

Breaking Up Is Hard to Do

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Overview: Fractions/Geometry. This lesson focuses on a problem solving approach using geometric figures to develop children's understanding of the concept of fractions. Through hands on activities and Internet interactive web sites students will identify geometric shapes and their properties, fractional parts, and equivalent fractions. As an assessment students will go on-line to reinforce their knowledge of fractions and create geometric design problems for other students to solve.

Grades:

3-5

Time Allotment:

2 - 45 min. blocks

Subject Matter:

Mathematics; fractions and geometry
Art

Learning Objectives:

Students will be able to:

- Read and write proper fractions for fractional parts
- Explain what numerators and denominators represent in a fraction
- Identify equivalent fractions
- Name geometric shapes and their properties (triangle, trapezoid, rhombus/parallelogram, right triangle)
- Identify congruent figures

Standards

The objectives listed may be used in part to address the following Virginia Standards of Learning: Virginia Department of Education <http://www.pen.k12.va.us/go/Sols/home.shtml>

1.The student will identify the part of a set and/or region that represents $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{8}$, and $\frac{1}{10}$ and write the corresponding fraction. (VA SOL 2.4)

2.Students will name/write fractions representing drawings or concrete materials. (VA SOL 3.5)

3. Students will compare the numerical value of two fractions having like and unlike denominators. (VA SOL 3.6)

4. Students will analyze plane and solid geometric figures and identify relevant properties of plane and solid figures. (VA SOL 3.18)

5. Students will identify and describe congruent and symmetrical two-dimensional figures, using tracing procedures. (VA SOL 3.20)

6. The student will identify and represent equivalent fractions using concrete objects (VA SOL 4.2)

7. The student will identify lines, which illustrate parallelism and perpendicularity. (VA SOL 4.17)

Media Components

Video:

Mathicas Mathshop 2 # 109, Winter Warm Up
Eddie Files # 104, Any Way You Slice It

Web sites:

Bookmark the following interactive web sites for whole class work: (All web sites listed in this lesson require Java compatible browser)

1. Pattern Blocks

http://www.best.com/~ejad/java/patterns/pattern_s_j.shtml -

This site provides visual exploration activities to reinforce students' knowledge of fractions by using online pattern block activities.

2. No Matter What Shape Your Fractions Are In

<http://math.rice.edu/~lanius/Patterns/> -

This site allows students to reinforce their knowledge of fractions by using online pattern block activities. The lessons are designed for students to work independently or with guidance from the teacher. Lessons should be printed so students can draw and color the appropriate shapes.

3. Designer Fractions

<http://math.rice.edu/~lanius/Patterns/design.html>

- This site provides visual practice in calculating fractional parts for four different colors in a geometric design. Students have the opportunity to create their own geometric designs on triangle grid paper using four metric shapes.

4. Your Fun Fractions

<http://math.rice.edu/~lanius/Patterns/draw2.html>

- This site displays student created designer fraction problems to solve. This New Internet Project site provides students with a model and an opportunity to design and post their fraction problems on-line for others to solve.

Materials needed for the Introductory Activity

- Hexagon patterns run off on white tag board (2 sheets per student)
- Crayons or markers
- Pencils
- Rulers
- Scissors (1 pair per student)
- Small plastic baggies to store shapes

Teacher/ Student Materials for Viewing/Culminating Activities:

- Students' Pattern shapes from Introductory Activity
- Book Fraction Fun by David Adler; illustrated by Nancy Tobin/ Holiday House/NewYork, 1996.
- Computers with Internet access (at least one computer for every 2 students)
- Guess my Fraction worksheet (print out from site 2- No Mater What Shape Your Fractions Are In)
- Triangular Grid Paper (print out from site 4- Your Fun Fractions)
- Colored pencils

Prep for Teachers

The teacher should preview and cue the videos as indicated in the Learning Activities section. The teacher should also have each Internet site book marked for easy access.

Day One

Introductory Activity:

1. The teacher should have students in small groups at tables if possible with necessary materials for activity handed out.
2. Provide the students with a **Focus for Media Interaction** by saying "Today you will be learning about some different geometric shapes and will use these shapes to help you understand what *fractions* are.
3. Ask students what they notice is the same about each of the pattern pieces on the pattern page. (*each has six sides, 6 corners, 6 angles, same size and shape*) Ask if they know the name of this geometric shape (*hexagon*). Write the word on the board.
Instruct students to color one of these hexagons yellow as you explain that a hexagon is a six-sided figure with six corners and six angles. (explain that an angle is like a corner or where two line segments join)

4. How could you prove that each of the hexagons is the same size and shape as your yellow hexagon? (*You could trace them or cut them out and lay them on top of each other*) Instruct students to cut the remaining hexagons out and stack them on top each other. Say, “When shapes are the same size and shape they are congruent.” Write the word on the board.

5. Ask students if they’ve ever had to share something like a cookie or a pizza with a friend or family member. What happens when one of you gets a larger piece than the other? (*accept all reasonable answers*) Today we’re going to do some problem solving using our hexagon shapes. We will try to make more geometric shapes that are equal in size and shape, or what we call congruent.

6. Using the following questions, allow students to problem solve in groups the math puzzles using the remaining hexagon shapes.

Math puzzle #1:

Instruct students to choose a different hexagon. Ask, “If you wanted to share this hexagon with a friend, how could you divide it into two congruent pieces where each piece has **four sides**? Tell students to use the center point and their ruler to guide them. Have students mark their divisions first as you check their accuracy. Once the puzzle has been solved, have them color their two pieces red, and cut them out. Ask students if the shapes are congruent. How do they know? (*They’re the same size and shape*) Ask, “What do you notice about the sides of this shape? Explain the term parallel lines and write it on the board. (two lines moving in the same direction but always the same distance apart) If you had made the dividing line going the opposite way, how many sides would each shape have? (5) Does anyone know what we call a 5-sided figure? (*pentagon*)

Math Puzzle # 2:

Using a different hexagon, ask, “How could you divide this into three equal or congruent parts with each part having **four sides**?” Tell students to use the center point and ruler to guide them. Check students dividing lines and have them

color the shapes blue and cut them out. Ask if the shapes are congruent and how they know.

Math Puzzle # 3

Using a different hexagon, ask, “How could you divide this hexagon into six equal and congruent parts with each part having **three sides and three angles**?” After checking accuracy, have students color the hexagon green and cut out the six triangles. Ask students, Are they congruent? How do you know? Who knows what we call each of these shapes?

Math Puzzle # 4

How could we divide a different hexagon into 12 equal pieces with each piece having **three sides and one right angle**? (Show students what a right angle is). Check for accuracy in division and have them color the hexagon purple and cut out the 12 pieces. Explain that these are special triangles called right triangles because they have one right angle.

7. Instruct students to put their pieces aside to use later in the lesson. Pieces may be stored in small plastic baggies.

Learning Activities:

1. Cue Mathicas Workshop 2 video # 109, Winter Warm Up, to the frame where the elf character is standing next to an easel with a hexagon shaped flower and geometric shapes.

2. Say to students, “Today we are going to watch a video segment that tells us what the shapes we’ve cut out are called. It will also explain how to write numbers that represent something smaller than a whole.”

3. Provide students with a **Focus for Media Interaction** by saying to students, “In the first video clip we’re presented with a Mystery Puzzle about a flower. Listen for the question you’re asked to solve.. **START** the video at the cue and **PAUSE** when you see the question “What color will cover the whole flower?” Ask students to predict which color will cover the whole flower . (*accept all predictions*)

4. Provide students with a **Focus for Media Interaction** by asking students to listen for the name of the red shape and what part of the flower one of these shapes will cover. **RESUME** tape and **PAUSE** when you see the fraction $\frac{1}{2}$ on the screen. Ask, “What was the name of the red shape? (*trapezoid*). How much of the flower did the trapezoid cover? ($\frac{1}{2}$) Using the **FREEZE FRAME** point to the fraction explaining how to write one half and that the top number tells how many parts are covered. Ask students, “What do you think the bottom number 2 means?” (*How many parts or halves are needed to cover the whole hexagon*) **RESUME** tape and **PAUSE** when you hear, “Two halves make a whole.” Ask, “How many trapezoids were needed to cover the flower?” (*two*) What was each part called ($\frac{1}{2}$) How many halves equal a whole? (*two*)

5. **RESUME** tape and **PAUSE** when you hear “Would yellow do the trick?” Ask students for their predictions. How many yellow pieces do you think it will take? Provide a **Focus for Media Interaction** by asking students to listen for the name of each yellow shape and how much of the hexagon flower the yellow shapes cover. **RESUME** the tape and **PAUSE** when you see the fraction $\frac{4}{6}$ on the screen. Ask, “What is each yellow shape called? (*triangle*). How much of the flower did the triangles cover?” (*four sixths*) Looking at the freeze frame say: Notice how this number is written $\frac{4}{6}$. Point to the 4 and ask students, “What does the 4 mean? (*4 pieces are covering the hexagon*). How many yellow pieces were needed to cover the whole flower? (*six*) What do you think the 6 stands for?” (*How many pieces are needed in all*) What would you call one of these triangles? (*one sixth*)

6. Provide a **Focus for Media Interaction** by saying, “In this last segment I want you to listen for the name of the blue shape and how much of the hexagon each shape represents.” **RESUME** tape and **PAUSE** when you see $\frac{1}{3}$ on the screen. Ask, “What was this shape called?” (*rhombus*) Write the word on the board. Ask, “What part of the hexagon did one rhombus represent?” ($\frac{1}{3}$) Ask students to explain what the one and three mean. **RESUME** the tape and

PAUSE when you see $\frac{2}{3}$ on the screen. Ask the meaning of the two and the three. **RESUME** and **PAUSE** when you see $\frac{3}{3} = 1$ on the screen. Ask students to explain both of the threes. What do you notice about the top and bottom numbers? (*they are the same*) What is another name for three thirds? (*one whole*) Explain that when the top and bottom numbers are the same they are talking about one whole. **STOP** the video and discuss the properties of the rhombus. (*four sides, each parallel; also called a parallelogram.*) Explain to students that the numbers $\frac{1}{2}$, $\frac{4}{6}$ and $\frac{3}{3}$ are called fractions. Fractions are numbers that represent equal parts of something. Write the word on the board.

Day 1 Interactive Website Activity

1. Use the bookmarked website **Pattern Blocks** http://arcytech.org/java/patterns/patterns_j.shtml Provide whole group instruction on how to use the site. (You can click on instructions to guide students through the use of the pattern block activity tools.) A large screen monitor also works well with these web sites for demonstration purposes.

Provide students with a **Focus for Media Interaction** by asking students to try to identify the shapes they have learned about today and to check their answers as they go.) Ask students to explore using the different shapes to create hexagons that are congruent to the yellow hexagon.

2. Once students understand how to use the tools, have two students work together to answer the questions on-line at the following site **No Matter What Shape Your Fractions Are In** <http://math.rice.edu/~lanius/Patterns/> Provide students with a **Focus for Media Interaction** by saying, “Use the Pattern Blocks site to help you and your partner answer the questions on this screen. (It may be helpful to print out the worksheet so students don’t have to go back and forth between sites). Once they have finished they can check their own answers on line. Students who finish early can write their own problems for others to solve. It is helpful if students know that the triangle is the basic counting unit.

Day 2

Begin Day 2 by reviewing the previous day's lesson.

1. Ask students to get the following shapes out of their baggies one at a time (informally assess their recognition of the geometric shapes). As each shape is identified ask students to name their properties

hexagon- six sides, corners, angles

trapezoid- four sided figure with two parallel sides; 4 angles

rhombus/parallelogram- four sides, four angles, opposite sides parallel and equal

triangle- three sides, three corners, three angles

right triangle- three sides, corners, angles; one angle is a right angle

Write the word congruent and review its definition. (*same size and shape*)

2. Say, "Yesterday we learned how to write a number to show an amount that is smaller than a whole. We learned that these numbers are called fractions." Write the word on the board. To provide a Focus for Interaction ask students to listen as you read a few pages from a book called Fraction Fun, by David Adler. Listen for the meaning of a fraction and the special names for the top and bottom number in a fraction. Read pages 1-8. (*The teacher may choose to read other sections of the book as well which provide additional activities to extend the concept of fractions*).

Following the reading, ask students questions to check their comprehension. Record student responses on the board.

- What is a fraction? (*an equal part or parts of a whole*)
- What do we call the top number in a fraction?(*numerator*)
- What does the numerator stand for? (*number of parts you're talking about*)
- What do we call the bottom number? (*denominator*)
- What does the denominator stand for?
- (*total number of parts*)

3. Using their pattern shapes from the previous day have students answer the following questions.

- How many trapezoids would it take to cover a hexagon? How much would one trapezoid represent? ($\frac{1}{2}$)

As students model this ask them to label each trapezoid $\frac{1}{2}$ as you review the meaning of each number

- If a hexagon represented one whole, how much would a rhombus represent? ($\frac{1}{3}$)

As students model this ask them to label each rhombus $\frac{1}{3}$

- What part of a hexagon would each of your six triangles represent?($\frac{1}{6}$)

As students model this ask them to label each triangle $\frac{1}{6}$

- How many right triangles would it take to cover a hexagon? ($\frac{1}{2}$) What part of the hexagon would each one represent? ($\frac{1}{12}$)

Have students label the right triangles $\frac{1}{12}$.

4. Instruct students to look at each piece and compare their sizes. Put them in order from the smallest to the largest. Ask, "Which is larger, $\frac{1}{2}$ or $\frac{1}{12}$? ($\frac{1}{2}$) Why do you think that is? (*the more pieces the smaller each one is*) Ask, "What happens to the fraction as the denominator gets larger? (*the fraction is smaller*) Give students the opportunity to compare several fractions including fractions with different numerators but the same denominator.

5. Ask students if they think two different fractions could represent the same amount? (*allow students time to respond*)

To demonstrate, have students use their pattern pieces to model the following:

6. Use your yellow hexagon shape and triangles to show $\frac{3}{6}$. Use your hexagon and trapezoid to show $\frac{1}{2}$. Do both these fractions cover the same amount of the hexagon? (*yes*) We call fractions that represent the same amount equivalent fractions. (Write the word on the board). We would write this as $\frac{3}{6} = \frac{1}{2}$. Can you use your

pattern pieces to find some other *equivalent* fractions?

($1/6 = 2/12$, $1/3 = 2/6$, $1/2 = 6/12$, $4/12 = 1/3$, $2/3 = 8/12$,) Allow students time to explore equivalent fractions and to share their answers.

Learning Activities

The following learning activity will help students make connections between fractions and real world experiences.

1. Cue Eddie Files Episode #104, Any Way You Slice It, where you see the sign Manhattan Country Club on the screen.

2. Ask students, “Why do you think it’s important for us to know about fractions? Can you think of some ways we use fractions in our everyday lives?” (Accept reasonable responses).

3. To set a **Focus for Media Interaction** ask students to listen for how a chef uses fractions when he’s cooking. **START** the tape and **PAUSE** when you hear the chef say, “Fractions, it’s so important that you know about them.” Ask, “Why were fractions important to this chef?” (*he used them to measure amounts and to know how much to prepare*) What might happen if he didn’t use the proper amounts?

4. **FAST FORWARD** to the picture of the photographer in the green turtleneck, just before he says, “Hey Eddie, how ya doin?” Provide a **Focus for Media Interaction** by saying, “Let’s listen to a photographer giving Eddie some advice about taking good pictures. Listen for what was wrong with Eddie’s pictures and the advice the photographer gives him. **PLAY** and **PAUSE** when you hear “Man, this fraction stuff is everywhere.” Ask, “What was wrong with Eddie’s pictures? (*they were blurry*) What advice did the photographer give him?” (*use a higher shutter speed*) Provide a **Focus for Media Interaction** by asking students to listen for what shutter speed means. **RESUME** and **PAUSE** where you hear “smaller amount of time; a smaller fraction of a second”. Ask, What does a faster shutter speed mean? (*a smaller fraction of a second*)

5. Provide a **Focus for Media Interaction** by asking students to listen in the next segment for two different looks a sports photographer can get in her photos and what causes these different looks. **RESUME** and **PAUSE** where you hear her say, “We can take the same scene and create something totally different using different fractions. Ask, “What are two different looks she could get? (*sharp or blurry*) What helped her get these different looks?” (*using different fractions*)

6. **FAST FORWARD** to the segment where you see the word JAZZ on the screen. Ask students to think how fractions might be used in music. (*accept reasonable answers*) To provide a **Focus for Media Interaction** ask students to listen for some fractions that are very important to a drummer and why they are important. **PLAY** the video and **PAUSE** after you hear the drummer say, “All those notes are the basics for putting any beat together.” Ask, “What fractions are important to this drummer? ($1/4$, $1/8$, $1/16$ notes) Why? (*they’re the basics for putting any beat together*). Provide a **Focus for Media Interaction** by asking students to listen for some different types of beats you can get from combining these different notes. **RESUME** and **STOP** after you hear the drummer say, “It’s the common language of all musicians.” Ask, “What is the common language of all musicians? ($1/4$, $1/8$, and $1/16$ notes) What were some of the different kinds of beats he was able to play using those notes?” (*rock, swing, jazz, hip hop*) Say to students, “We’ve learned three ways we use fractions in our everyday lives. Can you think of any more? (*accept all possible answers*) There are many more ways. Let’s keep on the lookout for fractions. They’re everywhere!”

Culminating Activity

1. Say to students, “Now let’s have some fun with fractions!” Explain how to use the interactive web site **Designer Fractions** <http://math.rice.edu/~lanius/Patterns/design.html> Provide students with a **Focus for Media Interaction** by saying, “You will be using this site to answer a set of questions about the geometric design you see. Remember the triangle is your basic unit. Once students have

completed the questions allow them to create their own geometric design using four different colored geometric shapes (triangle, parallelogram/rhombus, trapezoid and hexagon)

As students create their designs they can transfer them to the triangular grid worksheet. Each student will write questions about the fractional parts each color represents. An answer sheet should be part of the project as well. Students will share their designs and calculate the fractional parts of other students' designs. To see designs other students have created on line and practice calculating fractional parts, bookmark the following site:

Your Fun Fractions New Internet Project
<http://math.rice.edu/~lanius/Patterns/draw2.html> This site displays student Internet project designs and gives sample questions for each. Students could use these as models for creating their own projects.

It is helpful if students use the printed triangular grid worksheet while working on their design found at the **Designer Fraction** website
<http://math.rice.edu/~lanius/Patterns/design.html>

Assessment:

The culminating activity can be used as an assessment as well as informal assessments throughout the lesson.

Teacher made written test.

Cross- Curricular Extensions:

Literature connections:

The teacher could read aloud and discuss with students the following books:

Fraction Fun. Adler, David. Holiday House/New York, 1996.

Gator Pie. Mathews, Louise. School and Library Binding.

The Hershey's Milk Chocolate Bar Fractions Book. Pallotta, Jerry. Scholastic, Dec. 1999.

Greedy Triangle. Burns, Marilyn. Brainy Day

Books/School and Library Binding, March 1995.

Eating Fractions. McMillan, Bruce. School and Library Binding, September 1991.

Fraction Action, Leedy, Loreen. School and Library Binding. March 1996.

Have students read the rest of Fraction Fun and complete some of the activities.

Language Arts

Play Vocabulary Bingo using mathematics vocabulary

Read the Greedy Triangle. Have students make up their own stories about a different shape.

Write a "How to Make a ..." story creating an imaginary recipe using fractions.

Math

Give students ingredients to make cookies without a recipe having students guess at the amounts. Bake it and have a taste test. Discuss the importance of using accurate measures when cooking. Follow up by making the recipe using exact measurements.

Measure student heights and the lengths of various objects using standard measurement. Measure to the nearest $\frac{1}{4}$ inch.

Weigh a variety of identical small objects (such as pennies, tissues, nickels, etc.) on a scale until they equal one ounce. Calculate the fraction of an ounce each object represents. (activity taken from Fraction Fun)

Art:

Use geometric shape tiles or mosaics to create pictures. Calculate the fractional part for each color.

Music:

Listen to , learn to play, or create rhythms that use $\frac{1}{4}$, $\frac{1}{8}$, and $\frac{1}{16}$ notes.

Community Connections:

1. Invite a cafeteria worker to speak to the class about how fractions are calculated and used in cooking large amounts of food for students.
2. Invite a musician to the class to demonstrate how fractions and rhythm are related.
3. Have a professional photographer bring in some of his/her photographs and explain how shutter speeds provide different visual effects when taking pictures.

Internet Resource List

Visual Fractions Home Page

<http://www.visualfractions.com/index.htm> - This site provides a variety of interactive activities for extra independent practice on fractions.

National Library of Virtual Manipulatives

http://matti.usu.edu/nlvm/nav/grade_g_2.html - This site provides interactive activities to reinforce student knowledge of fractions.