**Fraction Chain**

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| In this lesson, students explore correct placement of fractions on a number line.  |

**NC Mathematics Standards:**

**Number and Operations - Fractions**

**NC.4.NF.2** Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark such as ½. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or > and justify the conclusions by using a fraction model.

* Reasoning about their size and using area and length models.
* Using benchmark fractions 0, ½, and a whole.
* Comparing common numerator or common denominators.

**Additional/Supporting Standards:**

**NC 4.NF.1** Explain why a fraction is equivalent to another fraction by using area and length fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size.

**Standards for Mathematical Practice:**

3. Construct viable arguments and critique the reasoning of others.

5. Use appropriate tools strategically.

7. Look for and make use of structure.

**Student Outcomes:**

* I can partition a number line and correctly place fractions on it.
* I can use a number line and benchmark fractions to correctly compare fractions.

**Math Language:**

* equal
* equivalent fractions
* greater than/less than
* numerator/denominator

**Materials:**

* Fraction Cards – Cut out (attached)
* 6-10 feet of string - 1 piece per group
* paper clips
* graph paper

**Advance Preparation**:

* Gather materials, cut out fraction cards, cut the string

**Launch:**

1. Introducing the Number Line (8-10 minutes)

Prior to beginning this lesson, set up strings around the room where students are going to work in groups of four. Have one string available for a whole group discussion.

Discuss with the class about using a number line as another way to represent a fraction. Ask, “Where do we see fractions on number lines in the real world?” Examples include measuring distances, thermometers, graphs, coordinate grids. Use pictures or technology to show any of these examples.

Distribute the whole number cards (1-4) to each group of students. Discuss how we could arrange them on our number lines. (We don’t want a discussion about leaving space between the numbers at this time; we are just looking for the order.) Have one student share how they would arrange the cards on the whole group’s string.

Once students are in agreement, dismiss them to set the whole number cards on their own string, and return to the large group. Once the students have returned, discuss any differences between the group’s number lines.

Hand out the halves number cards next. Explain to the class that they are going to add these cards to their number line. Students will not have to return this time to the large group.

**Explore:**

1. Placing Cards on the Number Line (18-20 minutes)

Students place the halves number cards on their number line where they belong. They can adjust the whole number cards if they need to. If a half number card has the same value as a whole number card, the students are to hang it below the whole number card with a paper clip.

Once the majority of the class has set up their number line, stop everyone and discuss the work they have done up to this point. Possible questions:

* What changes to the number line did you need to make? Why?
* What did you do when you had 4/2 as a card? Why did you place it under the 2?
* Are 2 and 4/2 the same number? Why?
* Is there anything else that you notice about our number line at this time?
* Do you see any patterns beginning to form?
1. More Fraction Cards to Place

Hand out the remaining number cards (fourths, eights, and mixed numbers). Each group will need to place the cards on the number line. They are allowed to change or modify their number line at any time to make the task easier. They cannot remove any card from the number line, only move it.

As the students are completing the number line, the teacher is moving from group to group discussing patterns that students see, any problems they may be having, confirming or questioning students’ conjectures, and redirecting students that need help. The teacher is also listening for discussion points from small groups that need to be heard by the whole group.

**Discuss:**

1. Discussion of Fractions on a Number Line (15 -20 minutes)

Bring the class back together to discuss the number lines. Add the halves to the group number line to represent the work that was done before the students were allowed to add the other number cards. Have selected groups share their thinking.

Questions to pose:

* What strategy did you use to start placing the cards on the number line?
* Pick a card and ask students - Where should I put this card? Why should I put it there?
* Pick a card and put it in the wrong place. Example: I think ¾ is less than ½. Am I correct?
* Were there any cards that were challenging? Why were they challenging?
* How did equivalent fractions help you place the cards? OR How can I figure out where 5/8 goes on the number line in relationship to ¾?
1. When the class discussion has finished, have students write to another student in order to explain how to place fractions on a number line.

**Additional Activities:**

\*These activities could be completed by the entire class or as centers.

* **Thirds, Sixths, and Twelfths**

Repeat the number line activity, but use fraction cards that have thirds, sixths, and twelfths as denominators.

* **Build the Cookie**

Students need multiple copies of the pattern blocks - hexagon, trapezoid, rhombus, and triangle OR they can use the website: <https://apps.mathlearningcenter.org/pattern-shapes/>. Students should explore all of the different ways they can use the pattern blocks to build a hexagon and write it as an equation in terms of sixths. Example: Making a hexagon from a trapezoid, a rhombus, and 1 triangle could be written as 1 = 3/6 + 2/6 + 1/6.
Extension: Students could treat 2 joined hexagons as a whole and do the same activity so that the values would be: 1 trapezoid = ¼, 1 rhombus = 1/6, triangle = 1/12.

* **Drawing Equivalent Fractions**

Students start with ½ of a rectangle shaded and explore different ways to create fourths and eighths. Students could also start with 1/3 of a rectangle shaded and explore different ways to create sixths and twelfths. For each example, they should explain how they know they have created an equivalent fraction.

* **Fractions of a Region**

Students need graph paper. Have students partition a 6x4 grid into various size regions. Regions can be halves, thirds, fourths, sixths, eighths, and twelfths. When done students need to write the fractional part of each region.

**Evaluation of Student Understanding**

**Informal Evaluation:**

* As students are working on their tasks, pose questions and make observations about which students need further support determining where each fraction card goes.

**Formal Evaluation/Exit Ticket:**

* Consider posing the following task as an exit ticket: A student placed 1 5/8 in between 1 ¼ and 1 ½ on a number line. Are they correct? Why or why not? Use a model to support your answer.

**Meeting the Needs of the Range of Learners**

**Intervention:**

* Start with just the numbers 0 and 1. Once the student has placed all the cards in the correct location, they can add the whole number 2 and the fractions in between.

**Extension:**

* Students create a number line using all the cards (halves, thirds, fourth, sixths, eights and twelfths). Choose two cards and compare them. Which one is bigger and how do you know? Can you justify your answer using just reason and not a mathematical process?

**Possible Misconceptions/Suggestions:**

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| **Possible Misconceptions** | **Suggestions** |
| Students are incorrectly placing cards.  | * Have students to make models of the fractions using Fraction Bars or Square Tiles so they have a visual to compare the fractions.
* Have students explain whether or not the fraction is less than or greater than a benchmark fraction such as ½.
* Students can write an equivalent fraction of their cards that can help make sense of where to place the card.
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**Special Notes:**

* This task can be done multiple times with different numbers. Students who struggle may benefit from using more common fractions. Advanced students can work with larger fractions.
* The Additional Activities could be repeated in future lessons.

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| 0 | 1 |
| 2 | 3 |
| 4 | 12 |
| 22 | 32 |
| 42 | 52 |
| 62 | 72 |
| 82 | 14 |
| 24 | 34 |
| 44 | 54 |
| 64 | 74 |
| 84 | 94 |
| 104 | 114 |
| 124 | 134 |
| 144 | 154 |
| 164 | 18 |
| 28 | 38 |
| 48 | 58 |
| 68 | 78 |
| 88 | 98 |
| 108 | 118 |
| 128 | 138 |
| 148 | 158 |
| 168 |  1  | 14 |
|  1 | 12 |  1 | 34 |
|  2 | 14 |  2 | 12 |
|  2 | 34 |  3 | 14 |
|  3 | 12 |  3 | 34 |