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Instructional Design
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Rationale

Many problems arise in the math classroom in today's world of technology. Most parents of the school aged, Generation X, learned, the "old school" methods for solving problems, like the traditional algorithms for long division and for multi-digit multiplication. The Millennial generation has become reliant on their technology, using their phones as calculators and relying on their computers to do the algorithms for them. The students in today's classroom, now struggle to see the value in learning things the traditional ways when they all already have smartphones with calculators that can perform the same operations for them. As a teacher I find myself struggling with finding a balance between using the resources we have and learning what they must know foundationally to be able to perform mathematical operations without technology. Learning multiplication and division in a flexible and fluid way is what will allow students to continue their learning with ease. Almost everything in math relates in some may to having an understanding of multiplication and division. This includes fractions. Fractions are a major content area focus for the 4th grade under the Common Core State Standards (CCSS). To simply be able to add and subtraction fractions, students must first know how to multiply and divide, since this is the way equivalent fractions are made. The problems I encounter when teaching my fraction unit is that the background knowledge of the multiplication and division and the real world connections are lacking in most of my students. Evidence shows that students learn better when able to use manipulatives, whether or not they are concrete or virtual. Therefore, a large piece of the introductory and developmental stages of the lesson plans will include manipulatives in concrete and virtual forms. (Burns & Hamm, 2011) This curriculum design will follow the model of the basic lesson plan structure as described in the text, *Curriculum in Context*, Chiarelott, 2006. (Chiarelott, 2006) The instructional design I am

presenting models the basic lesson plan structure, including in each lesson an introductory task, a developmental task and a concluding task. I will be covering the first three lessons in the Fraction unit, which include how to create fractions with common denominators, adding fractions with like denominators and subtracting fractions with like denominators and the identification and naming of mixed numbers and improper fractions.

The lessons will not end after the ones presented. They will continue further to demonstrate to students the different ways we use mixed numbers and improper fractions and how all fractions can be applied to real life situations.

Measurable Learner Outcomes

Adding and Subtracting Fractions

- Students will understand addition and subtraction of fractions as joining and separating parts referring to the same whole. 4.NF.3 (comprehension)
- Students will add and subtract mixed numbers with like denominators. 4.NF.3 (application)
- Students will solve word problems involving addition and subtraction of fractions with like denominators. 4.NF.3 (application, analysis)
- Students will compare two fractions with different numerators and different denominators by creating common denominators or numerators or by comparing them to a benchmark fraction like one-half. 4.NF.2 (comprehension, memory/recall)

Pre-Assessment

The pre-assessment will cover a variety of topics, not limited to what the learner outcomes are. The pre-assessment will also cover some pre-requisite skills that the students need in order to be able to learn the new concepts. As the teacher, I have to know what pre-requisite skills are missing so I can first address those before teaching my new content. It will also show me which students may already have an understanding of the skill and could need extension of the skill to reinforce the concept they already grasp. According to the CCSS, students in grade three should be able to "Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size." They should also already, by 4^{th} grade, be able to "Recognize and generate simple equivalent fractions, e.g., 1/2 = 2/4, 4/6 = 2/3. Explain why the fractions are equivalent, e.g., by using a visual fraction model." (Common Core State Standards, 2015)

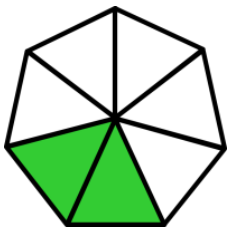
PRE-ASSESSMENT

Choose the best answer to the question given.

1. Label the numerator and the denominator:

2 _____
---
5 _____

2. What fraction does this model represent?



3. List 2 equivalent fractions for 2/3

4. 2/5 + 2/5

A.4/10

B.7/7

C.4/5

D.8/10

5. 7/8 – 3/8

A.5/8

B.4/8

C.10/16

D.10/8

6. 1/4 + 1/2

A.2/6

B.2/4

C.2/3

D.3/4

7. 10/12 – 2/6

A.6/8

B.1/2

C.8/8

D.4/10

8. Sarah measured out 4 1/5 cups of white sugar, while Daniel measured out 3 2/5 of brown sugar. How much sugar did Sarah and Daniel measure together?

A. 7 3/5 C. 1 1/5

B. 7 4/5 D. 1 4/5

LESSON PLANS

LESSON 1

How to create equivalent fractions to have common denominators and add fractions

Materials Needed:

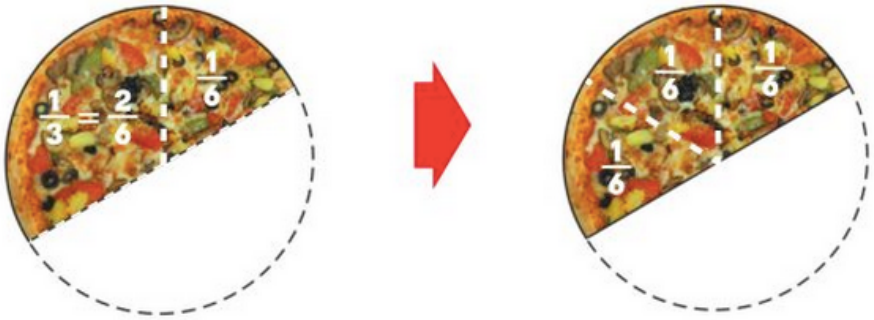
Colored paper, scissors, pencils, fraction circles, whiteboards, markers, smart board

Introductory task: 10 min

Students will work in groups of different sizes. Give a piece of colored paper and a pair of scissors to each group. Have students cut the piece of paper into smaller pieces so that they can share the piece equally. Encourage students to fold or draw dividing lines on the piece of paper before cutting it up into equal pieces. This activity reinforces the concept of fractions, and prepares students to add fractions. This activity allows students to make connections to their prior knowledge, students know how to split a whole into equal pieces whether or not they know that they're working on fractions. The teacher will encourage the students to think about what size piece they're holding and how their pieces are connected to each other's. This will segway into the following:

Developmental task: 30 min

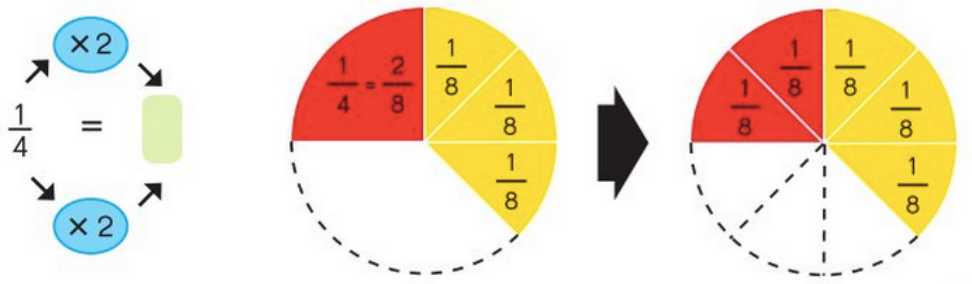
The teacher will present the question.
Lisa ate 1/3 of a pizza. Katie ate 1/6 of the same pizza what fraction of the pizza did they eat all together?
Then, the teacher will show the model to help while discussing the following:



Students add unlike fractions by finding equivalent fractions first. Ask: Are these like fractions? (no) Why? (The denominators are different.) These are unlike fractions because they have different denominators.

- Point out that when adding unlike fractions, the fractions have to be rewritten as fractions with the same denominators first.
- Review the concept of equivalent fractions and how to find them. Invite a student to name an equivalent fraction of 1/3 with a denominator of 6. Explain how to find it — multiply the numerator and denominator of by 2 to get the equivalent fraction of 2/6.
    - Then add 2/6 and 1/6 together to get 3/6 which in simplest form is ½, they ate ½ of the pizza.
    - Students can model this using their fraction circles.

Then the teacher will ask the students to practice on their own:
Add ¼ and 3/8. The teacher will offer the students this model and this scaffolding to aid in solving the problem.



Students should come to the following answer

¼ + 3/8 = 2/8 + 3/8 = 5/8

Concluding task: 10 min

Finally, the teacher will display the following three problems on the board for the students to complete on their boards. The teacher will record the correct and incorrect responses to use for future lesson planning:

1. ¾ + 1/8
2. 1/3 + 5/12
3. 2/10 + ½

LESSON 2

How to create equivalent fractions to have common denominators and subtract fractions

Materials Needed:

Fraction circles, whiteboards, markers, smart board

Introductory task: 10 min

Students will work in pairs.
Give each pair a set of fractions circles and pull out and put together the all 6, 1/6 pieces and say: This is one whole.
Ask: What fraction of the whole is each piece? 1/6
Put together three pieces and say: what fraction are we representing? Possible answers include, 3/6 or ½.
Remove 1/6 and ask: what do we have now? Answer: 2/6
So we have 3/6 – 1/6 = 2/6
Allow students time to formulate similar problems with the sixth pieces and find the answers.

Developmental task: 30 min

Students subtract unlike fractions by finding equivalent fractions first.
Display the following problem on the board:
Leo ate ½ of a pizza. Miranda ate 3/8 of the same pizza. Who ate more?

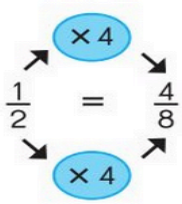
- Explain the problem in the example. Write the two fractions: ½ and 3/8. Ask: Are the like fractions? (no) Say: They are unlike fractions because they have different denominators.

The teacher will show the following model, to connect to the previous day's lesson.

- Point out that when comparing or subtracting unlike fractions, the fractions have to be changed to fractions with identical denominators first.

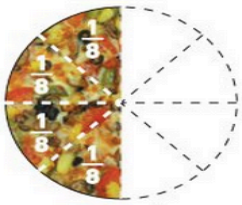
- Review the concept of equivalent fractions and the teacher will invite a student to name a fraction equivalent to ½ that has a denominator of 8. (4/8)
- Have another student explain how to find it. (multiply the numerator and the denominator of ½ by 4.)
- Then, subtract the two fractions to get the answer.

The teacher can use the following model and formula to aid in comprehension.

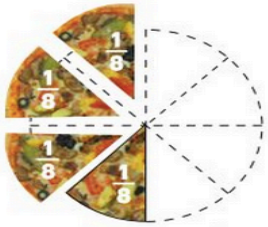


Then subtract.

$$\frac{1}{2} - \frac{3}{8} = \frac{4}{8} - \frac{3}{8}$$
$$= \frac{1}{8}$$



Leo ate $\frac{4}{8}$ of the pizza.



Miranda ate $\frac{3}{8}$ of the pizza.

Students can then work with fraction circles to solve the following, while the teacher aides students in completion.

1. 7/10 – 2/5 2. 7/12 - 5/6 3. ¾ - 1/2

Concluding task: 10 min

After two days of lessons, students should be able to solve the problem of the lesson. This problem will force the students to properly analyze the problem and apply the methods we have been learning in the previous lessons. The teacher will record correct and incorrect responses for lesson planning.

PROBLEM of the LESSON

$\frac{4}{5}$ of the fruit in a basket are apples. $\frac{7}{10}$ of the apples are red apples. What fraction of the apples are green apples? Express your answer in simplest form.

Teacher and students will discuss the formula and the solution together.
4/5 – 7/10
Rename 4/5 as 8/10
8/10 -7/10 = 1/10, 1/10 of the apples are green.

LESSON 3

How to name and identify mixed numbers and improper fractions

Materials Needed:

Fraction circles, whiteboards, markers, smart board

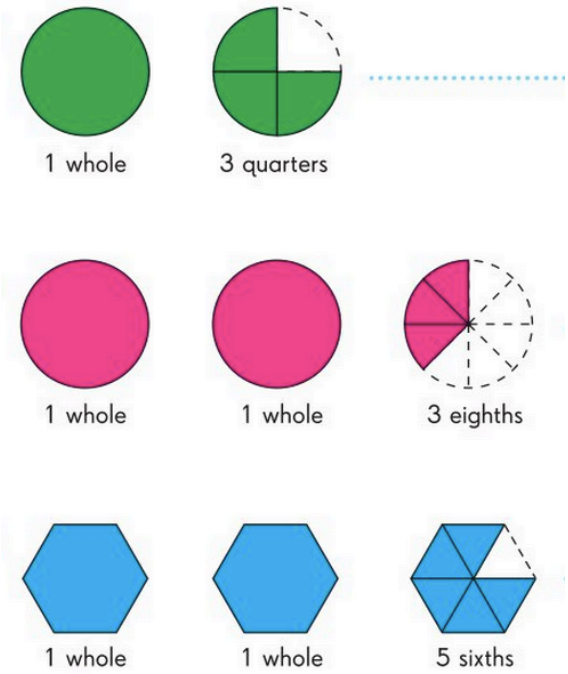
Introductory task: 10 min

Students will work in pairs then in groups.
Give each pair a set of fractions circles and pull out and put together the all 6, 1/6 pieces and say: This is one whole.
Then give each pair only 4 of the sixths.
Then ask them to partner with another pair and figure out how to name how many sixths they have all together? How many wholes and sixths do they have?
Possible answers: 1 whole and 2/6 or 1 1/3 or 8/6

Developmental task: 30 min

The teacher will display the following:

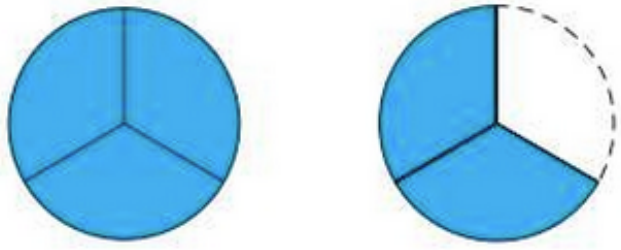
The teacher will lead the students to see that there are 2 whole watermelons and a half of a watermelon. The mixed number can be represented as 2 ½, the 2 is the whole number and the ½ is the fractional part.
A Mixed number is the sum of a whole number and a proper fraction.
Students will identify the following models as a mixed number on their whiteboards.



The teacher will be able to summatively assess the comprehension of the students based on their responses.

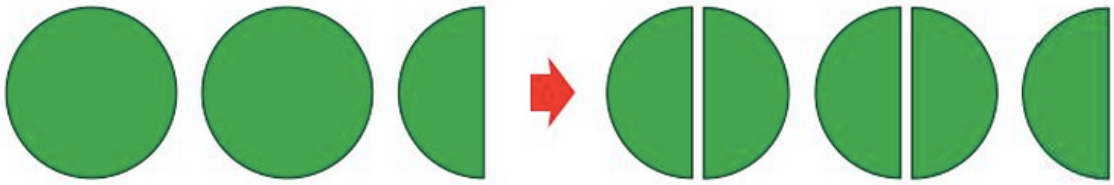
While the students are in the mindset of mixed numbers, the teacher will introduce a new way to name the same models, without changing their values.

The teacher will display:



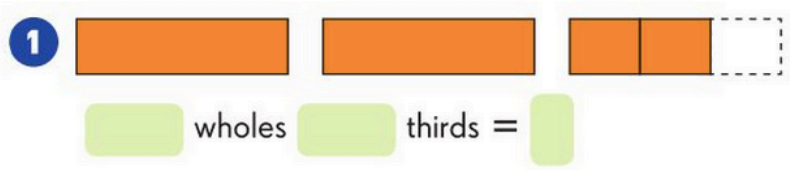
The teacher will ask: How many wholes do you see? (1) and how many thirds? (2)
The mixed number of this would be 1 2/3
But when we look at the pieces that make up the whole we can name it by the number of thirds it has. Answer: 5/3
Let's try another one, teacher will display:

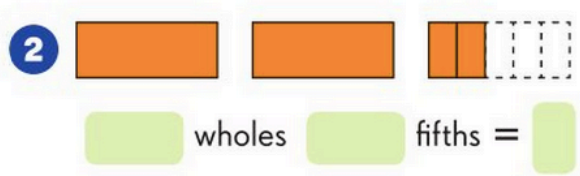
How many halves are there in $2\frac{1}{2}$?

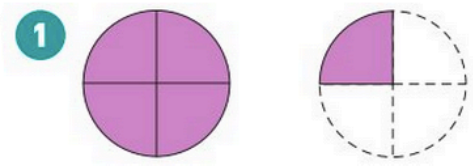


Answer: 5/2

Finally the teacher will ask the students to answer the following on their whiteboards.



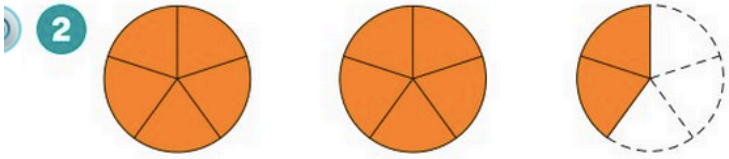




There are ____ fourths in $1\frac{1}{4}$.

$1\frac{1}{4} = \square + \square + \square + \square + \square$

$= \square$



There are ____ fifths in $2\frac{2}{5}$.

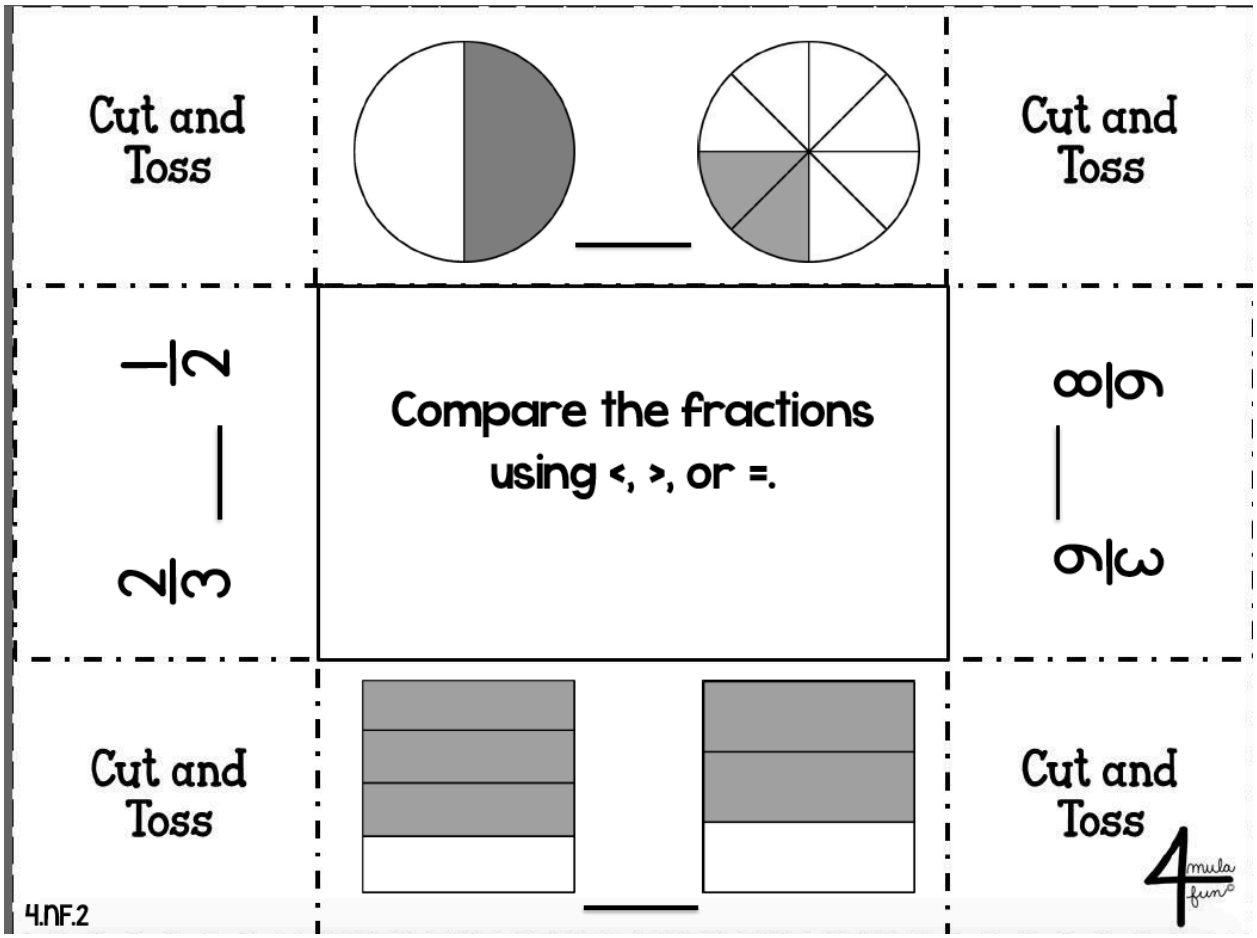
The students should be able to identify all of the answers. This will show a mastery of the content.

Closing task: 10 min
Students will be able to demonstrate how to name and rename models as mixed numbers and improper fractions by drawing models to show both.

Rename: 13/5 Rename: 1 1/3 Rename: 14/2 Rename: 2 1/5

Supplemental Resources

Students all have a notebook to glue resources into that becomes an interactive study source for this unit. Attached are some corresponding foldables:



Cut and Toss

$\frac{1}{5} + \frac{3}{5} =$

Cut and Toss

$\frac{1}{4} + \frac{3}{4} =$

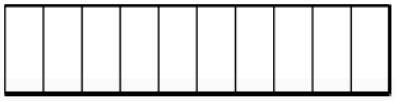
Adding Fractions

Shade the first fraction with one color and the other fraction with another color. How many total parts are shaded?

$2\frac{1}{2} + 2\frac{1}{2} =$

Cut and Toss

$\frac{3}{10} + \frac{4}{10} =$



Cut and Toss

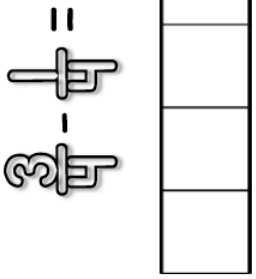
4.NF.3

4mula fun

Cut and Toss

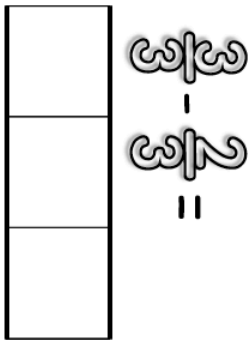
$\frac{5}{8} - \frac{3}{8} =$

Cut and Toss



Subtracting Fractions

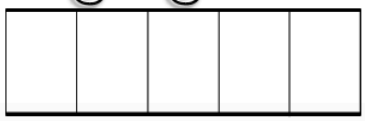
Shade the first fraction. Then X out the second fraction. How many parts are left?



$\frac{3}{3} - \frac{2}{3} =$

Cut and Toss

$\frac{4}{5} - \frac{3}{5} =$



Cut and Toss

4.NF.3

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Post Assessment

The post assessment will offer students an opportunity to show what they have learned in a multitude of ways. The teacher will be able to see students demonstrating their knowledge through an application of the skills in various ways. This assessment is aligned to the CCSS and it allows the students to apply their skills in a variety of ways. The post assessment will include topics not covered in the three lessons presented, but rather the whole unit. The teacher will be able to use the data from the pre-assessment and the post assessments to compare and show growth. The assessment will also allow the teacher to see which students have achieved mastery by achieving a grade of 70% or better.

Post Assessment

1. Molly has 3 whole Snicker's bars and ¼ of another. What is this mixed number written as an improper fraction?

A. 4/4 B. 3/4 C. 13/4 D. 3 and ¼

2. In cooking class, Mrs. Mintz told the students to grab a measuring cup and measure out the amount of chocolate chips they wanted to add to their cookie mixture. Anthony measured out 3/5, Dominic measured out 1/5, and Stacy measured out 4/5. Which answer represents the amount of chocolate chips Anthony, Dominic and Stacy measured out combined?

A. Eight-fifteenths

B. Seven-tenths

C. One and five-fifths

D. One and three-fifths

3. 10/11 is _____ 4/5.

A. Less than

B. Greater than

C. Equal to

D. Equivalent to

4. Four and two-sixths equals____, written as an improper fraction:

A. 8/6

B. 24/6

C. 26/6

D. 18/6

5. Monica added 3 5/6 and 2 5/6 and got the sum 5 10.6 . What is the proper way to write this answer?

A. Five and six-tenths

B. Five and six-sixths

C. Four and five-sixths

D. Six and four-sixths

6. Which 2 fractions are equivalent?

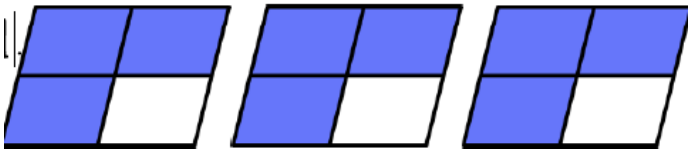
A. ½ and 3/6

B. 2/4 and ¾

C. 4/5 and 5/8

D. 5/9 and 10/20

7. Which equation is represented by the shaded parts of the picture?



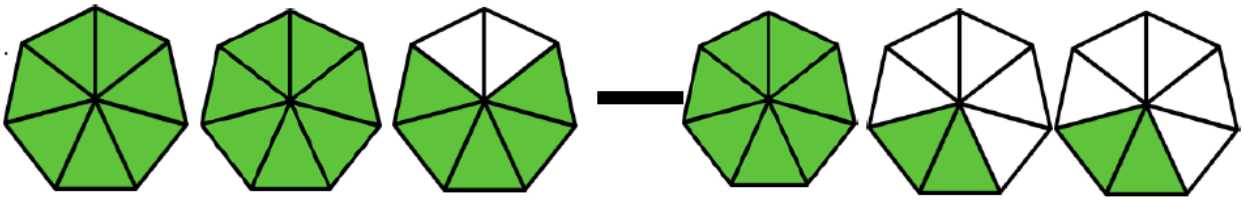
A. 3+3+3

B. ¾ x 3

C. ¼ x 3

D. 3x3

8. What equation is being represented in the model?
What is the answer to the equation shown in the model?



Answer: _____

9. Laila drank 1/3 of the water in her water bottle at practice every Tuesday and Thursday. If she did this each week for 3 weeks, how much water did Laila drink?

A. 2/3 cup

B. 3/3 or 1 whole cup

C. 6 cups

D. 2 cups

10. Sandra needed the following ingredients to make a cake.

•¾ cup of sugar

•4/8 cup of water

•3/6 cup of flour

•¼ cup of milk

Which two ingredients would Sandra have the same amount of?

A. Sugar & Water B. Sugar & Milk

C.Water & Flour D.Flour & Milk

References

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