Grade Level/Course: Grades 3 and 4

Lesson/Unit Plan Name: Number Lines, Fractions, and Bar Models

Rationale/Lesson Abstract: Students will be able to use bar models to help them identify points on a number line. They will also be able to compare points on a number line and find equivalent fractions using bar models.

Timeframe: Day 1: 50 min. Day 2: 50min.

Common Core Standard(s):

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

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

b. Represent a fraction $\frac{a}{b}$ on a number line diagram by marking lengths $\frac{1}{b}$ from 0. Recognize that the resulting interval has size $\frac{a}{b}$ and that it's endpoint locates the number $\frac{a}{b}$ 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 (equal if they are the same size, or the same point on a number line. ***Recognize that equivalencies are only valid when the two fractions refer to the same whole.***

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 that are equivalent to whole numbers. Examples: Express 3 in the form of $3 = \frac{3}{1}$; recognize that $\frac{6}{1} = 6$; Locate $\frac{4}{4}$ and 1 at the same point of a number line diagram.

4.NF.3

b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. Examples: $\frac{3}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$; $\frac{3}{8} = \frac{1}{8} + \frac{2}{8}$; $2\frac{1}{8} = 1 + 1 + \frac{1}{8} = \frac{8}{8} + \frac{8}{8} + \frac{1}{8}$.

4.NS.1.9 Identify on a number line the relative position of positive fractions, positive mixed numbers, and positive decimals to two decimal places.

Instructional Resources/Materials: number line templates, class set of rulers, plastic sleeves, dry erase markers, eraser or cloth

Background Knowledge: Fractions represent the part-whole relationship in mathematics. The whole (denominator) can be determined by counting the partitions of equal parts from zero to one. The part (numerator) is the quantity of parts either represented by a point on a number line or the quantity of parts shaded in a bar model.

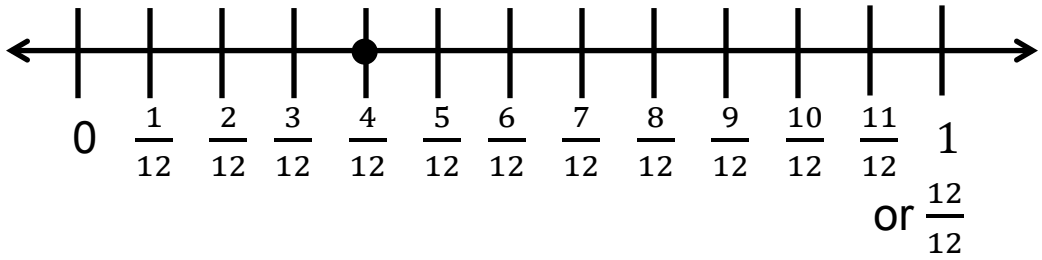
Give the students the number line template for the examples and you tries. They draw the bar model. Remind students that the intervals can be used to divide up their bar models.

Day 1

Example 1:

Label each number line with the correct fractions the tick marks represent.

"First, let's count the total number of equal parts from zero to one. This will be our denominator. Next, let's label each part in between zero and one as a fraction with the denominator we determined above."

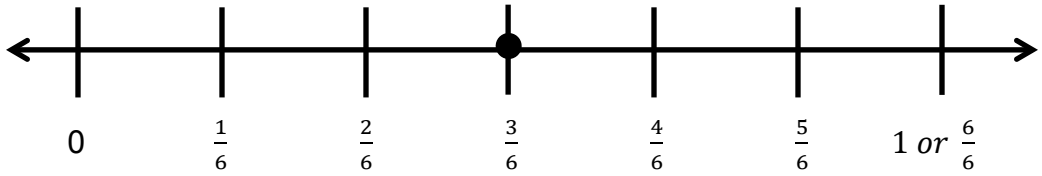


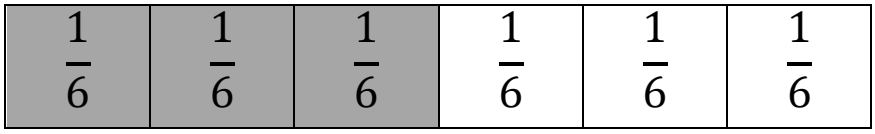
"Now, let's draw a bar model that has twelve equal parts. We are going to use our ruler to match the marks that appear on our number line to draw our bar model. Let's label each part on the bar model. Since we have twelve parts total, the denominator will be twelve. Each part of the bar model is $\frac{1}{12}$."

$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$

"Now, let's do the same with the number lines, below."

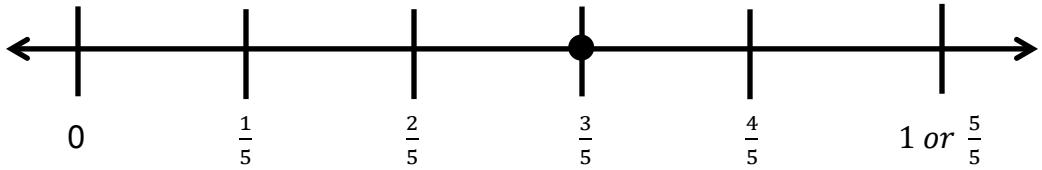
Example 2:

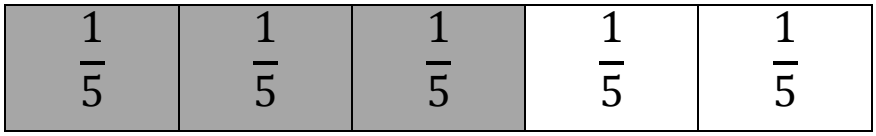




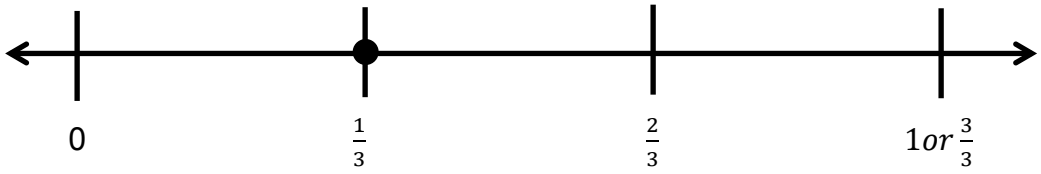
Note: The Fraction represented on the number line is only at the tick mark. It is not the part in between like we see in the bar model.

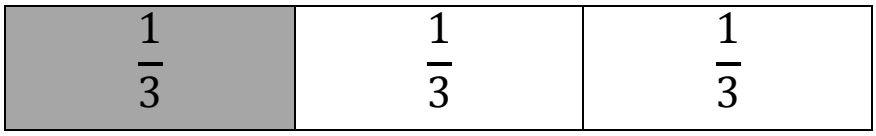
Example 3:



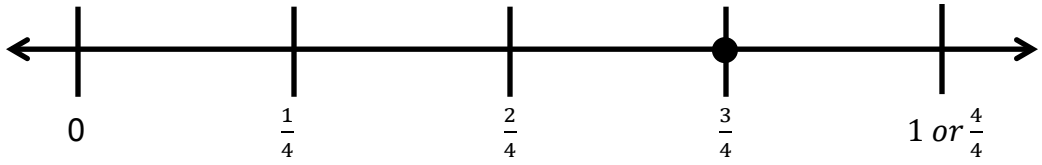


Example 4:



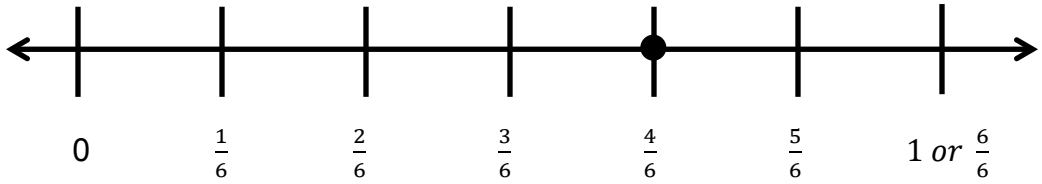


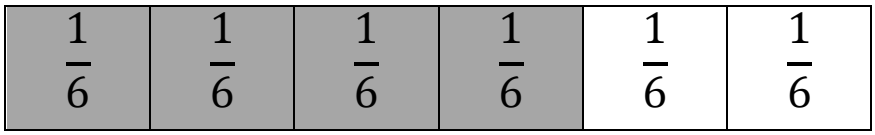
Example 5:



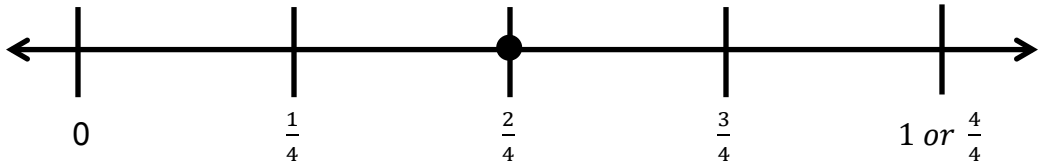
Draw a bar model to represent each number line. Do any of the number lines represent the same value? What fraction do they represent?

You Try 1:

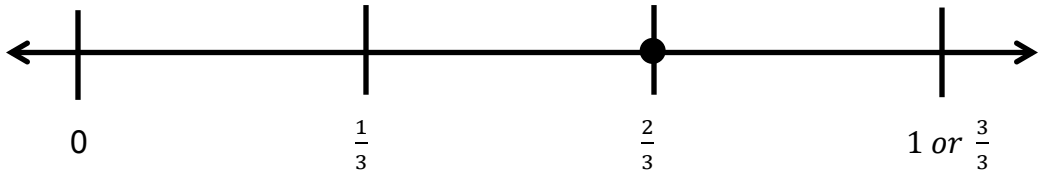


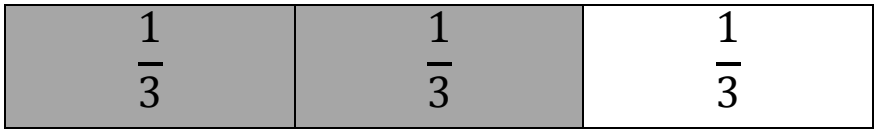


You Try 2:

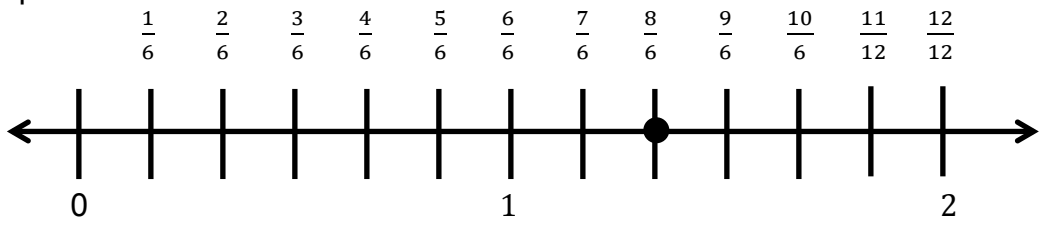


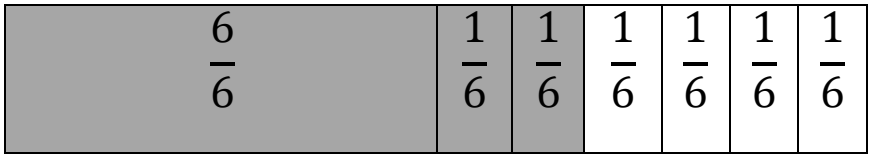
You Try 3:





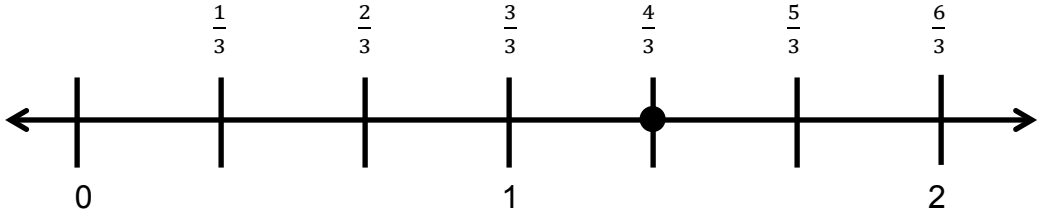
Example 6:

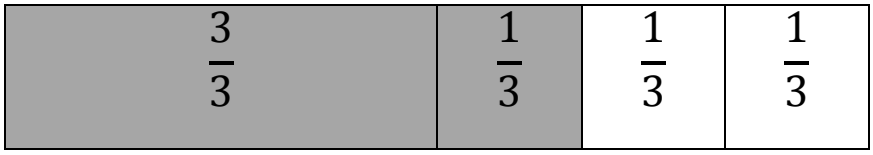




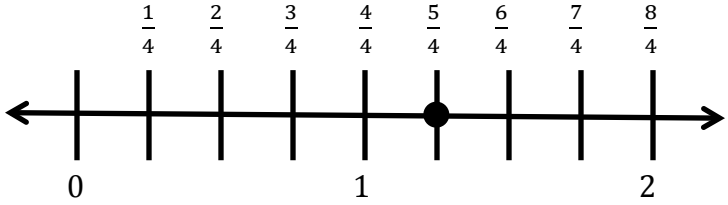
"What is another way to say $\frac{6}{6}$?" [1 or 1 whole]

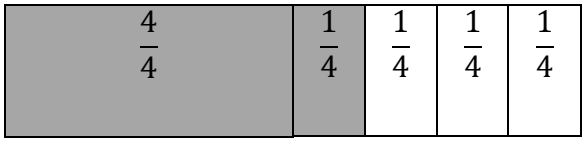
Example 7:



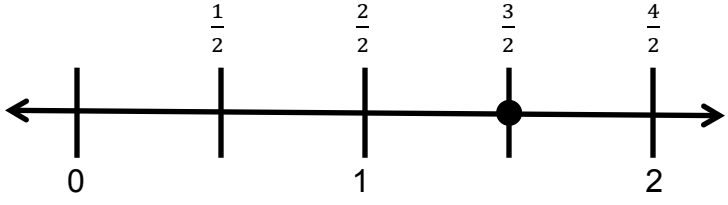


You Try 4:





You Try 5:

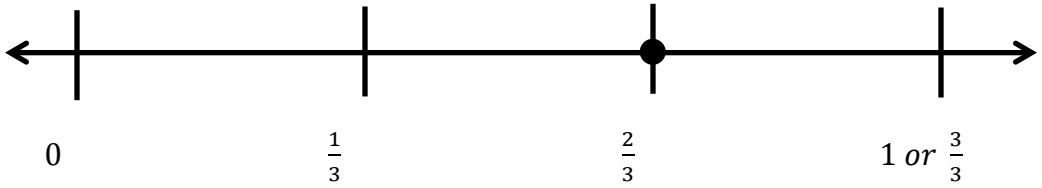


Day 2

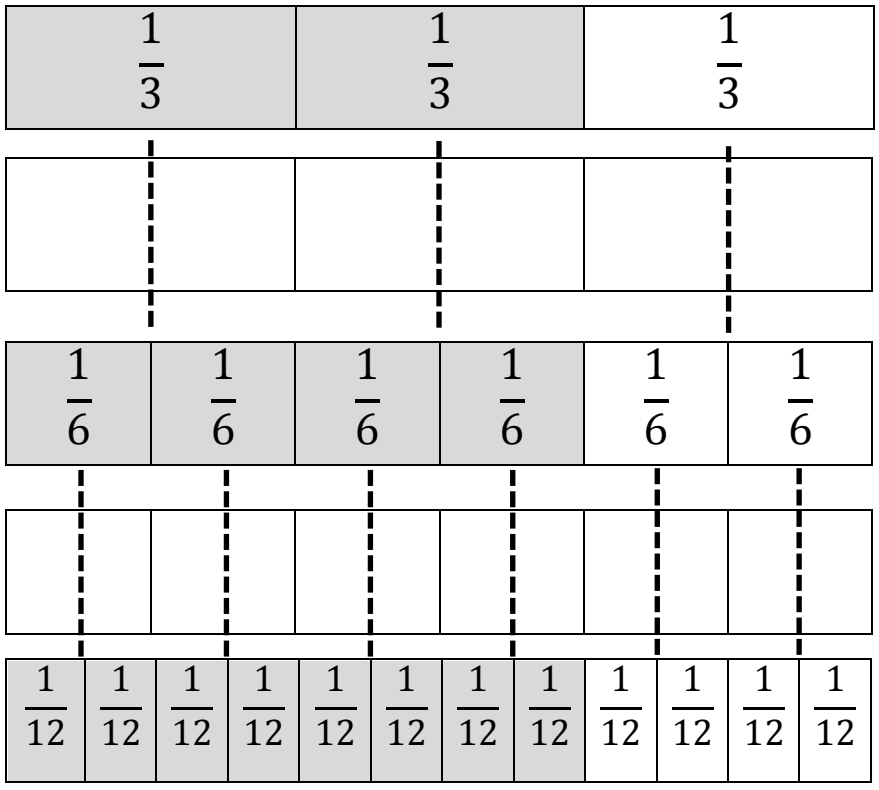
After students have had some practice with identifying fractions on a number line and drawing a bar model to match the number line, they will find equivalent fractions. Define equivalent fraction and make the connection to "equal".

Example 1:

Draw the number line and tick marks, and ask "How many parts do we have total? [3] What part does each mark on the number line represent?" $\left[\frac{1}{3}\right]$
Have students draw another bar model right below the first one.



Count how many parts are in each bar. Model together using choral response. Remind students that the total parts tells us what the denominator will be. Write in each new fraction.



"How many parts do we have if we divide each third in half? [six]

"How many parts do we have if we divide each sixth in half? [twelve]

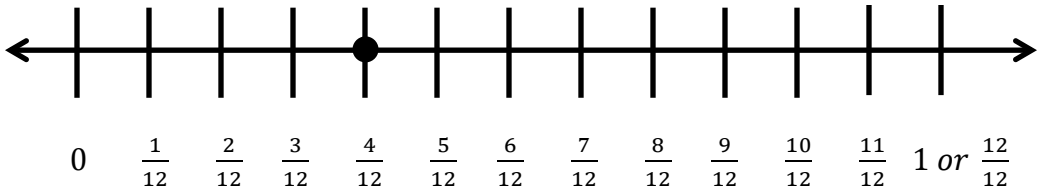
Ask students to think-pair-share and discuss what they notice about the similarities and differences between the bar models. Have students share with the whole group.

Have students write a therefore based on the bar models.

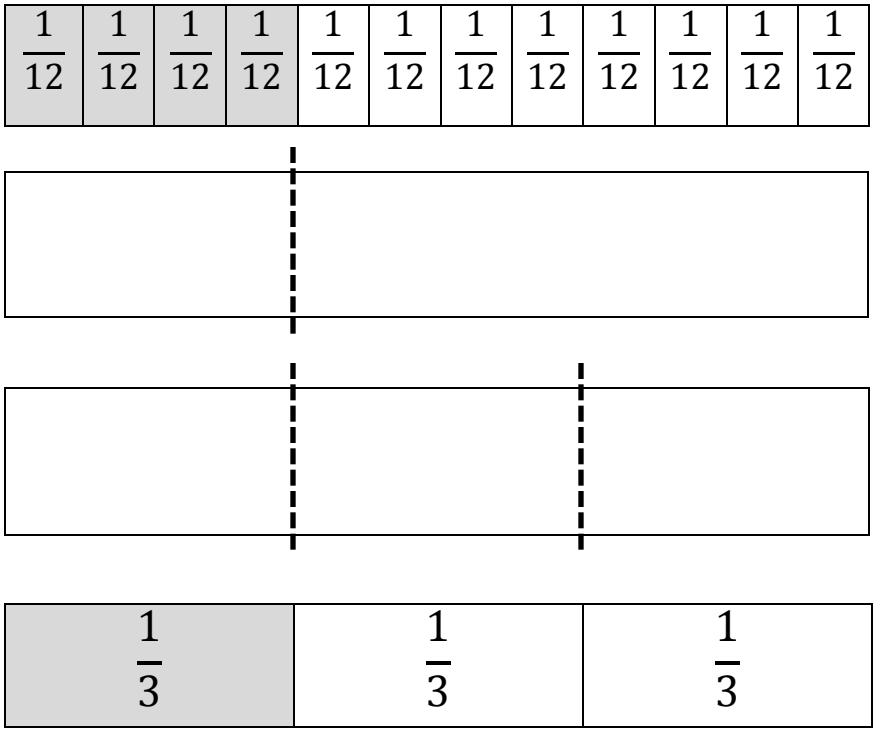
$$\therefore \frac{1}{3} = \frac{2}{6} = \frac{4}{12}$$

Example 2:

"How many parts do we have total? [12] What part does each mark on the number line represent?" $\left[\frac{1}{12}\right]$



Have students use their ruler to draw a line extending from the point on the number line. The line should match the first bar model.



"What do you notice about the line that you drew? How many $\frac{1}{12}$s are in the shaded area?" $\left[four\ \frac{1}{12}s\right]$

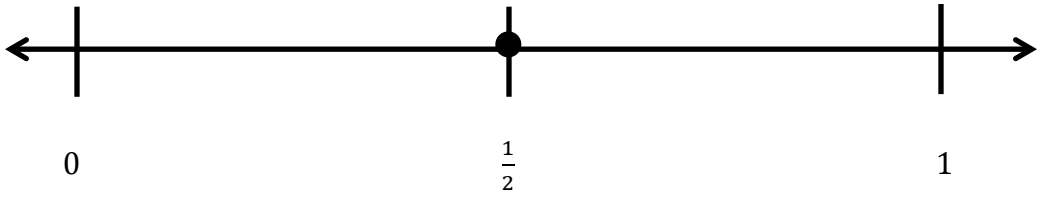
"Count over 4 more $\frac{1}{12}$s and draw another line. How may parts do we have now?" [3]

Students write $\frac{1}{3}$ in each part. They shade the first part to match the original point on the number line. Students write a therefore statement.

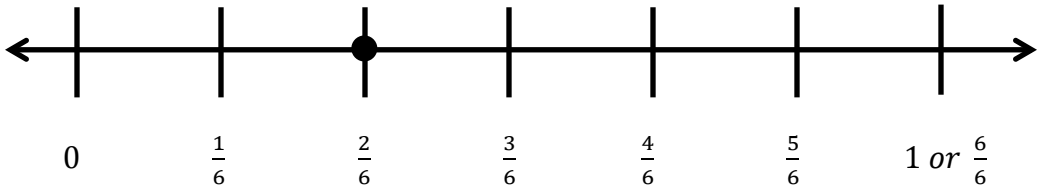
$$\therefore \frac{4}{12} = \frac{1}{3}\ or\ \frac{1}{3} = \frac{4}{12}$$

Find an equivalent fraction. Use bar models to show equivalencies.

You Try 1:



You Try 2:

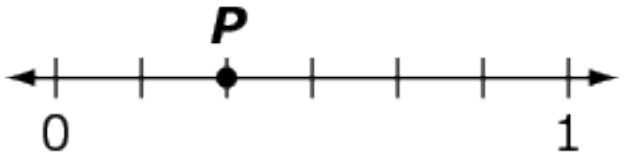


Follow Up Activity: Students slip the number line template in a plastic sleeve to make a dry erase board to keep in their binder. The teacher gives more you tries throughout the year to check for understanding.

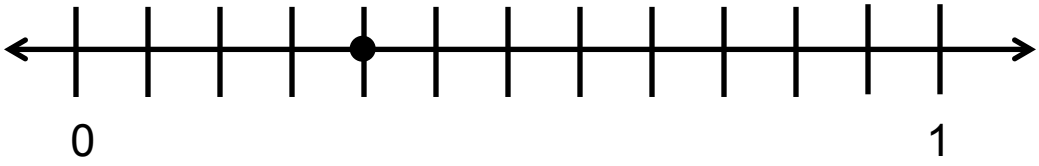
Assessment: After the follow up activity, students come up with their own number lines and bar models to match. Remind them that they must make at least two that represent the same value or fraction. Use the number line template for this assessment. Also, the following selected response question may be used as an assessment.

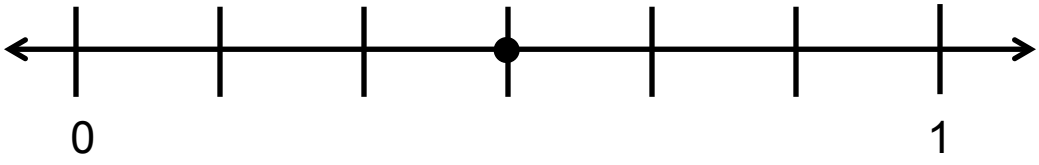
Sample Selected Response Question/Source: Smarter Balanced

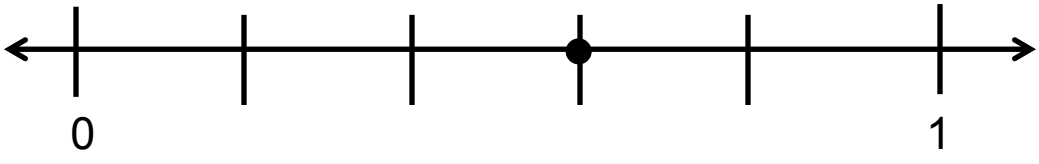
Look at point *P* on the number line.

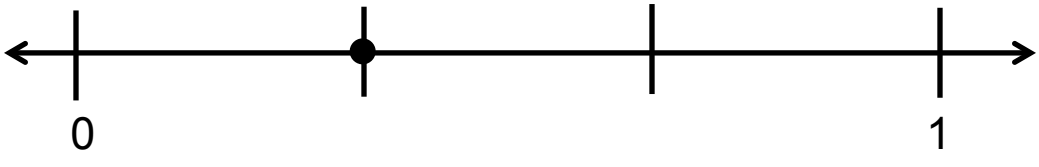


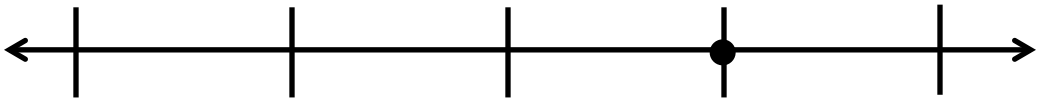
Look at number lines A – E. Is the point on each number line equal to the number shown by *P*? Choose Y for Yes or N for No.

A.  Y or N

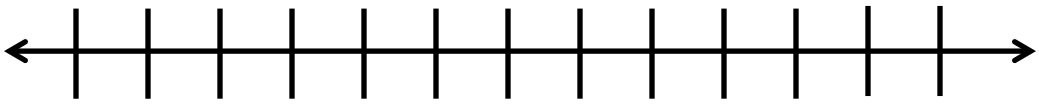
B.  Y or N

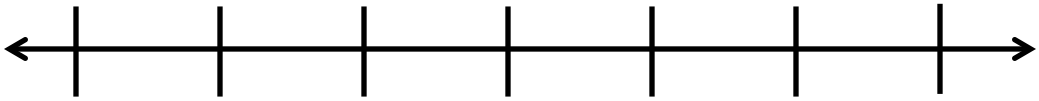
C.  Y or N

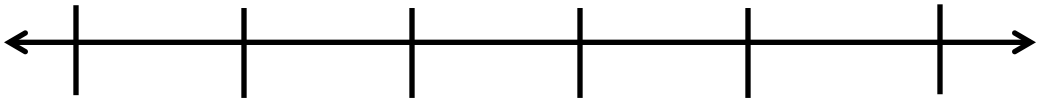
D.  Y or N

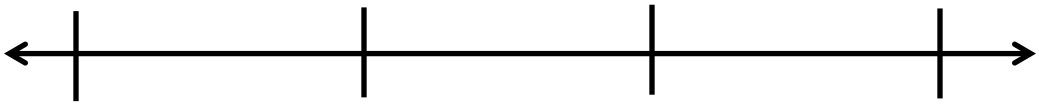
E.  Y or N

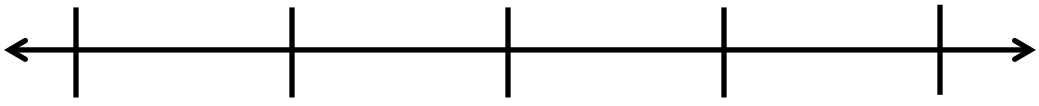
Number Line Template









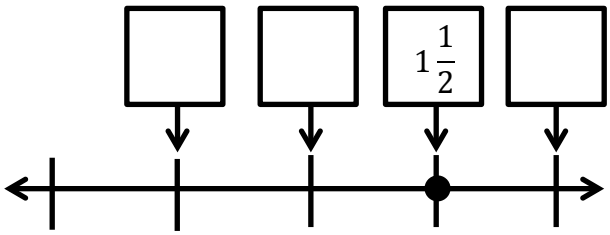


Warm-Up

CST/CCS: Grade 3

The point on the number line shows the location of $1\frac{1}{2}$.

Move each number into a box to show it's correct location on the number line.



1, $\frac{1}{2}$, 2

Review: Grade 3

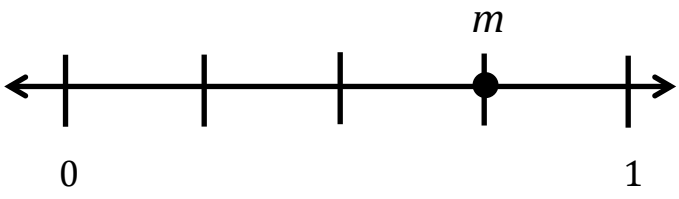
Look at the bar model below. How many parts are there in all? What part is shaded? What part is not shaded?

Write a fraction to show which part is shaded, and write a fraction to show which part is not shaded.

x

Current: Grade 3

Look at point m on the number line. Draw a bar model to represent the fraction for point m.



Other: Grade 4

Add.

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

Draw a picture to represent each fraction and your answer.

Create a story problem to go with this addition problem.