SEEING DOUBLE

ITV SERIES

MATH TALK:
#116: Flip and Fold

GRADES 6-8 *(Easily used at any grade where symmetry is taught.)*

PREVIEWING ACTIVITIES

Vocabulary:

congruent - two figures with the same size and shape

symmetry - the concept that the rotation or a reflection of an image produces an exact copy

reflection - a congruent image, reversed, on the opposite side of a line

line of symmetry - the line that divides a figure into two identical (congruent) parts

asymmetrical - not symmetric, a figure where each half is different

To introduce students to reflections and the vocabulary required for this lesson, complete one or both of the following activities with your students.

Create a symmetrical design from a signature by completing the following activity: (see sample in attachments)

- Fold a blank piece of paper in half, the 'hot dog' way.
- Unfold.
- Using a #2 pencil, write your name in cursive along the fold line, making sure that each letter touches the center fold.
- Close the paper, and using the side of your thumb and quite a bit of pressure, rub over the entire name area.
- Open, to hopefully find the reflection of the name on the blank half of the paper. (It may be faint, but there.)
- Trace over the reflection, making sure the name and reflection meet in the center.
- Using a dark marker, trace over the entire design. Fill in with colored pencils, markers, or crayons. It helps to turn the paper sideways to do this.
- Discuss that both halves of their designs are the same, only reflected. Comparing this to a mirror is a good visual cue for students.

OVERVIEW

Symmetry is a concept that is basic to many geometric definitions. This lesson is an introduction to symmetry. It is appropriate at many grade levels, whenever symmetry is first being discussed, as either a new topic, a review, or when formalizing a definition. Students will formulate an intuitive definition for symmetry after viewing a segment of video in which Mathman can eat only symmetric figures. They will then develop a more formal definition as a class. Next they will view a segment of video that will show the patterns developed when symmetrical patterns are repeated and reflected. An extension to this lesson gives students the opportunity to create similar patterns. They will finally complete a hands-on activity in conjunction with the video, where changing asymmetrical patterns into symmetrical patterns shows their understanding of symmetry. The action plans and extensions to this lesson take students beyond a simple definition, and explore symmetry in the world around them.

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LEARNING OBJECTIVES

Students should be able to:

- Compare symmetrical and asymmetrical shapes in order to learn the vocabulary of symmetry and formulate a definition for symmetry.
- List three components of a good mathematical definition.
- Construct symmetrical figures from asymmetrical figures, and repeat and reflect patterns to create symmetrical designs.

MATERIALS

Previewing Activities

- blank paper - 1 per student
- #2 pencils
- markers or colored pencils
- miras and mira activity worksheet

Viewing activities

- one inch square chips, at least 12 per student (old file folders cut up)
- graph paper, 1-2 sheets per student
- pencils
- transparencies of graph paper
- overhead pens

PREVIEWING ACTIVITIES (continued)

Miras introduce students to reflection images, congruent figures, and the notion that mira lines are actually lines of symmetry. Have students complete the activity sheets using miras to produce the reflections, as outlined on the sheets at the end of this lesson.

FOCUS FOR VIEWING

To give students a specific responsibility while viewing, tell them that at the end of this segment they will need to write a complete and concise definition for symmetry on their papers.

VIEWING ACTIVITIES

Pass out graph paper and 12 1-inch squares to each student.

BEGIN the video at the start of the Flip and Fold segment.

STOP at the end of the "Mathman" segment, and ask students to write a definition for symmetry on the back of their graph paper. **RESUME** the video after telling students to compare their definitions to the definition given on the video.

PAUSE after Winnie's definition and ask how many students wrote a definition like hers. Write her definition, "symmetry is when a shape is the same on both sides," on the overhead or board. **RESUME** the video.

VIEWING ACTIVITIES (continued)

PAUSE after Buster's definition. Again, ask how many wrote a definition similar to this, and write his definition, "symmetry is when a shape is exactly the same when flipped over a line," on the overhead or board. Have any students who wrote a different definition read theirs, and place these on the board as well. **RESUME** the video.

PAUSE after the complete explanation, including the example, is given. Decide which of the definitions is the most easily understood. Ask students to list the components of a good definition. These might include a) simple terminology, b) the word being defined is not used, c) a drawing or example, d) easily visualized, and e) short. Have the class formulate a final definition for symmetry. Write it on the board, and have students write it on their papers. **RESUME** the video after explaining that the next segment is for enjoyment.

PAUSE periodically to determine how the patterns are changing. **STOP** at the end of this segment, and discuss with the students where they may have seen similar patterns in the world. (If you are completing the extension, a more thorough discussion is beneficial at this point, about how the patterns were created, and rewinding and viewing it twice may be beneficial.)

To re-focus students before resuming the video, tell them to watch the following clip and identify a problem that the doctors have.

RESUME the video and play until the doctor asks where the case of asymmetriosis is. **PAUSE** and ask students to write a definition of asymmetriosis on their papers under the definition for symmetry. Tell students to listen to determine if their definition was correct. **RESUME** the video.

MATERIALS (continued)

Post-viewing activities and extensions

- materials to grow crystals
- one inch squares
- graph paper
- transparent graph paper
- Polygons and Patterns templates (used by permission of LaRon Smith, available from ICTM)

ACTION PLAN

Have students collect 10 objects from nature that are symmetrical, and bring to class to share and display.

Invite an artist to come and discuss the uses of symmetry in art.

Take a walk around the neighborhood or school, and identify buildings, or parts of buildings that are symmetric. This could also include other objects in nature, landscaping, cars, etc. This could be a silent walk, with students making their own lists for half of the walk. They could share their lists at the halfway point, and expand them as they return to class.

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EXTENSIONS

Art: Reflection patterns:

- Divide a piece of graph paper into four quadrants by drawing the axis lines.
- In any one quadrant, create a pattern of polygons from the lines on the paper and diagonals.
- Copy the patterns into the other three quadrants by reflecting the pattern over the axis lines.

Other suggestions for patterns:

Adjust the number of squares by grade level and complexity desired.

For a partner activity, have one student create the pattern, and another student reflect and color it.

Use the Polygons and Patterns worksheets to help students create their patterns.

VIEWING ACTIVITIES (continued)

PAUSE when the doctors ask, "How are we going to get half of this thing to be the mirror image of the other half?" Instruct students to build the figure in the video on their desks. Check to determine that all students have done so correctly. Tell students to now move squares to create a symmetrical figure. **RESUME** the video to check for correct responses.

PAUSE after the first solution is given and ask how many had the same solution. **RESUME** the video.

PAUSE after the second solution and verify similar solutions. **RESUME** the video and **STOP** at the end of this segment. Determine how many students created the 'best' solution by using one cut, on their first attempt at solving the problem.

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POST VIEWING ACTIVITIES

To determine if the students comprehend the concept of symmetry, have them rearrange the squares to create at least 5 more symmetrical figures while recording their solutions on their graph paper. More advance classes could be challenged to find all possible solutions. As unique solutions are discovered, have students also record them on a transparency, which could then be displayed on the overhead. Or, hand transparent graph paper to students with unique solutions and have them share their answers at the end of the activity.

Have the class grow crystals and watch as symmetric patterns evolve.

EXTENSIONS (continued)

Science: Have students cut pictures of insects or some other collection of natural objects from magazines. Mount these as a poster, and draw a line of symmetry on each object.

Language Arts: Palindromes are words or phrases that read the same forwards or backwards. Discover words that are palindromes, such as “Ada”, “race car”, or “a man, a plan, a canal, Panama”. Students could generate a list of palindromes. Sentences could then be made from the list of words.

Write a diamante form poem. In this form, the first line is one syllable, the second two syllables, the third three syllables, and so forth.

Explore the symmetry of the alphabet by drawing lines of symmetry on capital letters. Display on a poster. An exploration of various fonts from a computer might be interesting.

VIDEOS AVAILABLE FROM

ITV Overnight Blockfeed which may be taped off air. Consult your local PBS station for schedule..

Lesson Plan Developed by Master Teacher Kit Parker - South Junior High School-Boise School District

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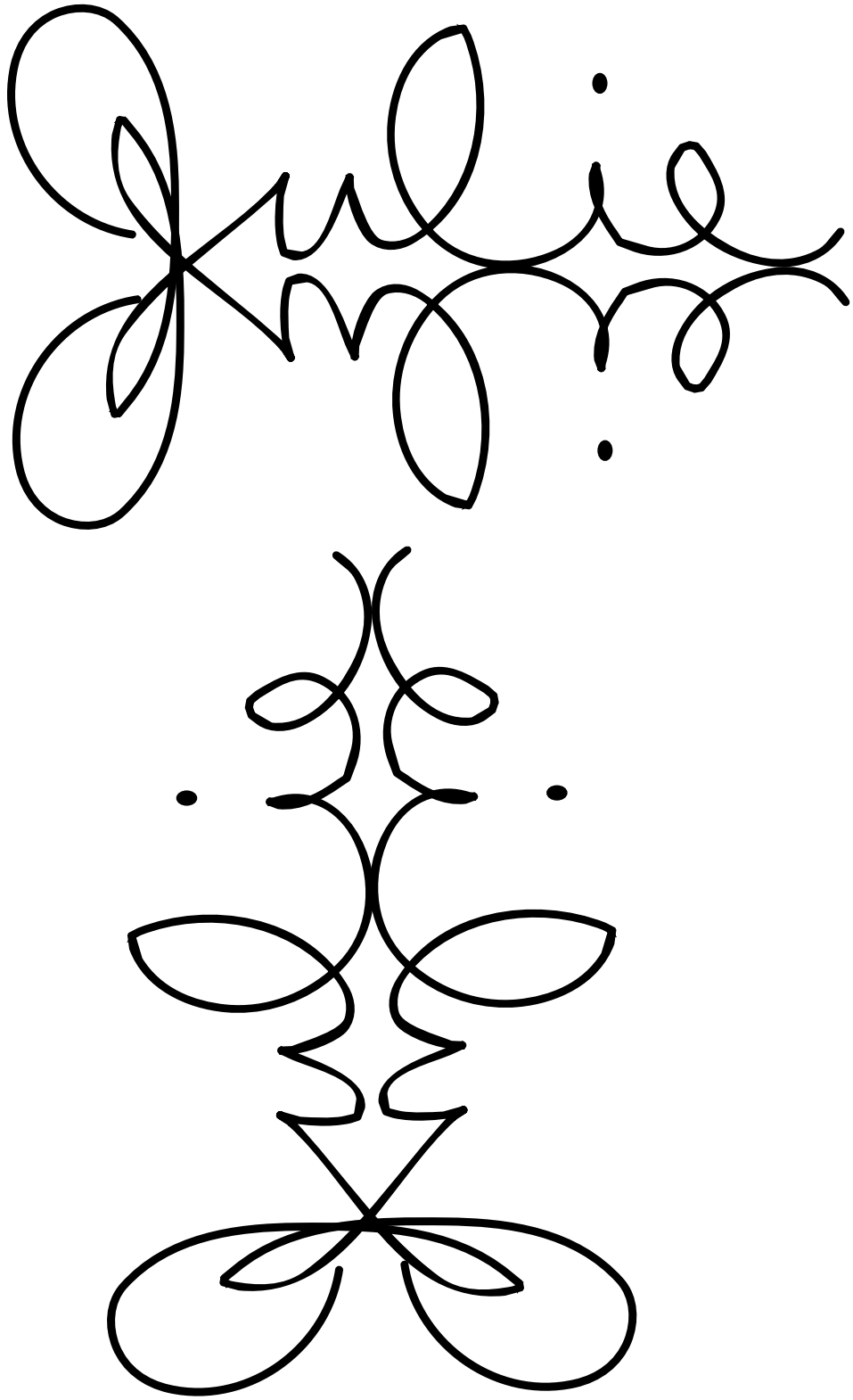
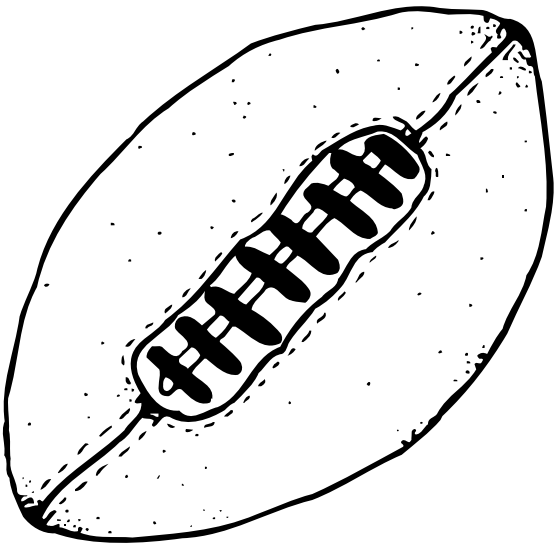


MIRA REFLECTIONS

Place the mira in front of each drawing below. Trace the reflection as seen through the mira, on the blank half of the page. Draw a line along the base of the mira. This is the reflection line.



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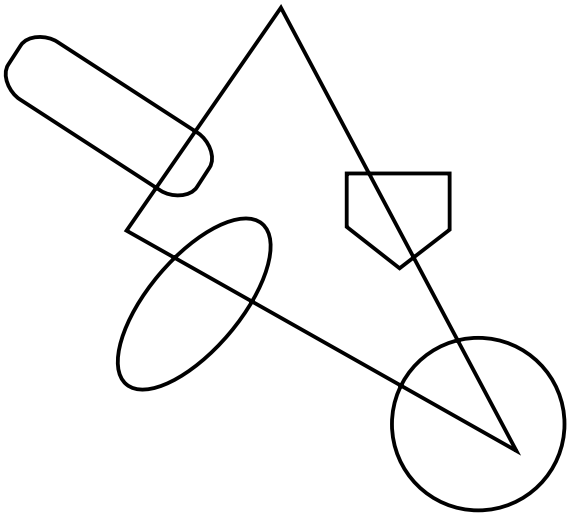

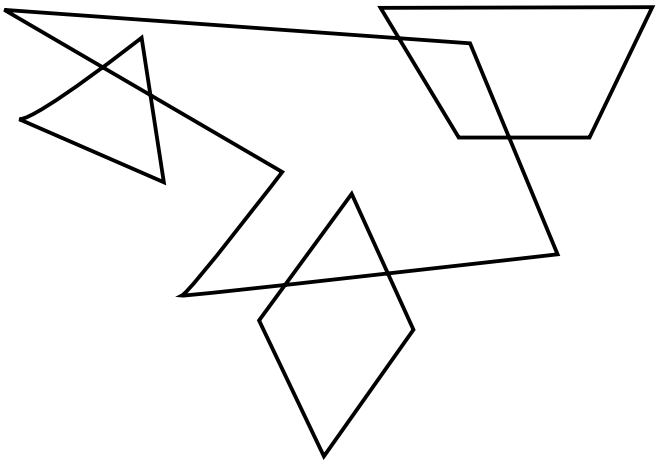

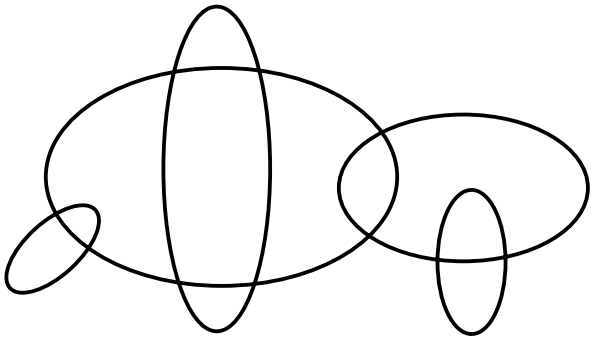

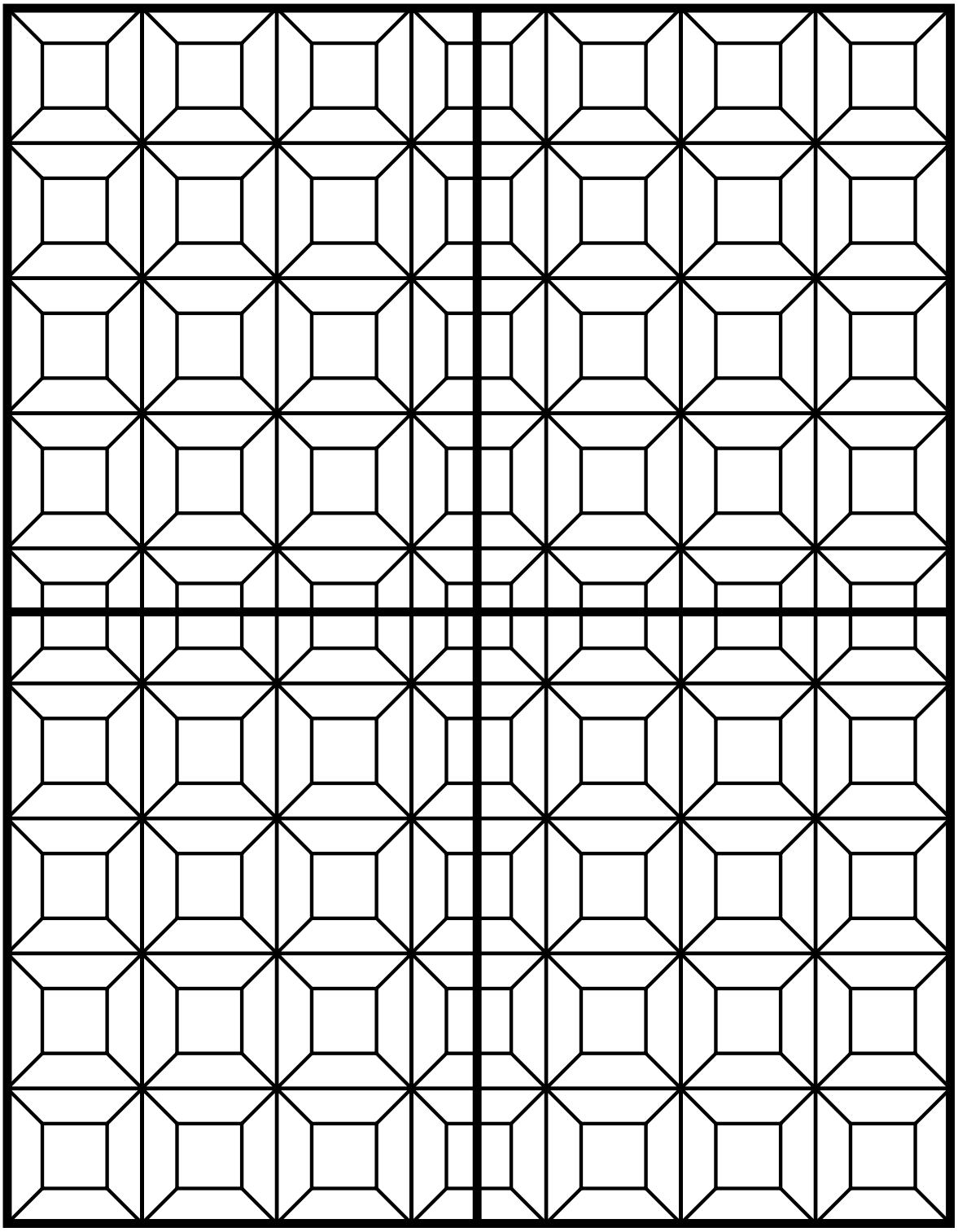

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