



Fraction Fluency

Helping All Children
Become Part
of the Whole



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▶ **Trish Alexander:**

- 19 years experience teaching middle school math
- Curriculum team for 15 years
- Table Leader for state assessment training

▶ **Joann Barnett:**

- 28 years experience teaching middle school math
- Helped develop EMS course work and presently facilitating Elementary Math Specialist program at Missouri State University.
- Instructor of Developmental Math classes at Ozark Community College

Lesson Design



- ▶ **Our challenge is to design our lessons so students can articulate important ideas.**
- ▶ Tomlinson, C. A. (2014). *Differentiated classroom: Responding to the needs of all learners*. Ascd.

Lesson Design

- ▶ **Students should not simply be heard as the teacher's echo.**



Lesson Design

- ▶ "Students joining your classroom have varied conceptions of what it means to do mathematics. It is important to establish immediately that mathematics is about ideas, that all the students in the class are capable of having ideas in mathematics, and that all are expected to contribute to the development of the class' ideas. **Students must learn that ideas need not be fully formed to be expressed; tentative ideas provide important beginnings.**"
(Page 10)

- ▶ Russell, Susan Jo, Deborah Schifter, and Virginia Bastable. *Connecting arithmetic to algebra: Strategies for building algebraic thinking in the elementary grades*. Heinemann, 2011.

Less is More and More is Less

- ▶ **The bigger the number is in the bottom, the smaller it is.**

- ▶ An ability to perceive the ordered pair in a fraction symbol as a conceptual unit (rather than two individual numbers) has been found to be an indicator for successful performance with rational numbers.
- ▶ Behr, Wachsmuth, Post, and Lesh (1984) ask, “what meaning, for example, do $2/3 \times 5/6$ or $2/3 + 5/8$ have for children who lack a well-internalized concept of the bigness of rational numbers?”
- ▶ Children have difficulty internalizing that the symbol for a fraction represents a single entity. (RNP)

Transition from Whole Number to Fraction Notation

▶ *Kindergarten*

- ▶ *When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object.*

Counting racecars



Transition from Whole Number to Fraction Notation

•Grade 1

Partition and describe two and four equal shares of circles and rectangles ...recognize that decomposing into more equal shares created similar figures

Grade 2

•Partition and describe two, three or four equal shares of circles and rectangles, ...recognize that equal shares of identical wholes need not have the same shape



Halves



4 halves

$$\frac{4}{2}$$

Fourths



10 fourths

$$\frac{10}{4}$$

Halves



4 halves

$$\frac{4}{2}$$

Thirds



5 thirds

$$\frac{5}{3}$$

Fourths



10 fourths

$$\frac{10}{4}$$

Fifths



3 fifths

$$\frac{3}{5}$$

Sixths



6 sixths

$$\frac{6}{6}$$

Eighths



5 eighths

$$\frac{5}{8}$$

Tenths



16 tenths

$$\frac{16}{10}$$

Twelfths



6 twelfths

$$\frac{6}{12}$$

Questions to ask



Halves



4 halves

$$\frac{4}{2}$$

Thirds



5 thirds

$$\frac{5}{3}$$

Fourths



10 fourths

$$\frac{10}{4}$$

Fifths



3 fifths

$$\frac{3}{5}$$

Sixths



6 sixths

$$\frac{6}{6}$$

Eighths



5 eighths

$$\frac{5}{8}$$

Tenths



16 tenths

$$\frac{16}{10}$$

Twelfths



6 twelfths

$$\frac{6}{12}$$

Questions to Ask

▶ Why are we able to make two whole circles with $\frac{4}{2}$

yet we couldn't even make 1 whole circle with

$\frac{6}{12}$?

Questions to Ask

- ▶ Look at all the 6's in the two numbers below:

$$\frac{6}{6} \quad \frac{6}{12}$$

What does each 6 mean, and why do the circle pieces look so different for the two numbers?

More questions

- ▶ How can $\frac{5}{3}$ be equal to more than 1 circle while $\frac{5}{8}$ is less than 1 whole circle?

Tell each other what you know....

- ▶ What do you know about the fractions below?

A.

$$\frac{\square}{7}$$

B.

$$\frac{7}{\square}$$



$$\frac{11}{7}$$

$$\frac{10}{7}$$

$$\frac{1,000,000,000}{7}$$

$$\frac{3}{7} =$$

Adjusting the Fraction Definition

▶ Basically:

- the top number is the count
 - the bottom number is what you are counting
- ▶ Activity adapted from John Van de Walle's "Teaching Student-Centered Mathematics, Grade 3-5." Pearson Education, 2006. Pages 138-140.

Comparing Fractions

- ▶ **The connection between the comparison of fractions and development of number sense is clear. Comparing fractions is necessary for obtaining an intuitive feel of the size of fractions. If a fractional number is recognized to be close to $1/3$ or $1/2$, for example, one has a better feel for its magnitude. This fractional number sense is particularly important when estimating with fractions. (Sowder)**

Comparing Fractions

- ▶ In support of this, Post et al. (1986) noted that “children who do not have a workable concept of rational number size cannot be expected to exhibit satisfactory performance across a set of tasks which varies the context in which the number concept of fraction is involved” (p. 2). Further, Behr, Wachsmuth, Post, and Lesh (1984) ask, “what meaning, for example, do $2/3 \times 5/6$ or $2/3 + 5/8$ have for children who lack a well-internalized concept of the bigness of rational numbers?”



Who is Winning?

During gym class, Mr. Miles had the students run the length of the playground. Mr. Miles planned to see how many seconds it took the students to travel the length of the playground.

Mr. Miles blew the whistle for 8 students to begin running. Mr. Miles then realized he had forgotten to start the stopwatch, so he blew the whistle and the 8 students stopped where they were.

The fractions below tell how much of the total distance each student had already traveled when Mr. Miles blew the whistle the second time.

Place each of these students on the number line to show where they had stopped when Mr. Miles blew the whistle the second time.

Adam: $\frac{3}{4}$

Ben: $\frac{3}{8}$

Carmen: $\frac{15}{16}$

Desiree: $\frac{4}{9}$

Elena: $\frac{5}{8}$

Felista: $\frac{1}{2}$

Gaston: $\frac{2}{3}$

Holden: $\frac{7}{8}$

What Strategy Could You Use?

- ▶ Write the following fractions in order from least to greatest.

$$\frac{9}{12} \quad \frac{5}{12} \quad \frac{3}{12}$$

Common Denominator Strategy

$$\frac{3}{12} \quad \frac{5}{12} \quad \frac{9}{12}$$

What Strategy Could You Use?

- ▶ Write the following fractions in order from least to greatest.

$$\frac{4}{3}$$

$$\frac{4}{6}$$

$$\frac{4}{9}$$

Common Numerator Strategy

$$\frac{4}{9}$$

$$\frac{4}{6}$$

$$\frac{4}{3}$$

What Strategy Could You Use?

- ▶ Write the following fractions in order from least to greatest.

$$\frac{3}{6}$$

$$\frac{5}{7}$$

$$\frac{2}{5}$$

Compare to $\frac{1}{2}$

$$\frac{2}{5}$$

$$\frac{3}{6}$$

$$\frac{5}{7}$$

What Strategy Could You Use?

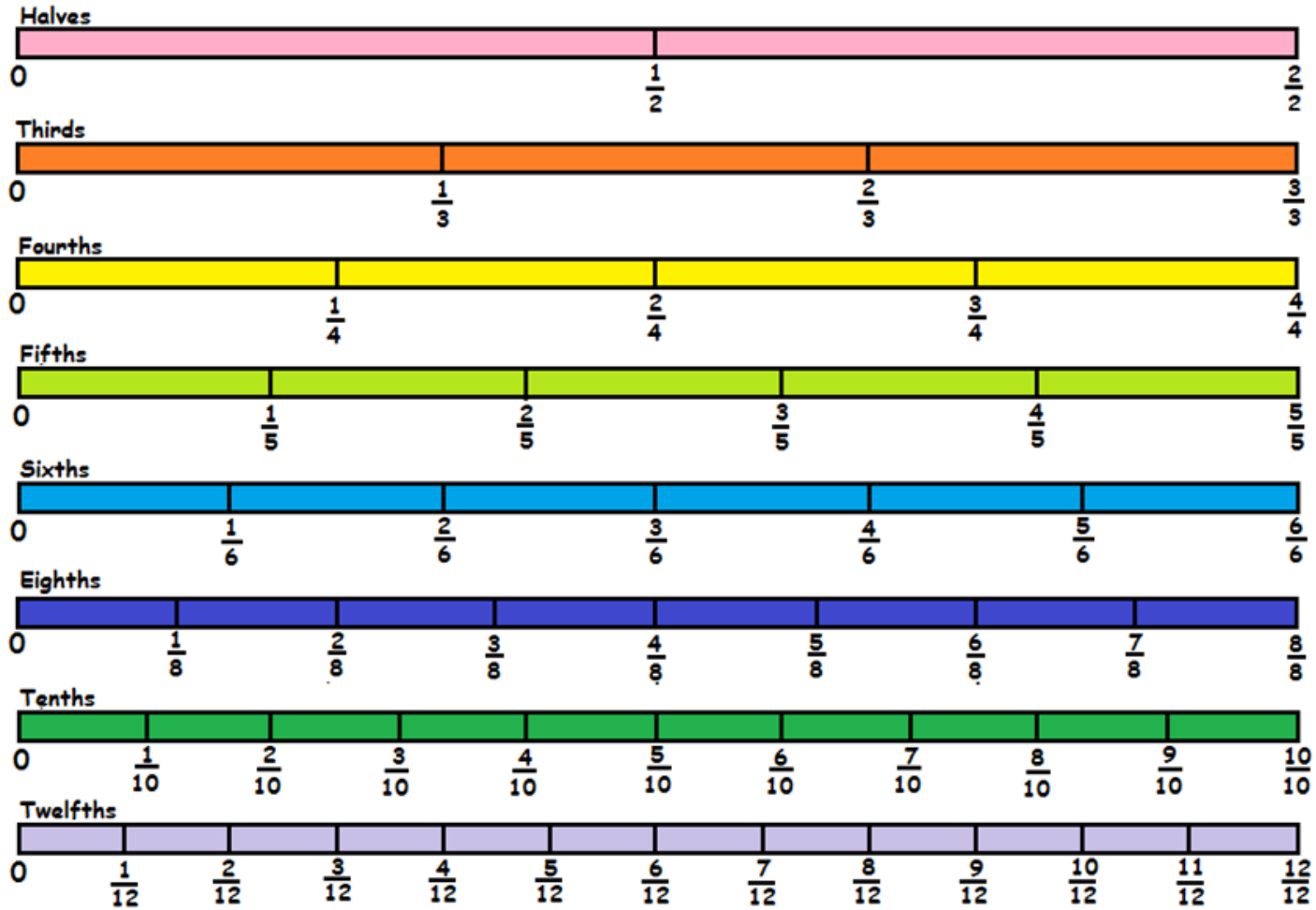
Write the following fractions in order from least to greatest.

$$\frac{2}{15}$$

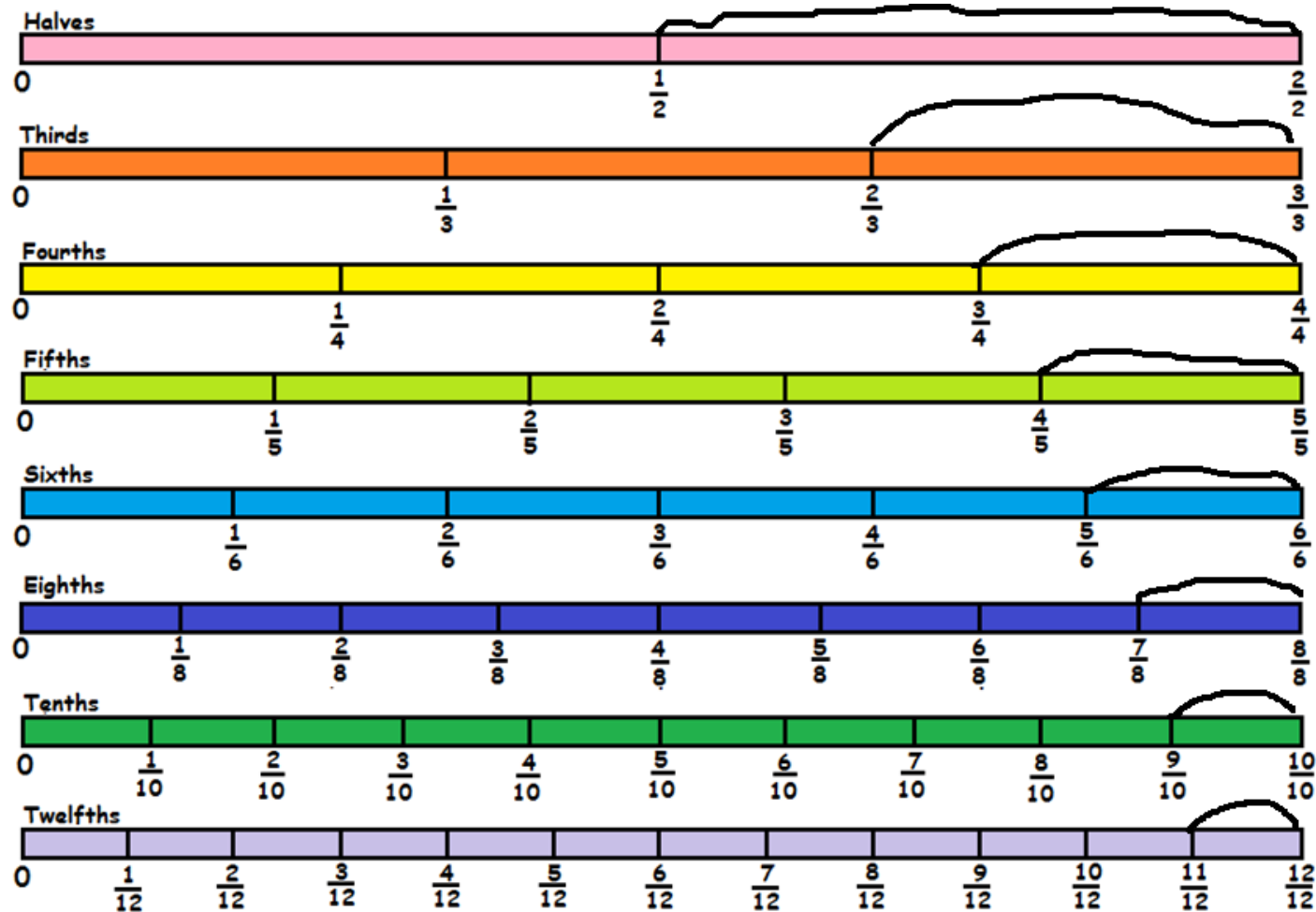
$$\frac{6}{12}$$

$$\frac{13}{18}$$

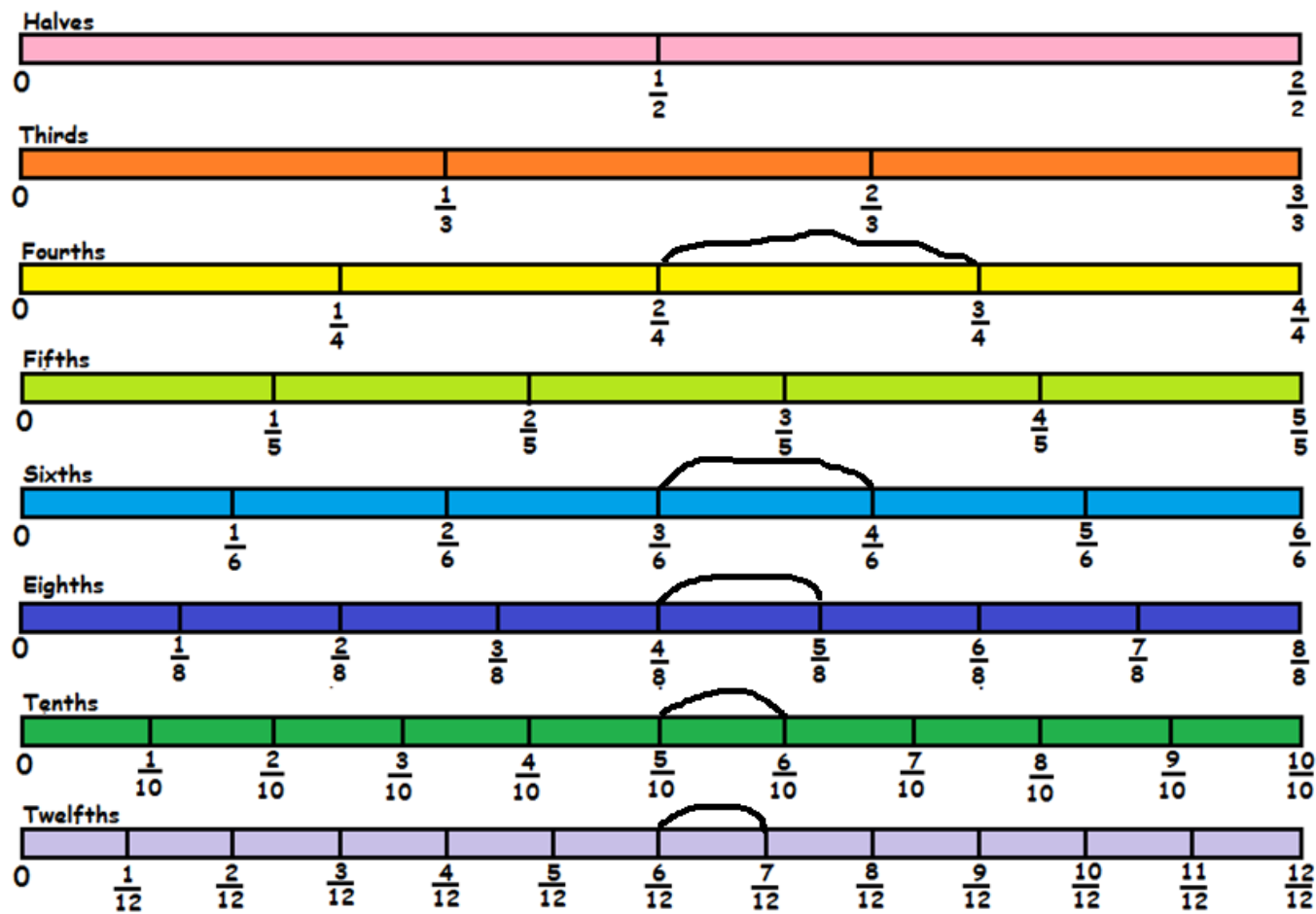
Fraction Strips



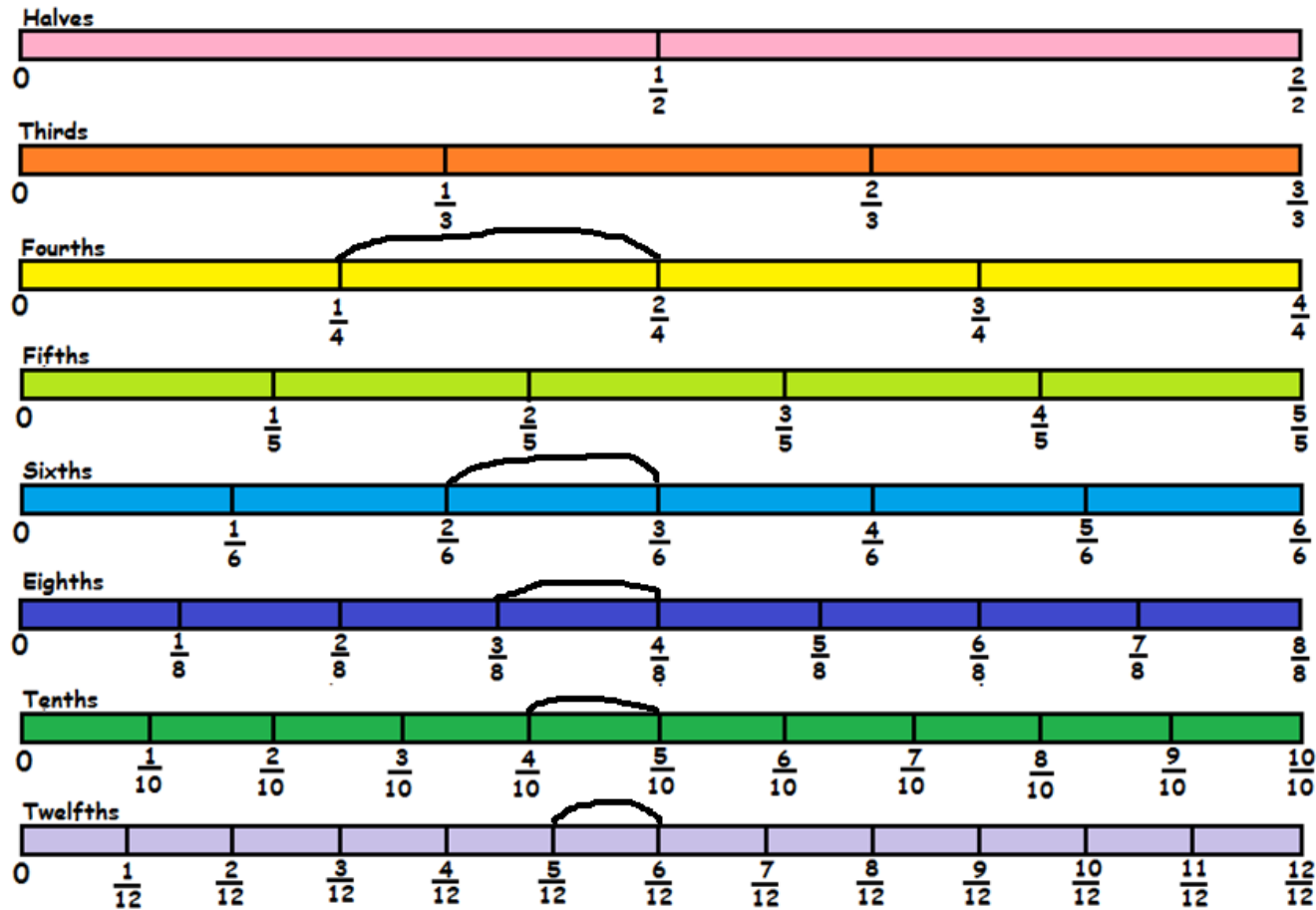
Fraction Strips with residual less than the benchmark



But what if it's greater than the benchmark?



Less than half?



Let's Practice these Strategies

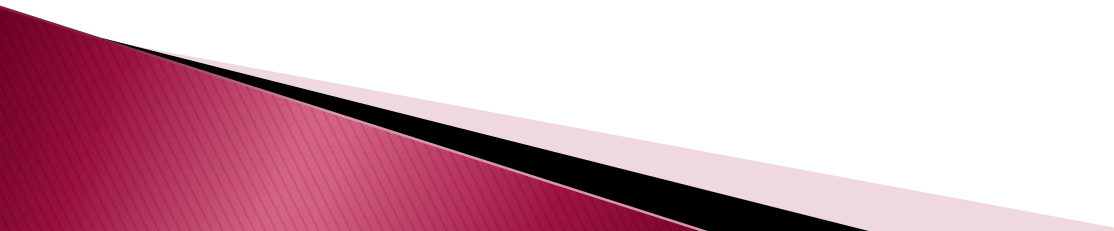
- ▶ **Which Strategy?**
- ▶ **Hands Up/Pair Up**
- ▶ **Rolling Something Close**

Which Strategy?

Common Numerator	Common Denominator	Compare to $\frac{1}{2}$	Unit Fraction Less than a Benchmark	Unit Fraction More Than a Benchmark

Common Numerator	Common Denominator	Compare to $\frac{1}{2}$	Unit Fraction Less than a Benchmark	Unit Fraction More Than a Benchmark
$\frac{3}{12} \bigcirc \frac{3}{8}$	$\frac{4}{6} \bigcirc \frac{5}{6}$	$\frac{2}{5} \bigcirc \frac{7}{12}$	$\frac{10}{11} \bigcirc \frac{23}{24}$	$\frac{13}{12} \bigcirc \frac{10}{9}$
$\frac{1}{5} \bigcirc \frac{1}{10}$	$\frac{19}{20} \bigcirc \frac{17}{20}$	$\frac{6}{12} \bigcirc \frac{11}{22}$	$\frac{4}{5} \bigcirc \frac{5}{6}$	$\frac{7}{12} \bigcirc \frac{10}{18}$
$\frac{7}{10} \bigcirc \frac{7}{12}$	$\frac{5}{12} \bigcirc \frac{3}{12}$	$\frac{5}{8} \bigcirc \frac{3}{10}$	$\frac{3}{8} \bigcirc \frac{5}{12}$	$\frac{4}{6} \bigcirc \frac{5}{8}$

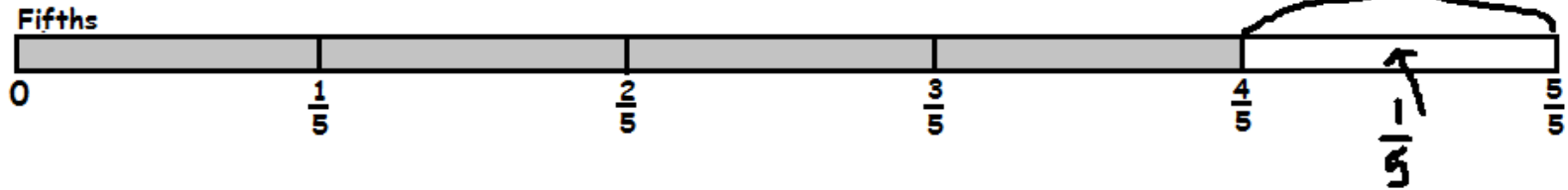
Pair Up, Game On, Trade Off

- ▶ **Which Fraction is Greater**
 - ▶ **Pair up with someone near you**
 - ▶ **Game on.... Quiz each other**
 - ▶ **Trade papers**
 - ▶ **Pair up with someone new**
- 

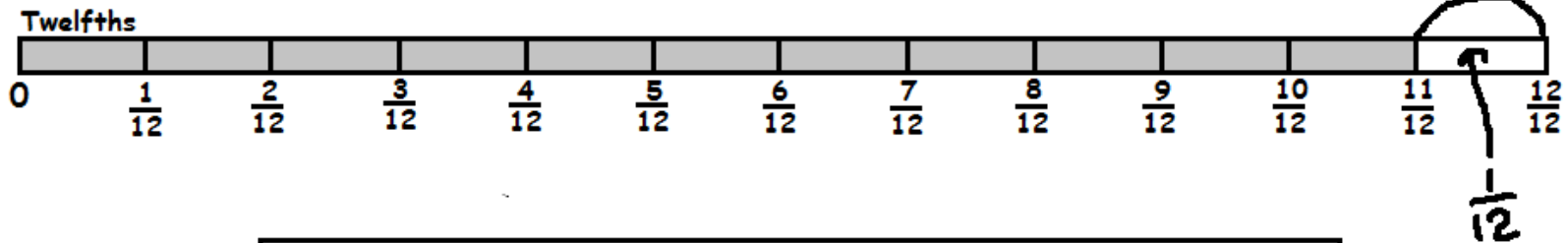
Which fraction is greater?

$$\frac{4}{5} \quad \frac{11}{12}$$

$\frac{4}{5}$ is $\frac{1}{5}$ less
than the whole



$\frac{11}{12}$ is $\frac{1}{12}$ less
than the whole



$\frac{4}{5}$ is $\frac{1}{5}$ less than the whole.

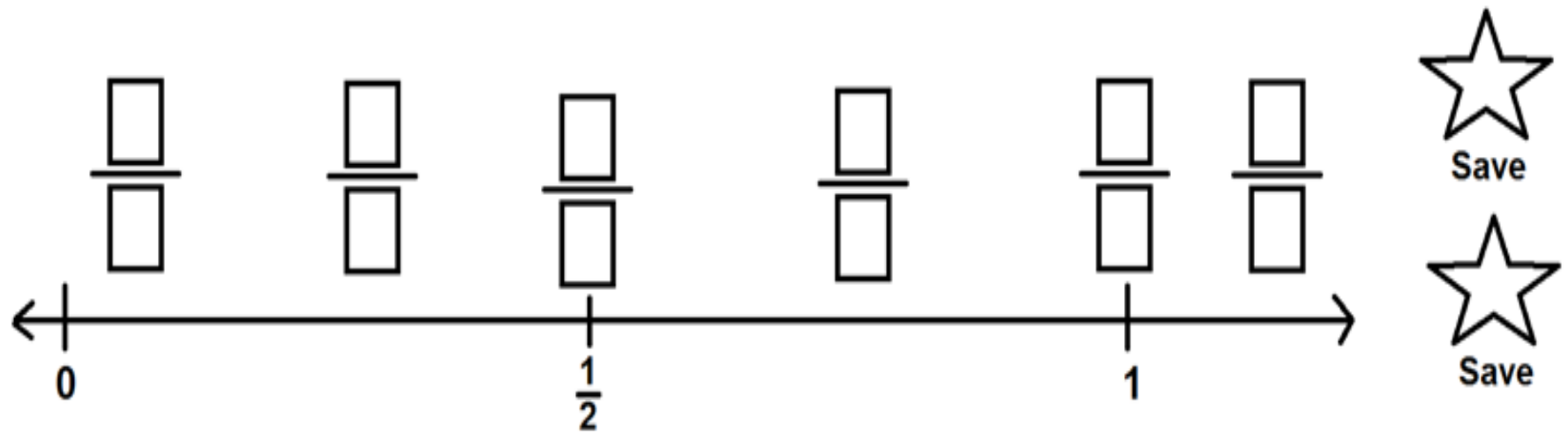
$\frac{11}{12}$ is $\frac{1}{12}$ less than the whole.

Since $\frac{1}{12}$ is a smaller distance than $\frac{1}{5}$, $\frac{11}{12}$ is closer to the whole than $\frac{4}{5}$.

Rolling Something Close

- ▶ Each time a digit is rolled, place it in one of the boxes.
- ▶ A digit that is rolled may be placed in the SAVE Stars at any point during the game.
- ▶ After we have rolled all 14 digits, the numbers in the SAVE Stars may replace any two digits on the number line IF doing so will help you create a more accurate fraction.
- ▶ Afterwards, check fractions with partner and circle any fraction you created on the number line that has the appropriate value.

Rolling Something Close



Learnbop as an Intervention Tool

What is the final answer?

Jan walks each morning for exercise. She takes a drink of water as she completes every $\frac{3}{4}$ of a mile. She walks a total of $4\frac{1}{2}$ miles.

How many times does she take a drink?




- A. 4 drinks
- B. 5 drinks
- C. 6 drinks
- D. 7 drinks

Submit Answer

Ask for Help

IXL as an Intervention Tool

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Sixth grade > W.8 Divide fractions and mixed numbers: word problems

There are $3\frac{2}{3}$ pounds of bricks in a bag. Each brick weighs $1\frac{5}{6}$ pounds. How many bricks are in the bag?

Simplify your answer and write it as a proper fraction or as a whole or mixed number.

bricks

Submit

Problems attempted

0

Time elapsed

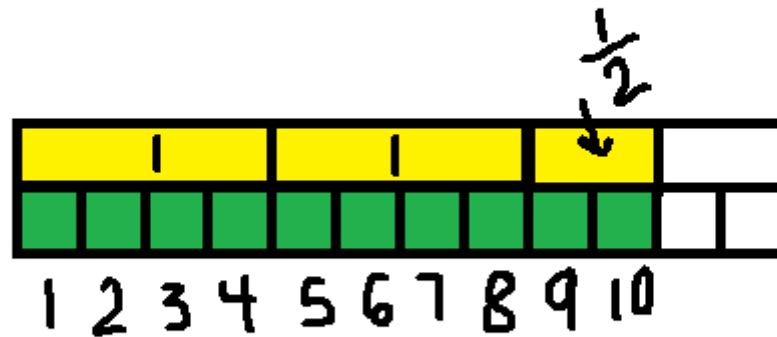
00 00 06
HR MIN SEC

SmartScore
out of 100 ?

0

Bar diagrams as Intervention Tools

$$2\frac{1}{2} \div \frac{1}{4} =$$



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- ▶ Please email Joann personally at the email above if you would like a copy of the comparing fractions activity using the Hands Up/Pair Up activity .





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