



Quilting with Fractions and Symmetry

GRADE: 3 and up **TIME: two sessions**

Developed by Linda Pfisterer



KIT INCLUDES:

- lesson plan
- book: Eight Hands Round
- transparencies (6)
- boards
 - vocabulary
 - quilt histories from book (2)
 - quilt process (2)
 - color wheel
 - equivalent fraction
 - lines of symmetry
 - quilt lesson examples
- magnetic borders:
 - 4 with no patterns
 - 6 with symmetrical pattern
- 3" x 9" straight edges (set)

MATERIALS:

- construction paper (in selected color scheme)
 - 3" x 3" squares
 - 9" x 9" squares
- black construction paper
 - 3" X 3"
 - 3" x 14"
 - 12" x 14"
- glue stick
- scissors
- 3" x 9" straight edge

LESSON DESCRIPTION:

Students learn about the extensive and interesting history of quilt making. They then cut shapes from squares using equivalent fractions and design the center and border squares using vertical, horizontal and diagonal symmetry.

VOCABULARY:

symmetry:
vertical
horizontal
diagonal
equivalent fractions
pattern
color scheme
contrast
slide, rotate

ART ELEMENTS:

x Line
x Shape/Form
x Color
x Value
___ Texture
___ Space/Perspective

ART PRINCIPLES:

x Pattern
___ Rhythm/movement
___ Proportion/Scale
x Balance
___ Unity
___ Emphasis

CONTENT CONNECTIONS:

Math:
--equivalent fractions
--lines of symmetry
--slide, rotate
Social studies:
--life reflected in quilt designs

THEMES:

Connections (life, math, art)

OBJECTIVES AND ASSESSMENT CRITERIA:

1. Students will identify symmetry and balance as they arrange squares, rectangles, and triangles into a nine square quilt block.
2. Students will cut squares into equal geometric shapes and identify equivalent fractions.
3. Students will design quilt borders using symmetry.
4. Students will draw a grid to accurately place the quilt pieces in symmetry.

PREPARE:

1. Teacher review lesson plan. Make a lesson sample beforehand to maximize student success.
2. Teacher and students choose color scheme before cutting papers.
 - Primary color scheme** - red, yellow and light and medium blue.
 - Cool color scheme** - blue, green, magenta, purple, lt. blue, lt. green, lt. purple.

3. From your class color scheme cut:

- **9" x 9" for center choice colors.** Since students only need one of these, their choice can be determined after day one so you can cut them to size in time for day two.
- **3" x 3" squares** for quilt pieces from your color choices. Place in trays for students to reach as they work.

Also cut black construction paper into:

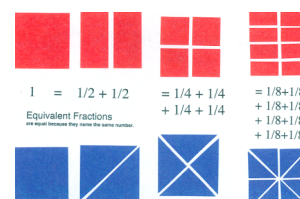
- **3" x 3" squares for center design**
- **3" x 15" for border strips**
- **12" x 14" for quilt backing**

ENGAGE AND EXPLORE:

Read students the book, **Eight Hands Round** by Ann Paul to give them background as to how quilts are made and the historical significance of some of the quilt patterns.

DAY ONE:

1. Today as we begin to make a quilt square design we will find how important it is to include math in our plan and design. Equivalent fractions will be used to change a square into equal triangles, rectangles and even smaller squares. Show the fraction board to find fraction pieces of $1/2$, $1/4$, and $1/8$.



2. Look at some quilt designs to see how they have used the equivalent fractions and the many color choices in a quilt. Also look for the new design created when quilt squares are placed next to each other. **Discuss these designs from the transparencies.** They are found in the book, **Eight Hands Round**. Churn Dash, Jacob's Ladder, Storm at Sea, and Variable Star. Find the lines of symmetry in each of the designs. Some have 2 lines of symmetry (vertical and horizontal or two diagonals) and some have all four lines. Discuss them as you teach each new design.

3. The color scheme choice of the quilt can be discussed. Even though there are only 3 colors and black being used, the light version of one color helps to develop contrast (light against dark) in a design.

Primary color scheme: red, yellow, blue, light blue and black.

Cool Colors: purple, blue, green, magenta and black, plus the light values of any of the colors.

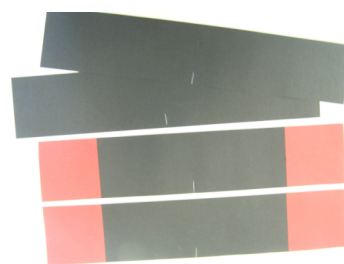
CREATE:

1. **Trays of colored squares** should be placed where four students can reach and choose as needed. Pass out the 3"x15" black border strips (they need 4), and glue sticks.

2. **Border Design:** Take each of the 3" x 15" strips of black paper and put two outside corners together and give a pinch (but do not fold across) to find the center of the rectangle. Mark the pinch line with pencil. This line will be used later as the center to place the shapes from a central point. Students can work from the center out, repeating the same shape placement on each side for mirror symmetry. This will create a border pattern.

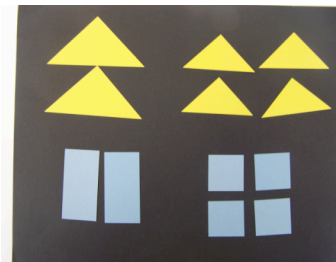
3. **Choose four squares of the same color and glue them on each side of 2 black strips.** Careful placement of the squares in the corners is important for later steps.

Write your name on one of the colored squares.



4. **Cutting Fractions:** Use the fraction/shape visual to demonstrate how to cut rectangles and squares up to $\frac{1}{8}$ size.

Rectangles: Place two corners of a square together and pinch. Let go and pinch the other two corners. Move your fingers to the center of your rectangle to finish the fold. Refold the square in half, back and forth, several times so you have a good crease. Place a second square of the same color behind the rectangle fold. Call this "the time saver." Cut on the fold line to make 4 rectangles.



Squares: Take one rectangle and fold it in half to find the center line to cut. Add another rectangle behind it to make 4 cut small squares. Set these aside and choose two more squares. These should be a different color from the first two squares.

5. **For the triangle fractions**, start with a new square and color and have students place the **straight edge** from corner to corner and draw a line. Place another square of the same color behind the square with the diagonal line and cut $\frac{1}{2}$ size pieces. Fold one $\frac{1}{2}$ piece triangle in half. Place a triangle behind it and cut four small triangles. Arrange the cut pieces (rectangles, squares and triangles) on one of the black strips to make a pattern. Do not put any shapes on the corner squares to keep the design simple.

6. **Show students how to make the border design symmetrical** by repeating the same shapes on each side of the center pencil line. Have students create a second pattern on the other strip. **Corner squares should be left empty of additional shapes for a better symmetrical design.**



7. **Students should check the symmetry** on the two different border designs, first by asking themselves, then a neighbor, and lastly the teacher. Next, choose the favorite of the two borders, dump the other design off and then make them both the same on the two strips.

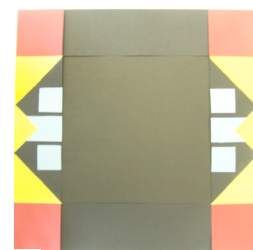
8. **Glue the shapes** after the two borders are checked for being exactly the same two symmetrical border designs, both vertically and horizontally.

9. Attaching strips to form a square: **A rotation of the border design might be necessary to make two lines of symmetry.**

Use the magnet border designs to demonstrate and ask the students if the designs need to be rotated to make them symmetrical. Lay out the four border pieces to make a large square, 2 solid black and 2 with shapes.

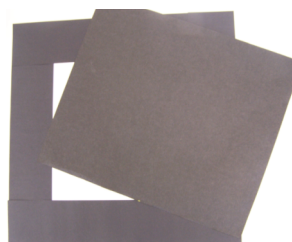


10. **Glue the 4 strips together on the corners** to create a large square. This is tricky because if the corners are not exactly square, it can create lumpy sides. The square must lay flat. Some squares will have to be pulled apart if the sides do not lay flat.



11. **Next glue the 12"x14" black paper** to the back of the quilt design by turning over the border patterns to the backside. Then put a good line of glue stick around the outside of the 12x14" black paper. Center the black backing on the backside of the quilt square because it is slightly smaller.

Stop here and continue the next day.



DAY TWO: Trays of paper squares are placed by each group.

12. Choose one of the student's square designs that had to use rotation to get two lines of symmetry. Explain that we will be **repeating our border designs** today on the two empty borders. But this time the quilt sides are glued in place and you have to **rotate your shapes as you lay them in place**. Point out that a specific shape touching the inside of the design must be on the inside on all four sides.

13. Place the matching magnetic borders on the board. Rotate one side and ask if the design changes. Show all three examples and ask if it needs rotation to be symmetrical from two directions. Talk about how to lay out the shapes that need rotating on your glued square.

14. Show the student example again and let them determine **how many squares of each color will be needed to get the exact amount of shapes** for the other two border sides. This is an excellent review to make students rethink how to cut the size of fraction pieces to repeat their design.

15. **Review the cutting of shapes** to create the fraction pieces needed to complete the other two border sides. Continue to cut two at once and save the extra pieces for the center design.

16. Allow **students to work independently** now. But no gluing should happen until their borders are checked for symmetry. Discuss direction #17 now because students finish with this step at different times and can move on to square choice independently. The center square should not be glued down until after #18, drawing the grid.

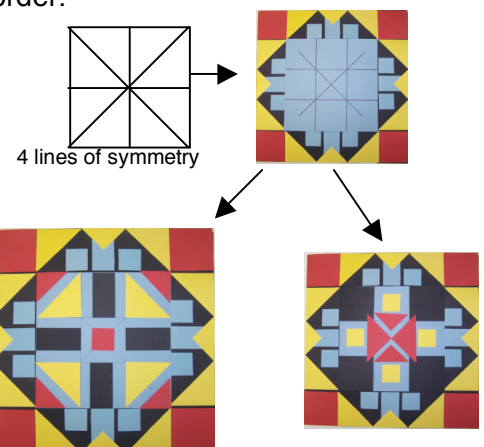
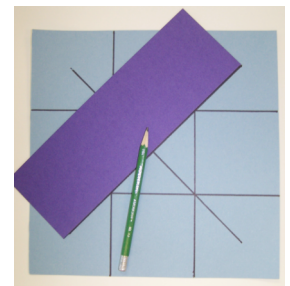
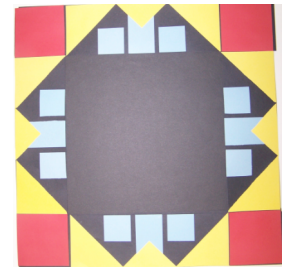
17. Students may **choose their center color square** after the borders are glued down. It works well if the teacher holds up a finished piece and places the different color choices in the center. Students can then see the color differences and then decide which color looks best.

18. **Drawing the grid on the center square** should be demonstrated in a circle on the floor or gathered around a large table. The 3"x 9" straight edge is perfect for drawing the grid lines. Lay the straight edge on each edge of the square, tap it and then draw a light pencil line. Also draw the two diagonal lines, intersecting the square corners. **Glue this grid in place**. Explain that the grid helps to place the pieces accurately.

19. **Demonstrate how to lay out designs**. Include the black squares as you demonstrate the horizontal, vertical and diagonal design possibilities. Remind them that they may use a few large whole squares from the tray and that they must use at least one or two black shapes in their designs. Black is an excellent contrast (dark against light) and it repeats black in the border.

20. **Remind students of the sequence** of drawing the grid, gluing it down, then begin choosing colors and cutting shapes for their center design. Try more than one design before choosing.

21. **Check for lines of symmetry** before gluing the design!



Other examples

CLOSE:

ASSESSMENT: It is important to assess the students as they go through the process of creating symmetry and rotating and sliding their designs. When the quilt is complete, students need to demonstrate or show how many lines of symmetry are in their quilt square.

Teacher administered assessment tool

DN.	OK	UP	Lesson_____ Teacher_____
			Grade_____ Date_____ Number of Students_____
			Using the thumbs up, ok, and down technique, ask your students the following questions and record their answers. (K=knowledge, S=skills, C= creativity, A=attitude, E=engagement)
			1. Can you identify the lines of symmetry in your quilt square? (K,S)
			2. Did you cut squares into fractions of rectangles, squares, and triangles? (E)
			3. Did you design your own quilt border using symmetry? (K,S,C,A,E)
			4. Did you draw a grid to accurately place the quilt pieces in symmetry? (K,S,E)
			5. Did you add an imaginative touch to your art? (C)
			6. Did you actively listen and follow directions? (A)
			7. Did you do your best during this lesson? (E)

Teacher self-critique

8. My teaching of this lesson:

1	2	3	4	5	6	7	8	9	10
needed improvement							was highly successful		

9. What would I do differently next time?

ALIGNMENT:**Alignment of Standards:**

Art: A1,2,3,4; B3,4,5; C1,3,4

Math: A, B, C, D

History: A, B

Alignment of GLE's:

Math: M2.2, M3.2.1, M5.2.3

M5.2.5, M5.2.7

Reading: R2.6, R2.7, R2.11

CREDITS:

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