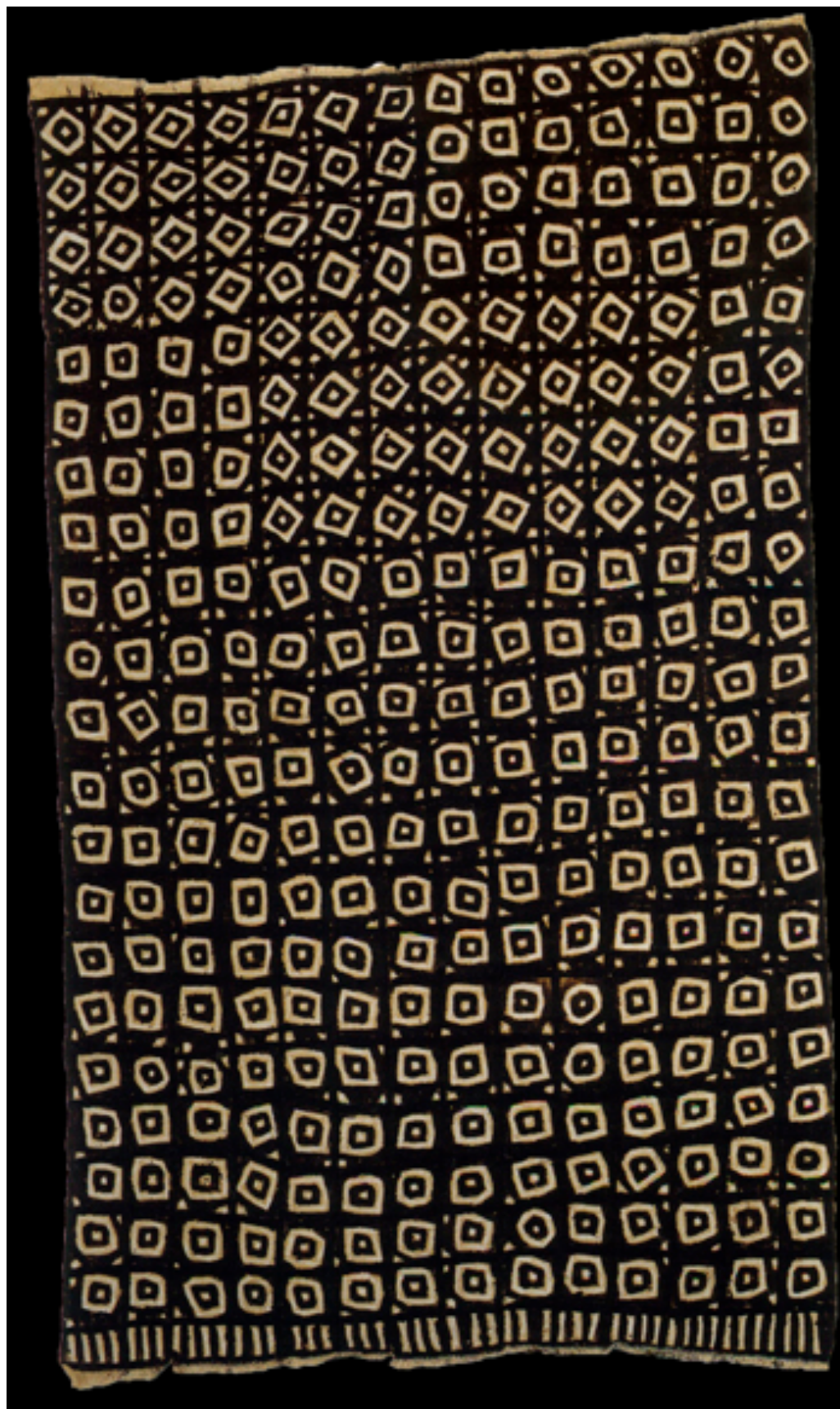
Narrow strips of plain fabric are woven (usually by men) and pieced together into a larger rectangular cloth; the cloth is then dyed in multiple baths of organic material (*n'gallama* leaves). The “negative” spaces around the desired patterns are painstakingly painted with mud, which reacts by turning those areas of the cloth black.

Selection from: www.venetianred.net

The cloth is soaked in a dye bath made from mashed and boiled, or soaked, leaves of the *n'gallama* tree. Now yellow, the cloth is sun-dried and then painted with designs using a piece of metal or wood. The paint, carefully and repeatedly applied to outline the intricate motifs, is a special mud, collected from riverbeds and fermented for up to a year in a clay jar. Thanks to a chemical reaction between the mud and the dyed cloth, the brown color remains after the mud is washed off. Finally, the yellow *n'gallama* dye is removed from the unpainted parts of the cloth by applying soap or bleach, rendering them white. After long use, the very dark brown color turns a variety of rich tones of brown, while the unpainted underside of the fabric retains a pale russet color.

Selection from: www.wikipedia.org

See: http://www.mnh.si.edu/africanvoices/mudcloth/index_flash.html for an interactive description of how the cloth is made.



Stamped Multiplication Arrays Rubric

	1 Does not meet Expectations	2 Approaching Expectations	3 Meets Expectations	4 Exceeds Expectations	Total Score
A. Artwork demonstrates an ability to create an alternating color watercolor wash.	Wash does not show two alternating colors.	Wash shows two alternating colors but paper is not fully painted.	Wash shows clear rows of two alternating colors.	Clear alternating rows of two complementary colors. Colors are saturated.	
B. Artwork demonstrates an understanding of arrays.	Rows or columns are not decipherable.	Two or more rows or columns do not have equal numbers of stamps.	All rows/columns have equal number of stamps. One row/column may be off.	Each row/column has an equal number of stamps and is lined up orderly.	
C. Artwork demonstrates students' ability to stamp.	Prints are sloppy and design cannot be identified.	Print uses excessive or not enough ink and design is difficult to identify.	Most of the design can be deciphered.	Design can be identified clearly and stamp has been rotated systematically.	

Total: _____