# Lab 6

## Exploring & Modeling Fractional Numbers

**Objectives:**

1. The teacher will explore methods for mentally estimating the size of a fractional number.
2. The teacher will explore methods for mentally comparing fractional numbers.
3. The teacher will explore utilizing games as a method for becoming more comfortable with fractional numbers.
4. The teacher will explore modeling and comparing fractions using wooden blocks, Cuisenaire Rods and Geoboards.
5. The teacher will utilize appropriate terminology when describing fractions.

***NOTE: NO CALCULATORS OR DIRECT CALCULATION SHOULD BE USED IN THIS LAB***

---

***Terms and Ideas to Know***

$\frac{1}{2}$ ← Numerator
Denominator

The fraction describes **parts of a whole**. The numerator tells us how many of the equal parts the fraction stands for and the denominator tells us how many equal parts are in the whole.[†]

**TOPIC: FRACTION SORTING**

- ***Materials: 1 set of FRACTION CARDS***

**1.**

Please look at the fraction cards while you answer a, b & c.

a. How would you explain the following to a child using the terms, ***part*** and ***whole***?

***"A fraction is (usually) close to 1[‡] if the numerator and denominator are approximately the same size."***

b. How would you explain the following to a child using the terms, ***part*** and ***whole***?

***"A fraction is (usually) close to [1/2] if the denominator is about twice the size of the numerator."***

c. Fill in the following:

***"A fraction is (usually) close to 0 if_____."***

How would you explain this to a child using the terms, ***part*** and ***whole***?

---

[†] ' "Math To Know", Mary Cavanagh, Great Source Educational Group

[‡] 0, 1/2, 1 and other similar fractions are called "Benchmark" Fractions. It is particularly helpful to have a strong understanding of their relative positions and values on the number line.

**TOPIC: THE FRACTION SORTING GAME**

- ***Materials: 1 set of FRACTION CARDS per playing group***
- ***ONE FRACTION SORTING BOARD per playing group (next page)***

d.

- Split into small playing groups of 2 or 3 students for the following.

***GAME PLAY (for each playing group)***

- Take the deck of fraction cards and shuffle them.
- Take turns taking a card and placing it in the appropriate column on the **FRACTION SORTING BOARD** [next page]
- Each time you place a card explain to your partner(s) why you are placing a card in this position.
- Make a note of the **FIRST TEN** fractions and the reasons you place them in their position on the table below.
- Use all of the cards--explaining their placement out loud to your partner(s)

| **FRACTION SORTING GAME RESPONSE TABLE** | | | | | | |
|---|---|---|---|---|---|---|
| **Turn** | **Close to 0** | **Close to but less than 1/2** | **1/2** | **Close to but greater than 1/2** | **Close to 1** | **Brief reason Do not use a calculated decimal number** |
| **1.** | | | | | | |
| **2.** | | | | | | |
| **3.** | | | | | | |
| **4.** | | | | | | |
| **5.** | | | | | | |
| **6.** | | | | | | |
| **7.** | | | | | | |
| **8.** | | | | | | |
| **9.** | | | | | | |
| **10.** | | | | | | |

- ***Move forward to page 5 after you complete this table.***

# FRACTION SORTING BOARD

## For the "Fraction Sorting Game"

| CLOSE TO 0 | CLOSE TO BUT LESS THAN $\frac{1}{2}$ | CLOSE TO BUT GREATER THAN $\frac{1}{2}$ | CLOSE TO 1 |
|---|---|---|---|
| | | | |

# FRACTIONS GAME BOARD
## For "Fraction War"

| PLAYER A | PLAYER B | PLAYER C (optional) |
|---|---|---|
| | | |
| | | |

*Playing teams should now combine back into 1 larger group*

2. As a group, for each of the following briefly explain your answer. Do not use a calculated decimal in your answer.

Given the fraction: $\frac{15}{\square}$ Placeholder

a. What numbers or range of numbers would work well for $\square$ to make the fraction close to 0?

b. What numbers or range of numbers would work well for $\square$ to make the fraction close to but less than 1/2?

c. What numbers or range of numbers would work well for $\square$ to make the fraction close to but greater than 1/2?

d. What numbers or range of numbers would work well for $\square$ to make the fraction close 1?

---

Given the fraction: $\frac{\square}{25}$

e. What numbers or range of numbers would work well for $\square$ to make the fraction close to 0?

f. What numbers or range of numbers would work well for $\square$ to make the fraction close to but less than 1/2?

g. What numbers or range of numbers would work well for $\square$ to make the fraction close to but greater than 1/2?

h. What numbers or range of numbers would work well for $\square$ to make the fraction close 1?

**TOPIC: FRACTION WAR GAME**

- ***Materials: 1 set of NUMERAL CARDS per playing group***
- ***ONE FRACTION WAR GAME BOARD per playing group (page 4)***

3. **Fraction War**[§]

- Split into small playing groups of 2 or 3 students for the following.

***GAME SET-UP (each playing group)***

- Take a deck of numeral cards (0, 1, 2, 3, 4, 5, 6, 7, 8, 9 & Wild) and shuffle the cards.
- Deal the cards evenly among the players. (Just set any "extra" cards aside).

***GAME PLAY***

- Each player turns up two cards from their personal pile of cards and follows the directions from the chosen game (below) to form a fraction on the **FRACTION WAR GAME BOARD.** [page 4 on the back of the Fractions Sorting Board]
- The order in which you place your cards is your choice. You can choice the numerator and you can choose the denominator each time you turn up two cards.
- The winner of each round (games below) picks up all four (or six) cards and places them FACE UP at the bottom of their pile of cards.
- If there is a tie between two or more players, repeat the play and the winner takes all of the cards.
- Play ends when the players have played all of their face down cards.
- The winner is the player with the most cards.

***Fraction War Games*** [Use the Fraction War Game Board]

a. Play Game One: What is the best strategy for winning Game One? Why is this the best strategy?

- Game One: *THE SMALLEST FRACTION*

Players form a fraction with their two cards on the Fractions Game Board. The player with the smallest fraction wins.

b. Play Game Two: What is the best strategy for winning Game Two? Why is this the best strategy?

- Game Two: *THE BIGGEST FRACTION*

Players form a fraction with their two cards on the Fractions Game Board. The player with the biggest fraction wins.

c. Play Game Three: What is the best strategy for winning Game Three? Why is this the best strategy?

- Game Three: *CLOSEST TO 1/2*

Players form a fraction with their two cards on the Fractions Game Board. The player whose fraction is closest to 1/2 wins.

[§] Inspired by an activity from "Mathematics Activities for Elementary School Teachers, A Problem-Solving Approach," Dolan, Williamson and Muri.

d. Play Game Four: What is the best strategy for winning Game Four? Why is this the best strategy?

- Game Four: *CLOSEST TO 1*

Players form a fraction with their two cards on the Fractions Game Board. The player whose fraction is closest to 1 wins.

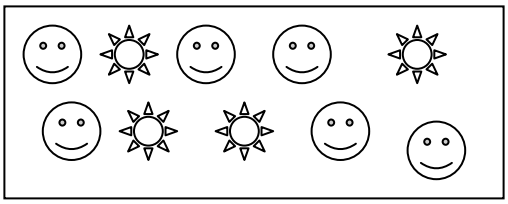
e. Design your own ***Fraction War*** game and describe your game here. Play your game. What is the best strategy for winning your game? Why is this the best strategy?

**<u>TOPIC: RECOGNIZING FRACTIONS</u>**

**[Look at your "Fraction Ideas Handout" for the rest of this lab]**

- ***Materials: PAPER AND PENCIL***

4. Consider the following set of suns and happy faces:



This set of _____ suns and happy faces is 1.

a. What part of the set is suns? Fractional number: _____

b. What part of the set is ***<u>EACH</u>*** sun? Fractional number: _____

Both of these sentences describes the suns as part of this set:
"Four of the ten objects in the set are suns." "The Suns are four-tenths of the set"

c. What part of the set is happy faces? Fractional number: _____

d. What part of the set is ***<u>EACH</u>*** happy face? Fractional number: _____

Write a sentence that describes the happy faces as part of this set:

- ***Materials: WOODEN CUBES***

e. As a group discuss how you could use wooden cubes to show the two fractions from the previous problem. What is your model for 1? Draw a picture of your work here:

The value of each block here is: _____ (fill in the blank)

This set of _____wooden cubes is 1.

5. For each of the following, as a group,

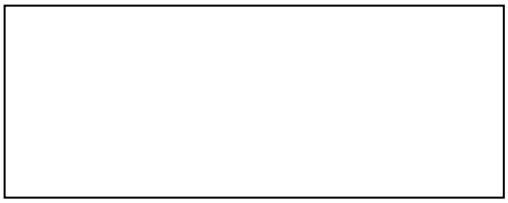
- For each part, use wooden blocks to model ***the most efficient unit set*** (model for one) that can be used to show each indicated fraction. Your model for one will vary for each part (a, b, c...)
- Draw a picture of the block set that you are using for your model for one.
- Circle the part of your set that shows the indicated fraction and LABEL this part of your set with the fraction name. Your fraction should look like the appropriate a of b parts while modeling the fraction a/b.

a. 1/2

The value of each block here is: _____ (fill in the blank)

This set of _____wooden cubes is 1.

b. 5/6



The value of each block here is: _____ (fill in the blank)

This set of _____wooden cubes is 1.

c. 8/11

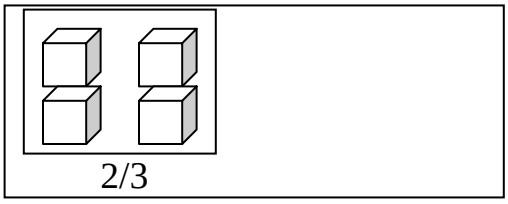
The value of each block here is: _____ (fill in the blank)

This set of _____wooden cubes is 1.

6. For each of the following, as a group,

- A fraction is given, but the model for one is not given.
- Use wooden blocks to model the unit set (model for one) that can be used to show the indicated fraction (this is not necessarily the most efficient model for one in every circumstance)..
- Draw a picture of the block model for one ***by completing the picture.***

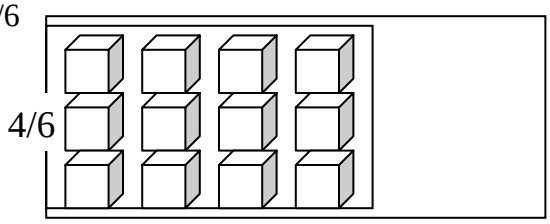
a. 2/3




The value of each block here is: _____ (fill in the blank)

This set of _____wooden cubes is 1.

b. 4/6




This set of _____wooden cubes is 1.

The value of each block here is: _____ (fill in the blank)

➢ ***Materials:*** **GEOBOARDS & GEOBANDS, 1 board per student**

Geoboards are wood or plastic square bases with pegs [nails or built in] that rubber "Geobands" can be wrapped around to form regions.

7. For each of the following, as a group,

- Use a Geoboard & Geobands to mark a region on the Geoboard to model a region for one and to model the indicated fraction. Your fraction (a/b) should look like the appropriate a of b parts.
- Sketch a picture of your Geoboard model by marking the region that you are using for one **and** the region that you are using for the fraction.
- **Label** the region that shows **one** and **label** the region that shows **the fraction**.

***Note: Count the squares on the Geoboards regions, not the nails.***

a. 2/3: Note you should have 3 total parts in your model for one and you should mark 2 of the parts to show 2/3.

The value of 1 square is: _____

b. (12)/(16)

The value of 1 square is: _____

c. (13)/(24)
How can you use your bands to make more than 16 regions?

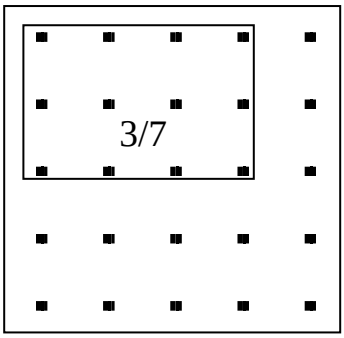
The value of 1 square is: _____

d. (18)/(32)

The value of 1 square is: _____

8. As a group,

- Use a Geoboard & Geobands to mark a region on the Geoboard to model a region for 1 and to model the indicated fraction. Your fraction (a/b) should look like the appropriate a of b parts.
- Sketch a picture of your Geoboard model ***by completing the picture*** by marking the region that you are using for one.
- Label the region that shows one.



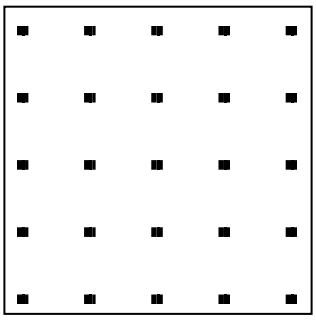

The value of 1 square is: _____

9. For each of the following, as a group,

- Take turns modeling a fraction on a Geoboard and then take turns determining which region represents 1.
- Sketch & label pictures of your fractions and regions for 1 here:
- Be creative, use regions that are *not rectangular* whenever possible!

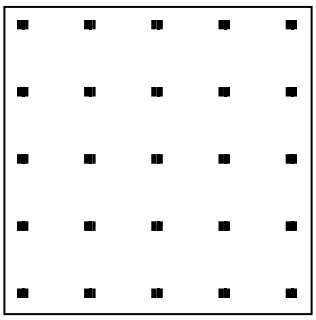
***Fill in the blanks with your names!***

a. _____ made the fraction and _____determined the region for 1



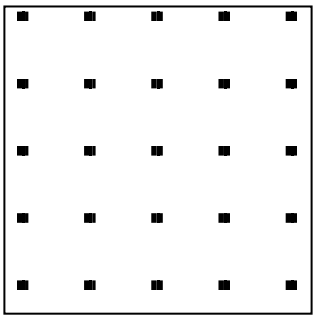
The value of 1 square is: _____

b. _____ made the fraction and _____determined the region for 1



The value of 1 square is: _____

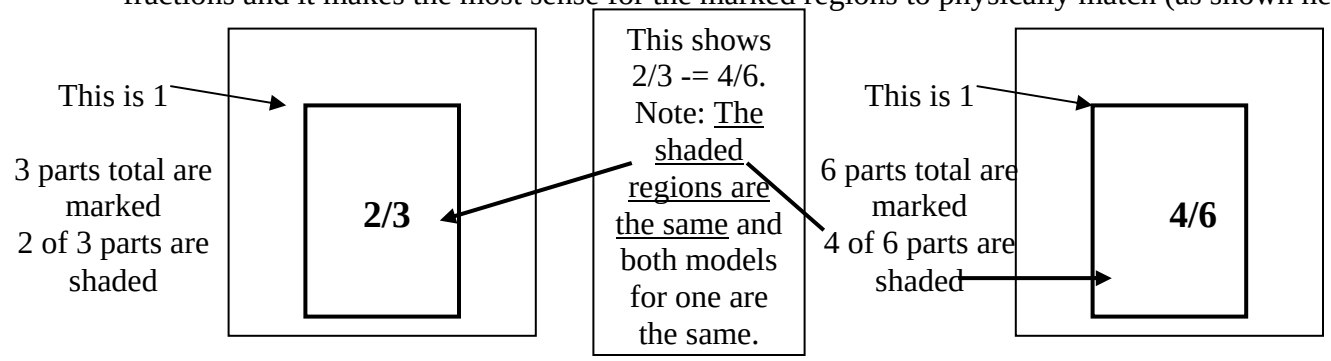
c. _____ made the fraction and _____determined the region for 1



The value of 1 square is: _____

10. As a group;

- Use a Geoboard to show the equivalence of the given fractions. Your fraction should look like the appropriate a of b parts. (So, for example, 3/6 will have to **show** 3 of 6 parts.)
- Sketch & label pictures of your fractions and regions for one here:
- This will only show the fractions are ***equivalent*** if you use the SAME model for one for each fractions and it makes the most sense for the marked regions to physically match (as shown here).




a. 1/2 = 3/6 = 6/12

b. 3/4 = 6/8 = 9/[12]

➢ ***Materials:*** **CUISENAIRE RODS**

With fractions we can start to fully explore the versatility of the Cuisenaire rod.

11. As a group, model each of the following with Cuisenaire Rods, label the pictures in a and b and sketch your own pictures for the rest of the problem.

a. If the red rod is 1 then the brown rod is _____

In this case the value of the white rod is: _____ (fill in the blank)

| Red | Rod | = | 1 |
|---|---|---|---|
| Brown Rod = _____ | | | |

***Sample sketch***

b. If the red rod is [1/2] then the brown rod is _____ and the _____ rod is 1.

In this case the value of the white rod is: _____

| Red | Rod | = | 1/2 |
|---|---|---|---|
| Brown Rod = _____ | | | |
| _____ Rod | | = 1 | |

***Sample sketch***

c. If the red rod is [1/3] then the brown rod is _____ and the _____ rod is 1.

In this case the value of the white rod is: _____

d. If the black rod is 1 then the light green rod is _____

In this case the value of the white rod is: _____

e. If the black rod is [1/2] then the brown rod is _____ and the _____ train is 1.

In this case the value of the white rod is: _____

f. If the black rod is [1/3] then the blue rod is _____ and the _____ train is 1.

In this case the value of the white rod is: _____

g. If the purple rod is [2/3] then the orange rod is _____ and the _____ rod is 1.

In this case the value of the white rod is: _____

12. Double check your understanding:
As a group, describe how to model 7/9 by comparing two Cuisenaire Rods. Draw and label the rods.

In this case the value of the white rod is: _____

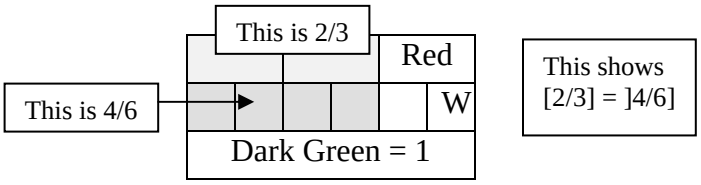
13. As a group; (see your FRACTION IDEAS handout)

- Use Cuisenaire Rods to show the equivalence of the given fractions [DON'T CONVERT THEM].
- Your fraction should look like the appropriate a rods of b rods.

So, for example, 1/2 would look like 1 of 2 rods, 3/7 would look like 3 of 7 rods, 2/3 would look like 2 of 3 rods but NOT like 4 whites in 6 whites.

- Remember, this will only show the fractions are equivalent if you use the SAME model for 1 for each fraction.

***Sample picture***




- Sketch & label pictures of your fractions here, be sure to say which rod or train is 1.
- DO NOT change the fractions by converting them to a common denominator or by reducing them.

a. Show [1/3] = [2/6] = [3/9]. Carefully discuss this with your group, make notes here for future reference.

b. Show [1/4] = [2/8] = [4/16] = [3/12]. Carefully discuss this with your group, make notes here for future reference.

***LAB SIX DISCUSSION QUESTIONS***

As a group, discuss and fill in the blank arrows. Feel free to also discuss/talk with the other groups.

What manipulatives could be used for MODELING FRACTIONS?

- Blocks
- Cards (regular or fraction cards)
- Cuisenaire Rods
- Geoboards
-
-
-
-

What mathematical knowledge would you want your students to KNOW prior to introducing MODELING FRACTIONS***?***

-

-

-

-

What mathematical knowledge would you want to EMPHASIZE while introducing MODELING FRACTIONS***?***

-

-

-

-