

Math Pop Art – Grade 6, Level 4

Lesson Overview

In this lesson, students will extend their understanding of fractions and decimals to include representing fractional parts as percentages where the whole is 100. Learners will make connections between concrete and visual representations of percentages and fractions, create a piece of art related to a popular art movement, and write about the math and the art from the lesson.

Students have studied equivalent fractions and decimal values through the thousandths place, as well as decimal notation for fractions with denominators of 10, 100, and 1,000. Decimal equivalents for fractional parts and fractions in lowest terms should be included in the lesson.

Alignment

Standard/Indicator Addressed

SC CCR Math 6.RP.3: Apply the concepts of ratios and rates to solve real-world and mathematical problems.
e. Understand that a percentage is a rate per 100 and use this to solve problems involving wholes, parts, and percentages.

SC CCR ELA Writing Standard 6: Write independently, legibly, and routinely for a variety of tasks, purposes, and audiences over short and extended periods of time.

SC Academic Standards for the Visual and Performing Arts Standard 6: The student will make connections between the visual arts and other arts disciplines, other content areas, and the world.

VA6-6.1 Analyze the similarities and differences between the visual arts and other arts disciplines.

VA6-6.2 Compare and contrast concepts, issues, and themes in the visual arts and other subjects in the school curriculum.

Standards for Mathematical Practice (as appropriate)

Standard 1: Make sense of problems and persevere in solving them.

Standard 2: Reason both contextually and abstractly.

Standard 3: Use critical thinking skills to justify mathematical reasoning and critique the reasoning of others.

Science and Engineering Practices (as appropriate)

NONE noted

Connections

Disciplinary Literacy Strategies (for Purposeful Reading, Meaningful Writing, and Productive Dialogue)

- Think-Ink-Pair-Share
- Show Me

Computational Literacy (Computer Science)

- Confidence in dealing with complexity.
- Persistence in working with difficult problems.
- The ability to communicate and work with others to achieve a common goal or solution.

Content Area (2 or more) Connections

Math, ELA, Art

Lesson Plan

Time Required – at least 4 60-minute periods

Disciplinary Vocabulary – fraction, percentage, rate, ratio, probability, op art, color field painting

Materials Needed:

- ¼" pony beads (100 beads for pair of students; 2 colors – 50 of each)

- 8" coffee filters (4 for each student plus some extras for mistakes)
- non-stretchy string (24" piece for each pair of students)
- pencils
- grid worksheet for art project (1 for each student – included)
- inch grid handout (optional – 1 for each student)
- 11 x 17 paper (optional – 1 for each student)
- colored paper (variety of bright colors)
- scissors (1 pair for each student)
- glue sticks (at least 1 for each pair of students)
- Show Me cards (set of cards lettered a, b, c, d for each student – included)
- phones or tablets for students to use to take pictures of their work (optional)
- chart or butcher paper for anchor charts (optional)

Materials notes:

Percent bead strings

Each set of 100 beads should be made up of two different colors, 50 of each. It doesn't really matter what the colors are, but having all the sets the same will make it easier to give directions to students when they string the beads. Put the beads and string in zip bags to pass out to students.

The coffee filters have to be 8" or the percent bead string won't fit properly. Packages are generally labeled with the size of the filter. Make a string of beads ahead of time and practice putting it around the outside edge of the filter. This will be important in the EXPLORE part of the lesson.

Art Connection

The grid handout is included in the materials for the lesson. Because the handout is on standard, letter-sized paper, the grid squares are only about $\frac{1}{2}$ " square. Run it on white card stock if possible.

Each student will need 100 colored squares to complete a picture. One way to make this as easy as possible would be to run the grid on colored paper or card stock. Then cut the grid in strips. Students can pick up strips and cut the squares they want to use in their pictures apart, leaving any they don't want for someone else to use.

If you have access to 11 x 17 paper, use that. There is another grid included in the handouts. This one has 1" squares. Run those on colored paper as suggested above.

Then students arrange and glue their squares in a 10 by 10 grid on the larger piece of paper. They might use a ruler to mark the borders of the 10" by 10" square

Formative Assessment Strategies: Think-Ink-Pair-Share, Show Me

Engage

- Use the disciplinary literacy strategy Think, Ink, Pair, Share. This strategy gives students the opportunity to first consider a prompt individually and commit to their thinking by writing down their ideas. Then, each student pairs with another to share their initial thinking and consider another point of view.
- Display the Fraction Action warm up. Students should individually **Think and Ink** their responses in their math notebooks.

Fraction Action

$\frac{2}{5}$ The top number is called the _____.

What information does it tell you about the fraction?

The bottom number is called the _____.

What information does it tell you about the fraction?


Draw 3 different representations for $\frac{2}{5}$

- When cued, students turn to their elbow partner and Pair and Share their responses.
- Ask volunteers to share their answers with the whole class.
- Be sure that models for multiple representations are included and encourage students to add any they don't already have to their notes.
- Models should include both partitioned figures and sets. Make note of students who represent $\frac{2}{5}$ as an equivalent fraction, such as $\frac{4}{10}$ or who use a number line model.
- Students work in pairs for the remainder of the lesson.

Explore

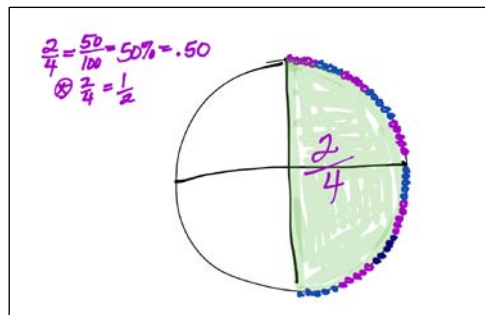
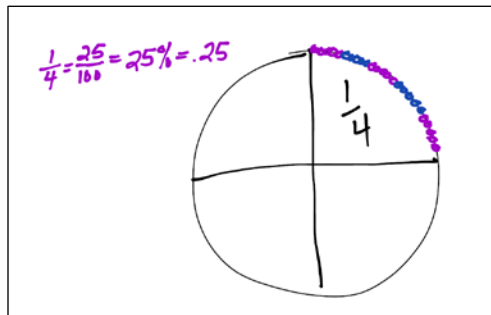
- Each pair of students needs materials to make a percent bead string. Instruct students to string bead in sets of 5, alternating between the two colors. The percent bead strings have 100 beads.

FOURTHS

- Give each pair of students a coffee filter. Have them fold it in half and then half again, making a good crease each time. When they open the filter, have them use a straight edge to carefully trace the creases.
 - Have students place their percent string around the outside of the coffee filter with the beads lined up so that a colored section begins on a crease line.
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- Draw a circle and partition in fourths to represent the coffee filter. Begin discussion by asking the following questions. Scribe student answers.
 - *What fractional part does one of the sections represent? How do you know?*
 - *What fractional part of the beads goes around the edge of one section? How do you know?*
 - *What other fractional parts are represented by the sections on the coffee filter? What fractional parts of 100 are represented?*
 - *How can the fractional parts be written as decimal numbers?*
 - Refer to the Essential Question for the lesson: How can I use what I know about fractions to help me understand percentage? Tell students that percentages are another way to represent parts of a whole.
 - Introduce the % sign and tell students that a fraction with a denominator of 100 can be written using that sign.
 - Have students draw the models for each example in their notebooks.
 - $\frac{1}{4} = \frac{25}{100} = 25\% = .25$
 - $\frac{2}{4} = \frac{50}{100} = 50\% = .5$ or $.50$ ($\frac{2}{4} = \frac{1}{2}$)
 - $\frac{3}{4} = \frac{75}{100} = 75\% = .75$

$$\circ \frac{4}{4} = \frac{100}{100} = 100\% = 1$$

Examples:



- Be sure to emphasize that this lesson is the beginning of learning about percentages. Head off possible future misconceptions and tell students that every whole they consider won't have exactly 100 parts like their percent strings. This fact is demonstrated by the coffee filter fractions that show fourths. In that case, the whole only has 4 parts but all the parts together equal 100%
- Take pictures of student work, print and use to make class anchor charts.

Explain

Part 1: FIFTHS

- Give each pair of students another coffee filter. Have them fold in half and then half again. This time, they'll use the percent string to find the fractions so they shouldn't trace the creases, but only put a dot at the intersection to mark the center of the filter.
- Have students place their percent string around the outside edge of the coffee filter and make a mark for every set of 20 beads.
- Next, have them use a straight edge to draw a line from each mark to the center of the filter.
- Then have students work to find the answers to the following questions:
 - *What fractional part does one of the sections represent? How do you know?*
 - *What fractional part of the beads goes around the edge of one section? How do you know?*
 - *What other fractional parts are represented by the sections on the coffee filter? What fractional parts of 100 are represented?*

- How can the fractional parts be written as decimal numbers?
- Have pairs of students form groups of four to compare work.
- Have students draw the models for each example in their math notebooks:

○ $\frac{1}{5} = \frac{20}{100} = 20\% = .2$ or .20

○ $\frac{2}{5} = \frac{40}{100} = 40\% = .4$ or .40

○ $\frac{3}{5} = \frac{60}{100} = 60\% = .6$ or .60

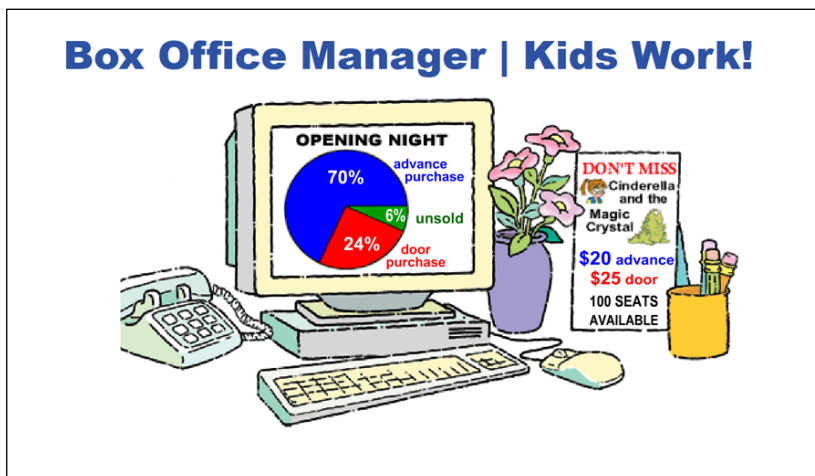
○ $\frac{4}{5} = \frac{80}{100} = 80\% = .8$ or .80

○ $\frac{5}{5} = \frac{100}{100} = 100\% = 1$

- Again, emphasize that this lesson is the beginning of learning about percentages. Head off possible future misconceptions and tell students that every whole they consider won't have exactly 100 parts like their percent strings. This fact is demonstrated by the coffee filter fractions that show fifths. In this case, the whole has only 5 parts but all the parts together equal 100%.
- Take pictures of student work, print and use to make class anchor charts.

Part 2: Check for Understanding

Box Office Manager – Kids Work (Know It All)



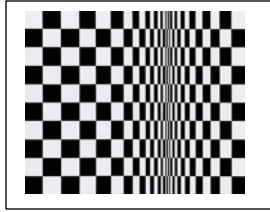
- Pass out the Show Me cards.
- Use the interactive white board to project the Box Office Manager video.
<http://knowitall.org/content/box-office-manager-kids-work-0>
- Have students brainstorm a list of all the information available in the picture and write it in their math notebooks.
- There are 5 multiple choice questions in the video. Go through them one at a time and have students hold up the letter card that corresponds to the answer of their choice.
- Have partners check in with each other, discuss how they got the answer, and decide to keep or change. Poll the room again. Reveal the answer and ask for an explanation.
- Repeat with each question.
- As an exit ticket, have students write one additional question that can be answered from the information given, answer it, and turn it in.

Extend

Art connection: The *op art* and *color field painting* movements of the mid to late 20th century often used geometric patterns and bright colors. The idea for this part of the lesson is based on an article from Mathematics Teaching in the Middle School. The article can be found at <http://mason.gmu.edu/~jsuh4/math%20masterpiece.pdf>

- Share examples of op art and color field painting art with students. Links and examples are included.
- Pay specific attention to *Colors for a Large Wall* by Ellsworth Kelly. The students will create a picture using this piece of art as an example.
- Give each student a copy of the grid handout.
- Have copies of the grid run on various colors of paper or cardstock available.
- Students choose the colors they want to use and cut apart the grids.
- Students arrange the squares of colored paper on the grid in a pattern that is appealing to them and glue the squares on the grid.
- Then students complete the chart at the bottom of the handout. Partners check each others' charts for accuracy.
- Students write a two-paragraph essay on their work. The first paragraph should describe the design of their artwork, why they chose the colors, and how they decided to create the design. The second paragraph should explain how their work in the chart at the bottom of the handout.

Examples of Op Art



Movement in Squares
Bridget Riley, 1961

<https://www.google.com/culturalinstitute/beta/asset/movement-in-squares/dwGpQ5o3Dc4FrQ?hl=en-GB>



Folkokta
Victor Vasarely, 1973

<https://www.artsy.net/artwork/victor-vasarely-folkokta-1>



Blanc et Couleur
Jesus Rafael Soto, 1975

<https://www.artsy.net/artwork/jesus-rafael-soto-blanc-et-couleur>

Examples of Color Field Painting Art



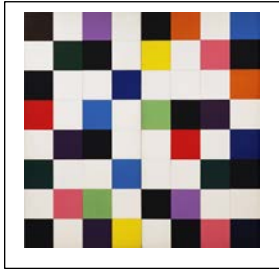
The Metropolitan Museum of Art, 1870-1970
Frank Stella, 1970

http://www.theartstory.org/movement-color-field-painting-artworks.htm#pnt_5



Nature Abhors a Vacuum
Helen Frankenthaler, 1973

http://www.theartstory.org/movement-color-field-painting-artworks.htm#pnt_5



Colors for a Large Wall
Ellsworth Kelly, 1951

<https://www.moma.org/collection/works/80528?locale=en>

See these links for more information:

<http://www.theartstory.org/movement-color-field-painting.htm>

<http://www.theartstory.org/movement-op-art.htm>

These are good links for students:

<http://artsmarts4kids.blogspot.com/2008/05/color-field-painting.html>

<http://kids1.tate.org.uk/blog/what-is-op-art/>