

Lesson Title: Fraction Rulers Trader's Game

Grade 3/4

Content Standard:

3.NF.1 Understand a fraction  $1/b$  as the quantity formed by 1 part when a whole is partitioned into  $b$  equal parts; understand a fraction  $a/b$  as the quantity formed by  $a$  parts of size  $1/b$ .

3.NF.2 Understand a fraction as a number on the number line; represent fractions on a number line diagram.

a. Represent a fraction  $1/b$  on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into  $b$  equal parts. Recognize that each part has size  $1/b$  and that the endpoint of the part based at 0 locates the number  $1/b$  on the number line.

b. Represent a fraction  $a/b$  (which may be greater than 1) on a number line diagram by marking off  $a$  lengths  $1/b$  from 0. Recognize that the resulting interval has size  $a/b$  and that its endpoint locates the number  $a/b$  on the number line.

3.NF.3 Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

a. Understand two fractions as equivalent if they are the same size or the same point on a number line.

b. Recognize and generate simple equivalent fractions, e.g.,  $\frac{1}{2} = \frac{2}{4}$ ,  $\frac{4}{6} = \frac{2}{3}$ . Explain why the fractions are equivalent. e.g., by using a visual fraction model.

c. Express whole numbers as fractions, and recognize fractions are equivalent to whole numbers.

Materials:

1 board for every 2-3 students. Boards are 18" (top to bottom) x 24" (side to side) laminated mats. The boards are divided into six 3" tall horizontal rectangles. The first (bottom) rectangle is partitioned into eight equal sized 3" x 3" squares. The next rectangle moving up the board is partitioned into six equal sized 3" x 4" rectangles. The next rectangle is partitioned into four 6" rectangles. The next rectangle is partitioned into three 3" x 8" rectangles. The next rectangle is partitioned into two 3" x 12" rectangles. The top rectangle is left as one whole and is not partitioned.

1 set of fraction cards per board. These are colored coded, laminated construction paper pieces that are sized to fit the partitions on the board. These are: eight red 3" x 3" cards (eighths), six green 3" x 4" cards (sixths), four yellow 3" x 6" cards (fourths), three blue 3" x 8" cards (thirds), and two orange 3"

x 12" cards (halves).

1 die per board. The die has six faces. Three of the faces are colored red (for eighths), two of the faces are colored green (for sixths), and the remaining face is colored yellow (for fourths).

Shared experience and procedure:

Assign the students to groups of 2 or 3. Each group needs a board, cards, and 1 die. Model for the class how the Trader's Game is played. Here are the rules: Player A rolls the die and places a piece of that color on the board in one of the spaces that is partitioned for that fraction. So if red is rolled a red eighth piece is placed on the board in one of the eight spaces on the bottom row of the board. If yellow is rolled, a yellow piece is placed on one of the four spaces of that size on the third row (from the bottom) of the board. After a roll and piece placement the player has a choice (this choice can never happen on the very first roll of the game, but may occur for either player after that). If, after placing a piece, there is some combination of pieces anywhere on the board that is equivalent to a larger piece, the player may choose to remove and exchange those pieces for the equivalent piece, and then place the equivalent piece into one of the spaces on the row that is partitioned into pieces of that size. If a player makes an exchange, that player is awarded an additional roll and piece placement. The player can then, if it is possible and the player chooses to do so, make another exchange and be awarded an additional roll. A player may have a situation where there are 2 possible trades on the board. The player may choose to make either of the trades but must roll and place a piece before making the other trade. The player's turn continues until that player can make no more exchanges or chooses not to make one. A player is awarded a point when a player can make an exchange for one whole (in fact I don't make "whole" pieces, but tell the players to verify the exchange by placing the pieces and exactly filling the top row of the board). Whenever a player makes a whole, that player's turn is over even if there are more exchanges left on the board. Note: recycle the smaller pieces after an exchange is made for use in future rolls.

After a period of play, stop play and have everyone in the class set their boards with the following pieces: one red, one green, one yellow, and one blue. With the board set with those pieces, tell them you have rolled red on the die, and they should add the red piece to the others already on the board. Ask them to now make all the exchanges they can with the 5 pieces they have on the board (no additional rolls, just the exchanges that are possible with those 5 pieces). Hand them 5 step lesson papers and ask them to use pictures and words to show all the exchanges they were able to make.

Possible picture: There are 4 possible exchanges: 2 reds for 1 yellow, 1 green and 1 blue for 1 orange, 2 yellow for 1 orange, and 2 orange for 1 whole. The students may choose to represent some or all of these trades with pictures of the pieces and how they match up. They may name the pieces by their color codes, formal terminology, or picture size. They may show a picture of the board and show how the pieces can be matched and moved to fill up the top row.

Possible people talk: Discussion should include all possible exchanges. It may also include combinations of pieces that cannot be exchanged. A discussion must be initiated as to what determined when an exchange could be made.

*Mathematical focus: The game provided the shared experience that each trade/exchange represented two ways to show the same amount (or in more formal terms that two fractions are equivalent if they are representations for the same amount or quantity).*

Feature talk: fractions (eighths, sixths, fourths, thirds, halves), pieces, colors (red, green, yellow, blue, orange), board, numbers, die, exchange, trade, equivalent, same amount, equal size, add, combine, equal, numerator, denominator, whole .

Feature sentences:

- 1) We traded two red pieces for one yellow piece because they were the same amount.
- 2) We traded two yellow pieces for one orange piece because they were the same amount.
- 3) We traded one green and one blue piece for one orange piece because they were the same amount.
- 4) We traded two orange pieces for one whole because they were the same amount.

Depending on what is generated by the class, the sentences may substitute synonyms for the key words in these feature sentences, i.e. Two eighths is equivalent to one fourth, etc.

Possible symbolic representation: Students may create a picture symbol for each of the different pieces, possibly color coded or drawn to scale. They may also use formal fraction symbols for the pieces. Exchanges may be shown with a merging of picture symbols or an equal sign. Some students may express the exchanges as  $1/8 + 1/8 = 1/4$ , etc.

Because there are four sentences, a teacher may choose to have them symbolically represent only the first one. When sharing a student's symbolic representation of the first sentence, the class can then try to represent the other three sentences using that representation.

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Search words: fractions, equivalent, game, 3<sup>rd</sup> grade, 4<sup>th</sup> grade