Building Concepts: What is a Fraction?

TEACHER NOTES

Lesson Overview

This TI-Nspire™ lesson uses a dynamic action-consequence document to help students understand and visualize a fraction as a number that can be represented as a point on a number line.

A fraction is a number that can be represented as point on a number line.

Learning Goals

Students should understand and be able to explain each of the following:

1. $\dfrac{a}{b}$ is **a** copies of $\dfrac{1}{b}$.

2. $\dfrac{an}{n}$ is a fraction.

3. $\dfrac{0}{n}$ is equal to **0.**

4. One fraction can be named in several ways.

5. A fraction can be represented by a point on a number line.

6. Whole numbers can be written as fractions.

7. The relationship between the numerator and the denominator determines the value of the fraction.

Prerequisite Knowledge

What is a Fraction? is the first lesson in a series of lessons that explore fractions. Each lesson builds on the knowledge presented in the previous lesson. Prior to working on this first lesson, students should understand the concept of whole numbers on a number line.

Vocabulary

- **fraction:** For the fraction $\dfrac{a}{b}$, this number, **a**, indicates the number of copies of the unit fraction $\dfrac{1}{b}$.

- **numerator:** For the fraction $\dfrac{a}{b}$, this number, **a**, indicates the number of copies of the unit fraction $\dfrac{1}{b}$.

- **denominator:** For the fraction $\dfrac{a}{b}$, this number, **b**, indicates the number of equal partitions of one unit.

- **unit fraction:** If a unit is divided into **b** equal partitions, then one of those partitions can be represented as $\dfrac{1}{b}$.

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⏱ Lesson Pacing

This lesson contains multiple parts and can take 50–90 minutes to complete with students, though you may choose to extend, as needed.

Lesson Materials

- Compatible TI Technologies:

  📱 TI-Nspire CX Handhelds, 👆 TI-Nspire Apps for iPad®, 💻 TI-Nspire Software

- What is a Fraction_Student.pdf

- What is a Fraction_Student.doc

- What is a Fraction.tns

- What is a Fraction_Teacher Notes

- To download the TI-Nspire activity (TNS file) and Student Activity sheet, go to http://education.ti.com/go/buildingconcepts.

Class Instruction Key

The following question types are included throughout the lesson to assist you in guiding students in their exploration of the concept:

📌 **Class Discussion:** Use these questions to help students communicate their understanding of the lesson. Encourage students to refer to the TNS activity as they explain their reasoning. Have students listen to your instructions. Look for student answers to reflect an understanding of the concept. Listen for opportunities to address understanding or misconceptions in student answers.

✓ **Student Activity Sheet**: The questions that have a check-mark also appear on the Student Activity Sheet. Have students record their answers on their student activity sheet as you go through the lesson as a class exercise. The student activity sheet is optional and may also be completed in smaller student groups, depending on the technology available in the classroom. A (.doc) version of the Teacher Notes has been provided and can be used to further customize the Student Activity sheet by choosing additional and/or different questions for students.

◎ **Bulls-eye Question**: Questions marked with the bulls-eye icon indicate key questions a student should be able to answer by the conclusion of the activity. These questions are included in the Teacher Notes and the Student Activity Sheet. The bulls-eye question on the Student Activity sheet is a variation of the discussion question included in the Teacher Notes.

Mathematical Background

This TI-Nspire™ lesson helps students to understand fractions as a number that can be represented as a point on a number line. In working with whole numbers, students understand a number in terms of one symbol. Fractions use two symbols to describe this new kind of number: the fraction $\frac{a}{b}$ on a number line is a lengths of $\frac{1}{b}$. The b indicates that the unit segment, the distance between 0 and 1, is partitioned into b equal intervals. The a represents the number of copies of those intervals joined end-to-end on the number line, beginning at 0. Students will learn that the denominator indicates the number of equal parts in each whole unit and the numerator indicates the number of those parts. (Note that a and b ($\neq 0$) both represent whole numbers.)

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Part 1, Page 1.3

Focus: Students investigate fractions on a number line in order to:

- Identify a fraction $\frac{a}{b}$ as a copies of $\frac{1}{b}$.

- Recognize that whole numbers, including 0, are fractions.

- Understand that a fraction is a point on a number line.
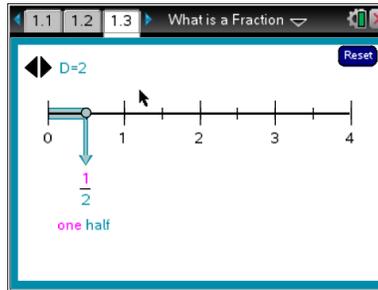
TI-Nspire Technology Tips

Students may find it easier to use the tab key to toggle between objects and then use the arrow keys to move or change their selections.

To reset the page, select **Reset** in the upper right corner.

Students will build on what they know about whole numbers as points on a number line to develop the concept of a fraction. The black arrows allow a denominator to be selected. That selected denominator determines the unit fraction, $\frac{1}{b}$, and partitions the number line into equal parts, subintervals of length $\frac{1}{b}$. By dragging the circle along the number line "a," copies of $\frac{1}{b}$ are generated. The activity shows how fraction words tell the number of copies of a unit fraction. For example, *four-fifths* means 4 copies of the unit fraction $\frac{1}{5}$ laid out on the number line beginning from 0. Four-fifths is represented in fraction notation as $\frac{4}{5}$.

Drag the dot along the number line to set a numerator for the fraction. Use the left and right arrows to select the denominator for a unit fraction. Drag the dot along the number line to select specific copies of the unit fraction. The fractional parts on the number line will change to reflect the chosen denominator.

Lead students in a discussion of the questions below. Encourage them to explain their answers.

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TEACHER NOTES
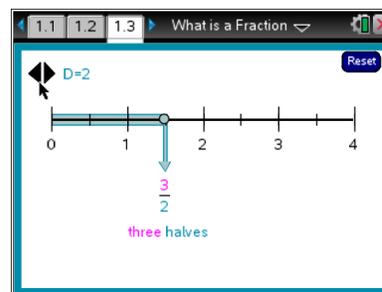
> **Teacher Tip:** Make sure students understand that the denominator of a unit fraction names the number of equal parts into which the unit has been partitioned, and that the numerator names the total number of copies of the unit fraction from 0 to the point on the number line named by the fraction.

★ Class Discussion

Have students…	Look for/Listen for…
• **On page 1.3, the D stands for denominator. Drag the dot to 0, then click on the arrow at the top of the page. When you increase the value of D, how does the number of equal parts in the interval from 0 to 1 change? What happens to the length of those parts?**	Answer: The number of equal parts increases, matching the number that is equal to D. As the number of parts increases, the length of each part gets shorter.
✓ $\frac{1}{D}$ **is a unit fraction. If you have two different unit fractions, which one is greater? Explain your reasoning.** (Question #1 on the Student Activity sheet.)	Answer: The greater unit fraction will have a smaller denominator because the unit was divided into fewer equal parts.
• **Describe where three fifths would be located on a number line. How does three fifths differ from seven fifths? Explain your thinking, and then check your answer using the file.**	Answer: $\frac{3}{5}$ is equal to three copies of the unit fraction $\frac{1}{5}$, while $\frac{7}{5}$ has seven copies of the unit fraction $\frac{1}{5}$. There are five $\frac{1}{5}$ unit fractions in each interval, and since $\frac{3}{5}$ has three copies of the unit fraction $\frac{1}{5}$, it would be located between 0 and 1, closer to 1, on the number line. Since $\frac{7}{5}$ has more than five $\frac{1}{5}$ unit fractions, it is greater than 1 interval, but less than 2.

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> **Teacher Tip:** For the ✓ question below have students make their predictions by completing the number lines on their activity sheets (Question #2 on the Student Activity) before working together on the interactive number line.

★ Class Discussion (continued)

Have students…	Look for/Listen for…
Think about making copies of the unit fraction $\frac{1}{8}$ on a number line. Answer each of the following questions and explain your reasoning. Then use the interactive number line to check your answer.	
✓ ***Where is $\frac{4}{8}$ located?*** (Question #2 on the Student Activity sheet.)	Answer: *$\frac{4}{8}$* is half way between 0 and 1 because there will be the same number copies of *$\frac{1}{8}$* unit fractions on each side of the *$\frac{4}{8}$* point.
• ***Where is $\frac{0}{8}$ located?***	Answer: *$\frac{0}{8}$* is at the whole number 0 on the number line because there are zero copies of *$\frac{1}{8}$*.
• ***Is $\frac{11}{8}$ closer to one or to two?***	Answer: *$\frac{11}{8}$* is closer to one because it is not quite half way between 1 and 2. *$\frac{12}{8}$* would be halfway.

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### Part 2, Page 2.2

Focus: On this page, students transition to the symbolic name for a fraction by specifying the numerator and denominator $\frac{a}{b}$.

The horizontal arrows on the upper left side of the screen are used to set the denominator of a fraction and partition the number line accordingly. The vertical arrows on the top right of the screen are used to select the number of copies of the unit fraction. The shaded portion of the number line represents **a** copies of $\frac{1}{b}$. The shaded arrow is set at the point on the number line that represents $\frac{a}{b}$.
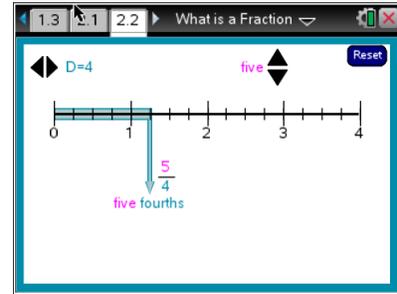
> **Teacher Tip:** At this stage students should not need the fraction words written out, but some may need to reconnect with the words to keep their thinking straight.

As students work with or observe the manipulation of the file, help them to focus on the relationship between the number of copies of the unit fraction needed to get to the midpoint between two whole numbers or a whole number. Discuss how this relationship affects the position of the fraction on the number line as a precursor for developing a sense of $\frac{1}{2}$ as a benchmark fraction.

📌 Class Discussion

Have students…

For each of the following fractions, tell whether each is closer to a whole number or a point halfway between two whole numbers on the number line. If the fraction is located halfway between two numbers, identify the two numbers. Explain your reasoning.

- $\frac{7}{9}$

Look for/Listen for…

Answer: closer to 1 because $\frac{7}{9}$ is $\frac{2}{9}$ away from 1 – or $\frac{9}{9}$ – but it is further than $\frac{2}{9}$ from $\frac{7}{9}$ to $\frac{1}{2}$ on the number line.

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📌 **Class Discussion (continued)**

- $\dfrac{6}{11}$

  Answer: closer to $\dfrac{1}{2}$ because you need five more copies of $\dfrac{1}{11}$ to reach $\dfrac{11}{11}$ – or 1 – and because $\dfrac{6}{11}$ appears closer to the middle between 0 and 1.

- $\dfrac{2}{4}$

  Answer: $\dfrac{2}{4}$ is exactly in the middle of 0 and 1 because there are two copies of $\dfrac{1}{4}$ on either side of the fraction.

- $\dfrac{10}{3}$

  Answer: $\dfrac{10}{3}$ is closer to the midpoint between 3 and 4 because it is one unit fraction away from $\dfrac{9}{3}$, but not even a whole unit fraction to get to the middle between 3 and 4.

◎ *Suppose the unit fraction was $\dfrac{1}{5}$ and the numerator was between 11 and 14. Describe the location of the fraction on the number line.*

  Answer: The fraction would be between $2\left(\dfrac{10}{5}\right)$ and $3\left(\dfrac{15}{5}\right)$.

- *If the unit fraction is $\dfrac{1}{6}$, where would fractions with a numerator between 25 and 29 be located?*

  Answer: The fractions would be located between $4\left(\dfrac{24}{6}\right)$ and $5\left(\dfrac{30}{6}\right)$. Be sure students can explain their how they reason about the unit fractions and the number line to find their answer because this problem intentionally cannot be checked using the TNS file.

✓ *How many copies of $\dfrac{1}{2}$ are between 0 and 2 on a number line?*

  (Question #3 on Student Activity sheet.)

  Answer: 4 copies of $\dfrac{1}{2}$.

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Class Discussion (continued)

Use the interactive number line to decide whether the following sentences are true or false. Explain your reasoning.

- *0 is a fraction.*

  Answer: True because it is on the number line and is 0 copies of any unit fraction.

- *A whole number cannot be a fraction.*

  Answer: False. Every whole number can be written as copies of many different unit fractions – 1 could be written as $\frac{2}{2}$, $\frac{3}{3}$, $\frac{4}{4}$ and so on.

- *A fraction can have many names.*

  Answer: True. See the answer to part b; you could also write $\frac{2}{4}$, $\frac{3}{6}$, and many other fractions at the same place on the number line as $\frac{1}{2}$ because they each divide the interval into two equal parts.

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Sample Assessment Items

After completing the lesson, students should be able to answer the following types of questions. If students understand the concepts involved in the lesson, they should be able to answer the following questions without using the TNS activity.

1. Which fraction can name the point marked by X? ***Answers can vary:*** $\frac{8}{6}, \frac{4}{3}$
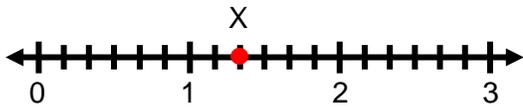
2. On the portion of the number line shown below, a dot shows where $\frac{1}{2}$ is. Use another dot to show where $\frac{6}{8}$ is.
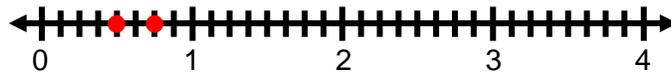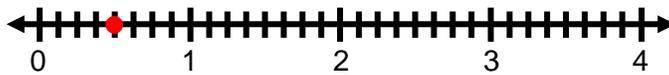
NAEP 2003

    Answer:

3. Which fraction has a value closest to $\frac{1}{2}$?

    a. $\frac{5}{8}$ b. $\frac{1}{6}$ c. $\frac{2}{2}$ d. $\frac{1}{5}$

    Answer: a

NAEP 2009, Grade 4

4. On the number line, what number does *P* represent?
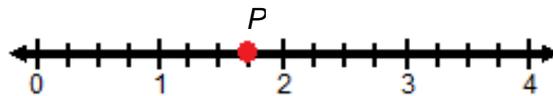
NAEP 2009, Grade 4

    a. $\frac{2}{3}$ b. $\frac{3}{4}$ c. $\frac{3}{5}$ d. $\frac{7}{4}$

    Answer: d

5. Sketch a number line to show the location of the following fractions:

a. $\dfrac{4}{7}$

Answer:

b. $\dfrac{11}{7}$

Answer:

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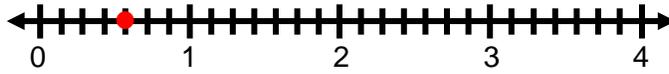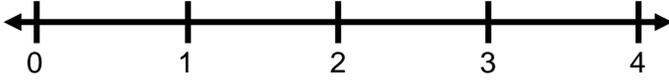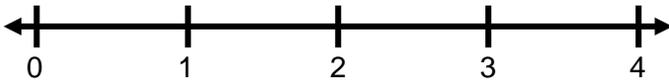
Student Activity solutions

Vocabulary

fraction:

For the fraction $\frac{a}{b}$, this number, **a**, indicates the number of copies of the unit fraction $\frac{1}{b}$.

numerator:

For the fraction $\frac{a}{b}$, this number, **a**, indicates the number of copies of the unit fraction $\frac{1}{b}$.

denominator:

For the fraction $\frac{a}{b}$, this number, **b**, indicates the number of equal partitions of one unit.

unit fraction:

If a unit is divided into **b** equal partitions, then one of those partitions can be represented as. $\frac{1}{b}$

Students will use a number line to explore fractions.

1. $\frac{1}{D}$ is a unit fraction. If you have two different unit fractions, how can you tell which fraction is greater?

    Answer: The greater unit fraction will have a smaller denominator because the unit will have been divided into fewer equal parts.

2. Think about making copies of the unit fraction $\frac{1}{8}$ on a number line. Where would $\frac{4}{8}$ be located? Draw a point on the number line to show $\frac{4}{8}$. Use the interactive model to check your answer.

    Answer:

3. How many copies of $\frac{1}{2}$ are between 0 and 2 on a number line?

    Answer: 4 copies of $\frac{1}{2}$.

4. 🎯 A fraction is located between 2 and 3 on a number line. Find fractions where the denominator is 3 and the numerator is greater than 3. Explain your answer.

    Answer: The numerators would be either 7 or 8 because the number 2 is equal to $\frac{6}{3}$ and 3 is equal to $\frac{9}{3}$. If the fraction is between 2 and 3, it would have to be either $\frac{7}{3}$ or $\frac{8}{3}$.

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