# Strategies and Resources for Teaching Fractions Through the Common Core

Grades 3 - 5

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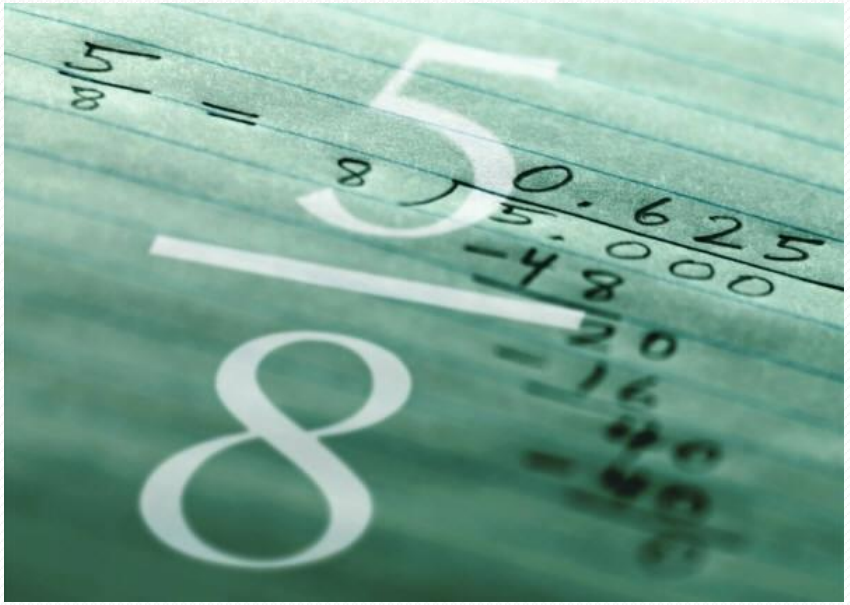
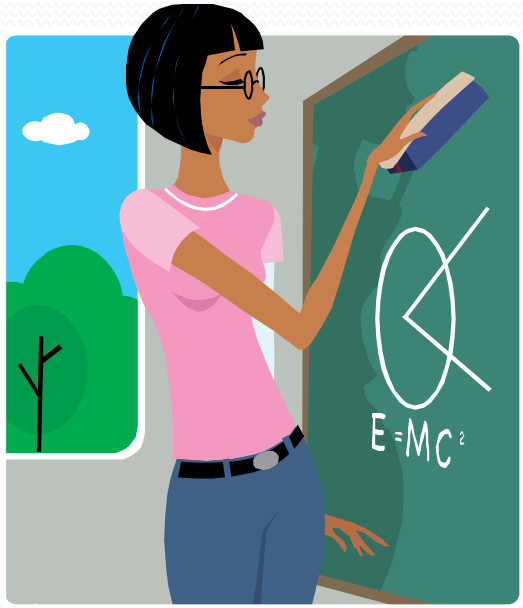
# About this Presentation…

- Common Core Standards
- Road Map to the Common Core
- Why Fractions?
- Identifying Strategies for Comparing Fractions
- Developing an understanding of Fractions as Numbers
- Using Visual Models
- Lesson Ideas and Resources



# The Common Core

- Achieve equity for all students
- Teachers concentrate on a more focused set of major concepts
- Engages students in solving real-world math problems
- Incorporates mathematical practice standards




*"The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers." ~Common Core State Standards Initiative (2012)*

# Common Core Standards For Mathematical Practice

- Make sense of problems and persevere in solving them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning.

# Road Map to Common Core

## Understanding Fractions

Grade 3

Students will learn about

- Unit fractions and their size.
- Compare and find equivalent fractions using *visual models* 3.NF.3
- Fractions on a number line 3.NF2

Grade 4

Students will learn about

- Comparing two fractions with different numerators/denominators by using *benchmark fractions/visual models* 4.NF.1

## Operations with Fractions

Grade 4

Students will learn to

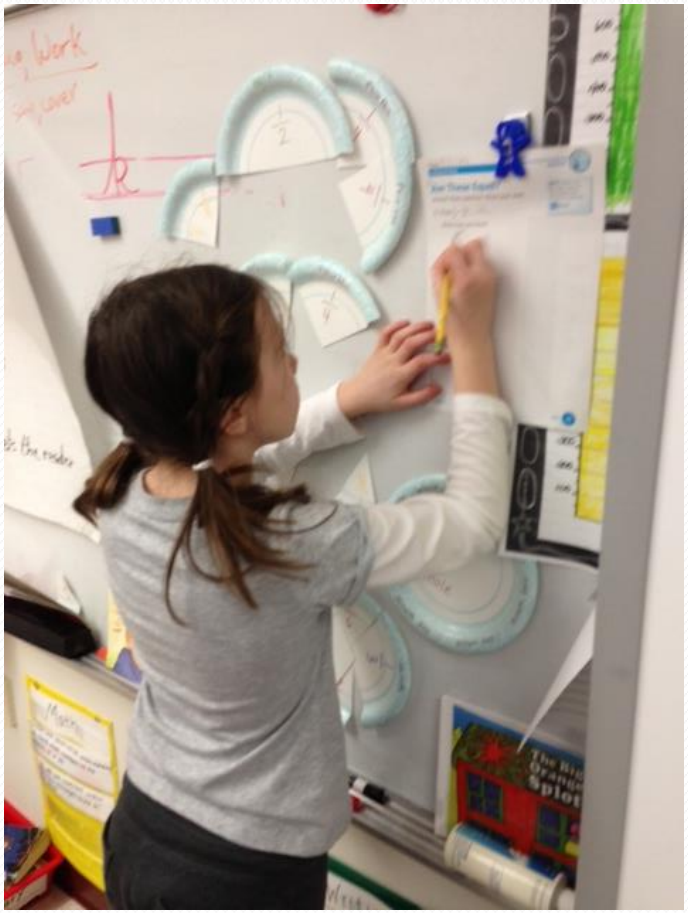
- Add & Subtract fractions with like denominators using visual models 4.NF3d
- Create equal fractions (3/8 = 1/8 + 1/8 +1/8)
- Multiply whole numbers by a fraction.

Grade 5

- Add & Subtract fractions with unlike denominators using *visual models* (5.NF.6)
- Multiply a fraction by a fraction.
- Divide a whole number by a fraction and a fraction by a whole number.

# Common Themes - Common Core

- *Construct mental images*
- *Use multiple fraction models*
- Extended time/practice with models
- *Real-world problem solving*
- Discussion of the reasoning strategies used when comparing fractions



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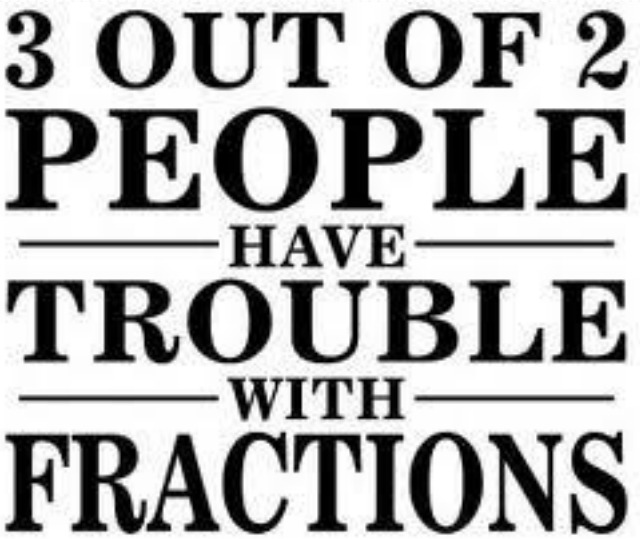
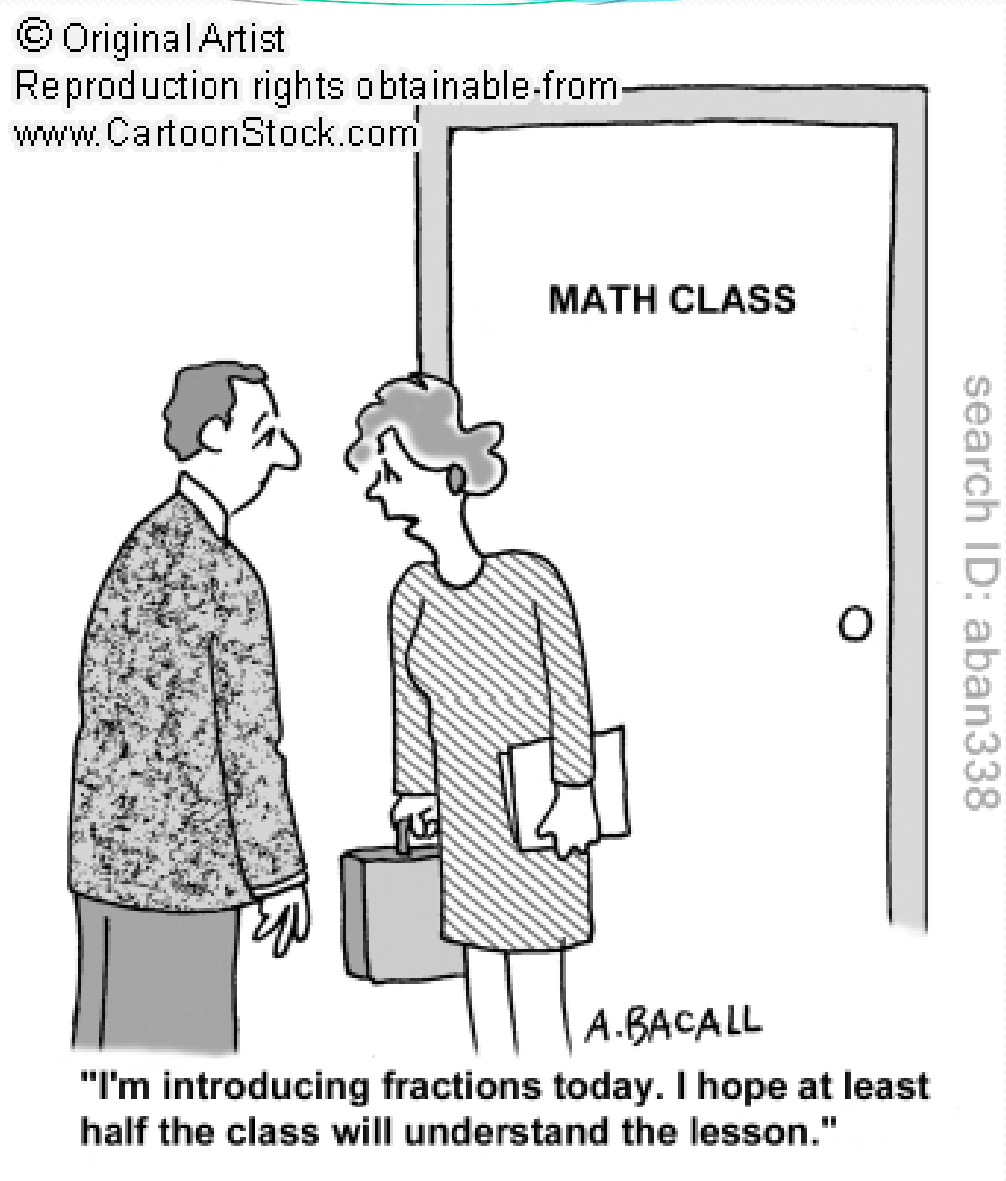
# Why Fractions?

- Complex subject
- Requires *conceptual* understanding and *reasoning*
- Operations with fractions are counterintuitive to what children have learned about whole numbers
- Fractions follow students throughout their school years and beyond

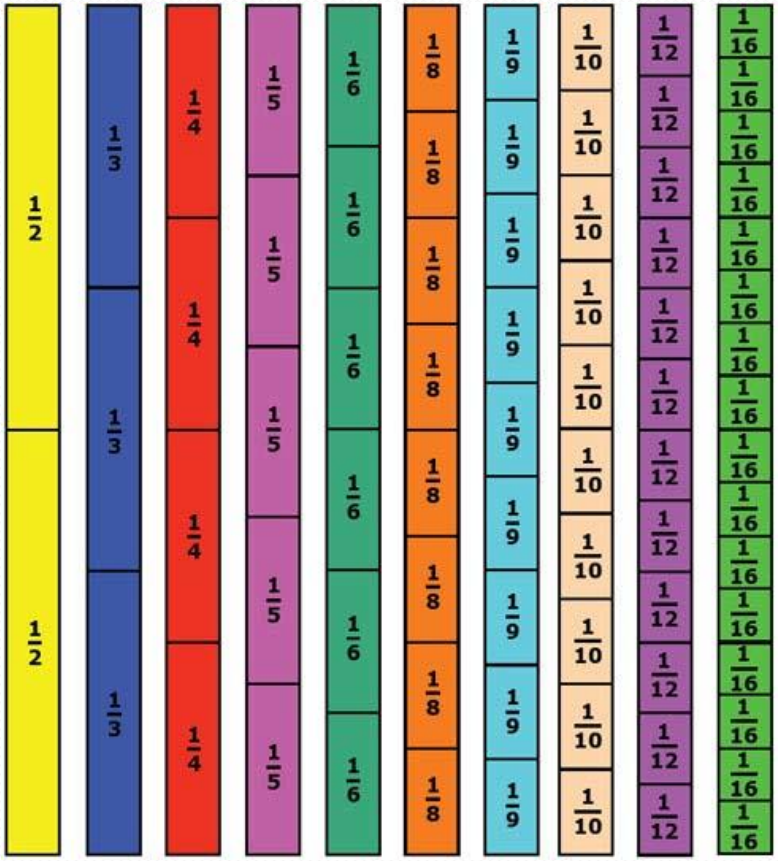


# Did this ever happen to you?



# Comparing Fractions – BIG Ideas

- Understand strategies students are using in order to support student learning
- Identify what struggling learners are missing in order to provide interventions and direct instruction
- Explicitly teach these strategies using multiple modes and models



# Strategies for Comparing Fractions

1. *Same Denominator*
2. *Same Numerator*
3. *Transitive*
4. *Residual*

Same Denominator - The same denominator implies that one is comparing parts of the unit that are the same size

Same Numerator - involves understanding that an inverse relationship exists between the number of parts a unit is partitioned into and the size of the parts.

Transitive - students use a single outside value to compare both fractions

Residual - students focus on the "leftover" part in judging the relative size of the fractions

# Same Denominator – More Same Sized Parts

## Big Ideas

- Students use *concrete materials* to compare fractions and use this knowledge to move to more abstract thinking in the later grades.
- Concrete models should first focus on *area models*
- Pieces are the "*same size*"
- Largest numerator is the largest fraction

Elementary and Middle School Mathematics: Teaching Developmentally (van de Walle 2007)

# Same Denominator – Visual Model

This comparison focuses on the number of parts selected/shaded. Students should recognize that it always refers to the *same whole*.

3/10

5/10

# Same Numerator – Same Number But Different-Sized Parts

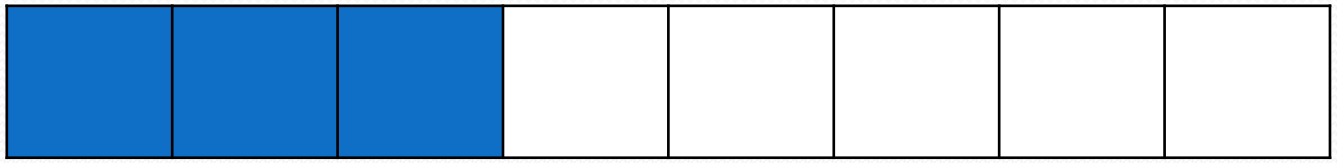
**Big Ideas**

- Always refers to the same whole
- Students become familiar with models for fractions and describing part-to-whole relationships
- With fractions, the *more* pieces, the *smaller* the size of each piece
- Students *reason* about size of pieces

# Same Numerator – Visual Model

This model demonstrates reasoning about the size of each part. Students need to shift their thinking from comparing whole numbers.

3/8



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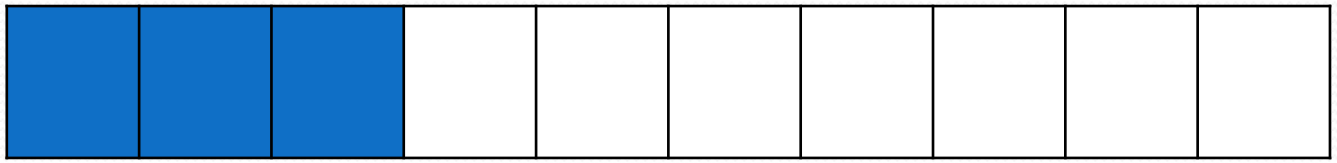
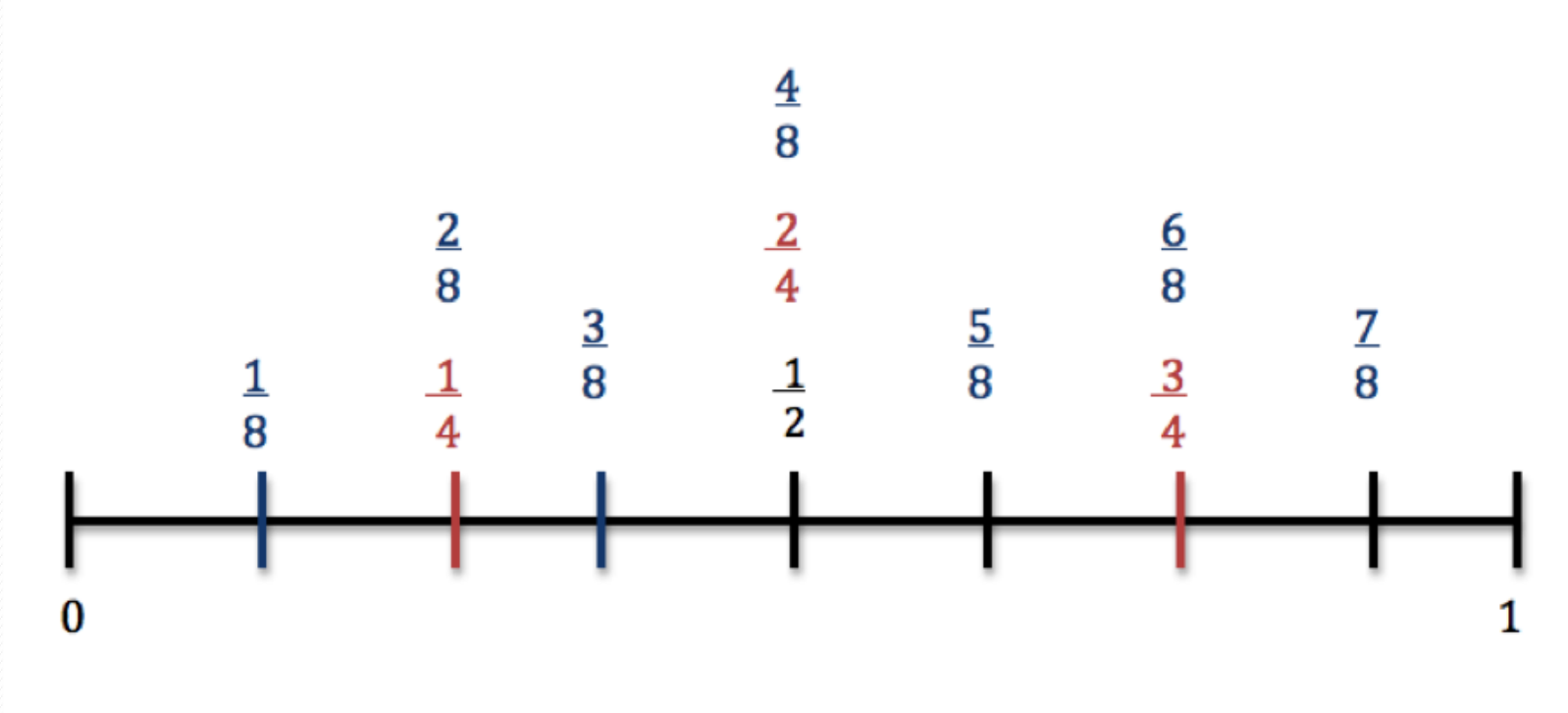


# Transitive Strategy: Benchmark ½

When students use the benchmark of ½ and one they are using the transitive property.



# Activity – Comparing Fractions (Transitive Strategy)

Which Fraction is greater:

14/24 or 17/36

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# Answer: Which Fraction is Bigger?

- Although both fractions are close to ½, 14/24 is more than ½ because 12/24 is exactly ½ and 14/24 is greater than that. Likewise, 17/36 is less than ½ because 18/36 is exactly ½ and 17/36 is less than that. So 14/24 is greater than 17/36

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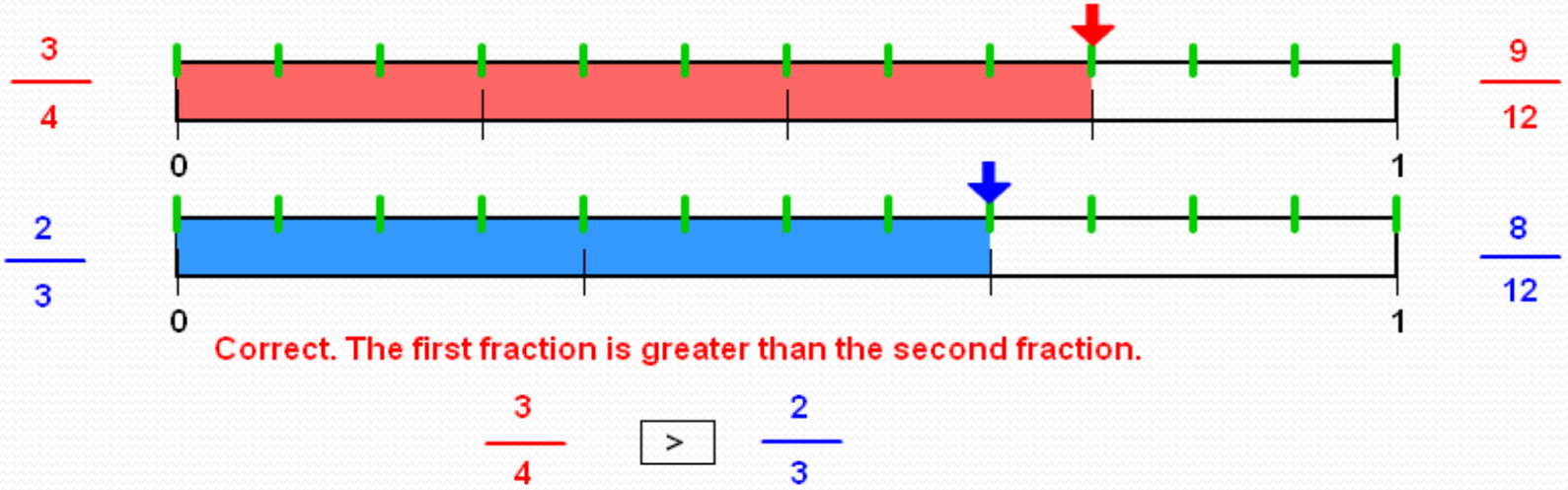
# Residual Strategy: Fill the Whole

When comparing fractions students decide on the relative size of each fraction by reflecting on the amount away from the whole. Students rely on the same numerator strategy; they compare what's left, to determine which of the original fractions have the largest amount away from one.



# Activity – Comparing Fractions (Residual Strategy)

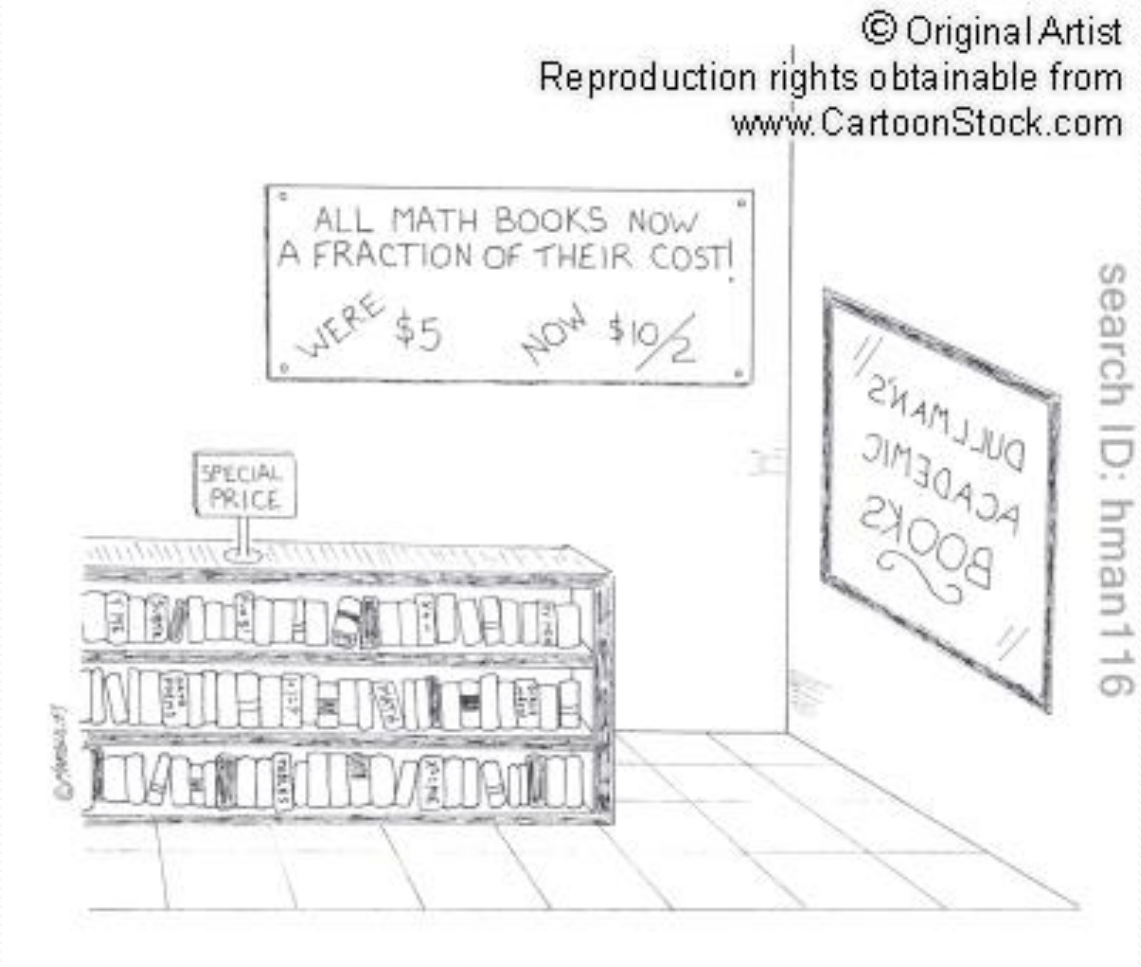
Which fraction is greater?

3/4 and 7/8

# Turn and Talk – Student Thinking

- What does the student know?
- Is the student using the Residual Strategy?
- Is the student thinking abstractly?
- Is there evidence of the student reasoning about numbers?
- What does the student need to understand in order to use this strategy?

# Reason Abstractly and Quantitatively



# Make Sense of Problems

- "Teaching students both HOW and WHY computational procedures work results in greater math proficiency."
  ~Tim Lamarre

# Real Word Problem Solving

- Ms. Lippens is making brownies. One batch needs 2/3 cups of chocolate chips. But, she wants to make 5 batches so she will have enough to feed all her students. How many cups of chocolate chips does she need in all?

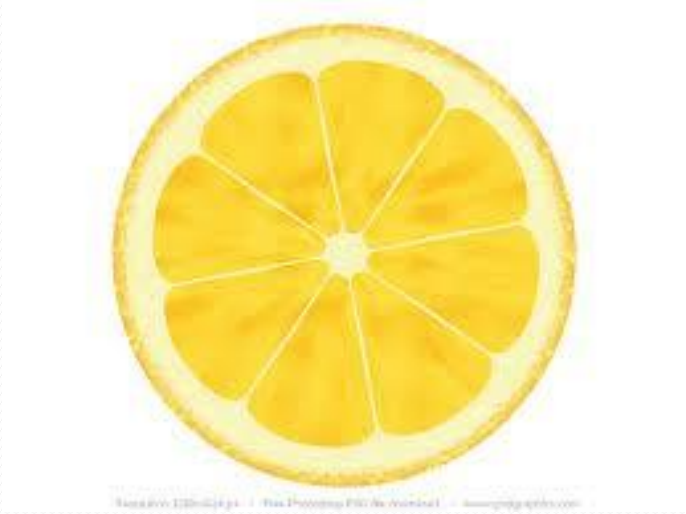
# Develop an Understanding of Fractions as Numbers

Many experiences with *physical models* are needed to overcome the influence of children's *whole number* thinking.

# Beyond Pizza

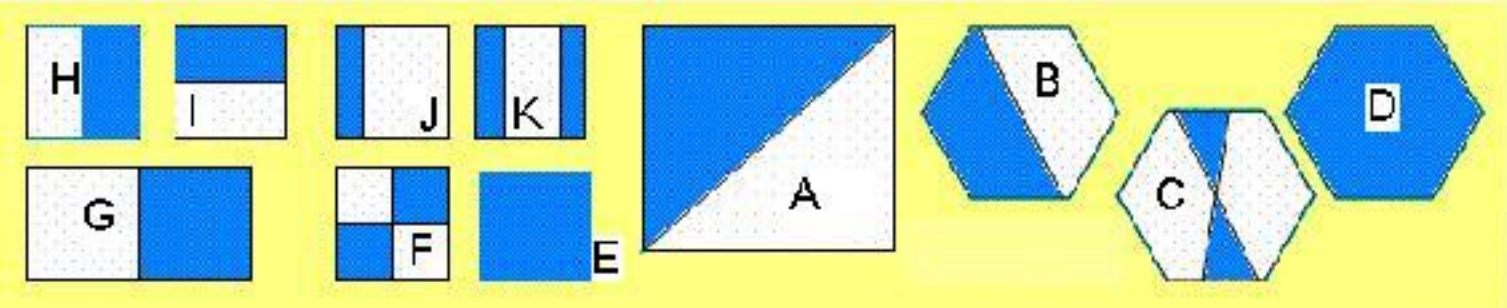
- *Multiple concrete models*
- Physical aids are just one component in the acquisition of concepts
- Verbal, pictorial, symbolic and *real-world* representations
- Opportunities to *talk* about mathematical ideas
- *Conceptual knowledge* **prior** to formal work with symbols and algorithms

(Teacher's Guide to the RNP: Initial Fraction Ideas, p. 12).



# Lesson Idea: Area Models

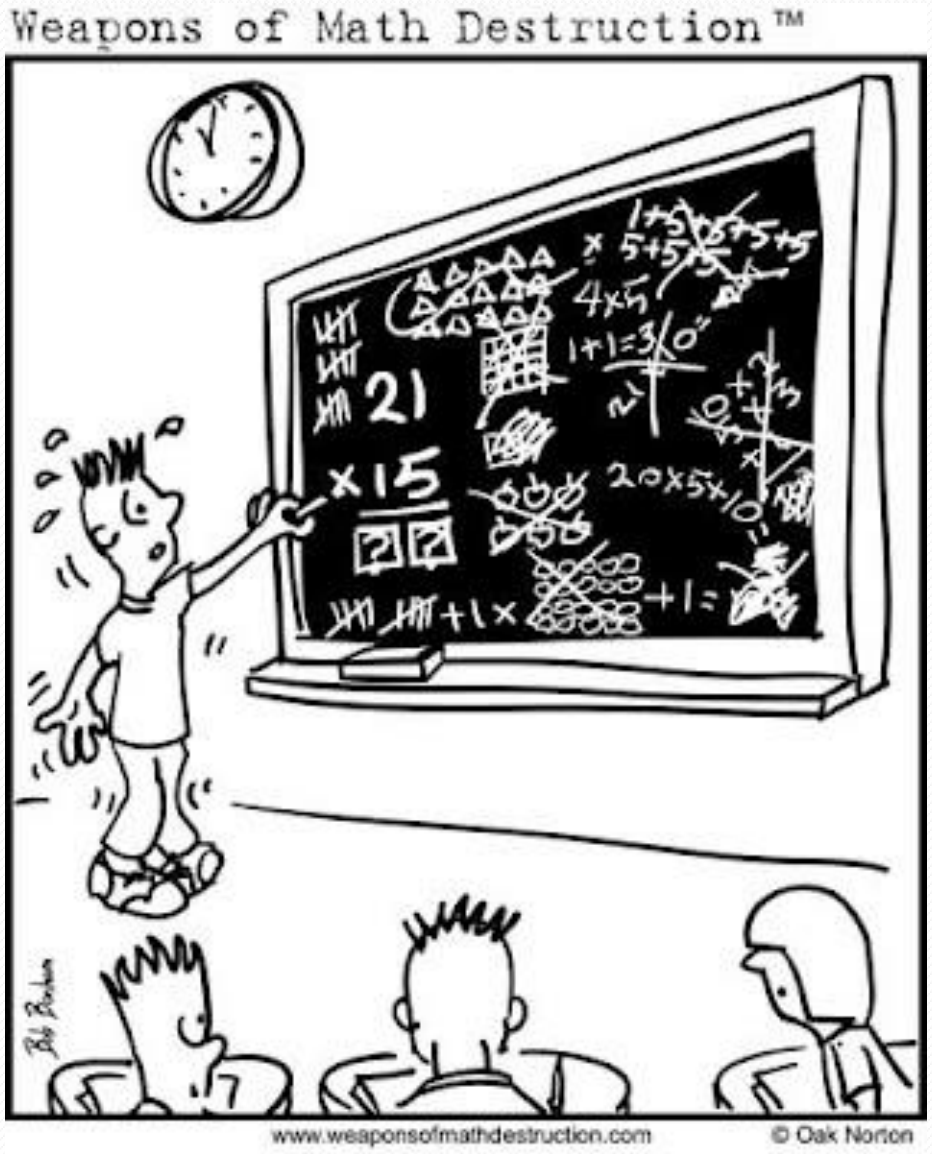
- Developing the idea of the *relative amount of the area that has been shaded is not possible unless the size of the basic rectangle is sometimes varied within one exercise.*
- Central idea of relative sizes is a key idea for fractions




*What is the same and what is different?*

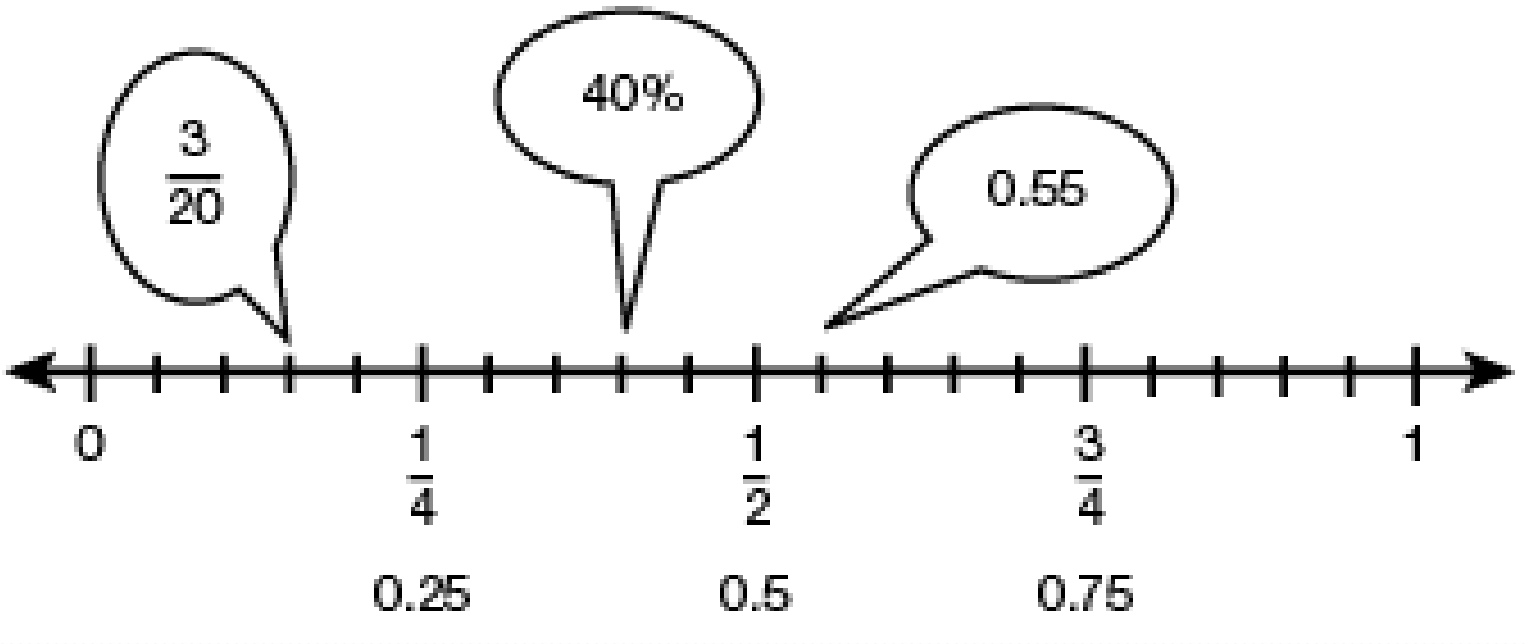
*Lesson Idea: Students determine relative use of space in newspapers for ads, articles, pictures etc..*

# Attend to Precision



# Fractions have MAGNITUDE

- Fractions are NUMBERS
- Clearly illustrate the magnitude of fractions



# Lesson Idea: Measurement with Fraction Strips

- To start, take a strip of card stock or construction paper that represents the initial unit of measure (i.e., a whole) and use that strip to measure objects in the classroom (desk, chalkboard, book, etc.).

| 1/2 | 1/4 |
|---|---|

- When the length of an object is not equal to a whole number of strips, teachers can provide students with strips that represent fractional amounts of the original strip

| 0.5 | 0 .25 |
|---|---|

# Visual Models: Fraction Wall

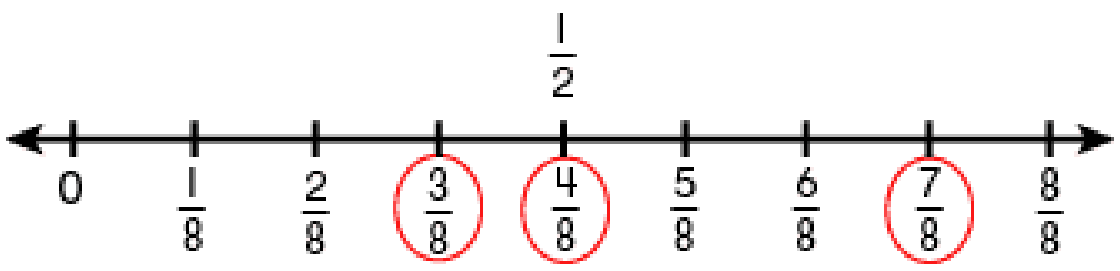
- Focuses on creating equal-sized pieces
- Visualizes equivalent fractions
- Visualizes that $^1/_7$ is a fraction (this is not on many commercial models)
- Shows that $^1/_7$ will be a bit bigger than $^1/_8$ and a bit smaller than $^1/_6$, etc.

# Online Resources

- www.geogebratube.org
- www.coolmath.com
- The National Library of Virtual Manipulatives, (NLVM) http://nlvm.usu.edu/en/nav/topic_t_1.html
- www.thinkingblocks.com
- www.adaptedmind.com
- www.ixl.com/Math
- www.sheppardsoftware.com/math.htm
- www.mathisfun.com
- www.helpwithfractions.com

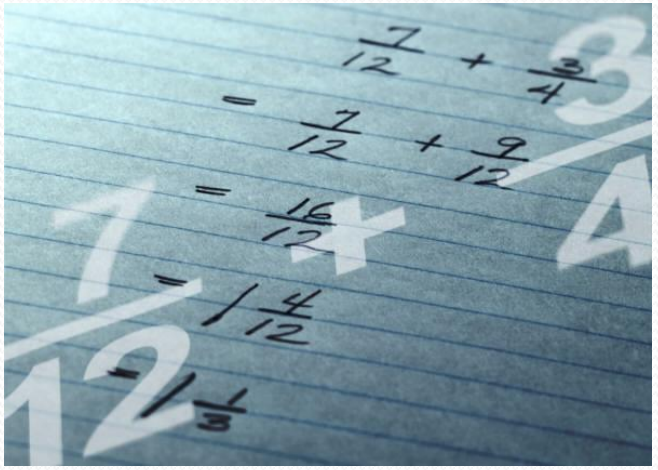
# Online Resources: Fractions on a Number Line

- http://www.bgfl.org/bgfl/custom/resources_ftp/client_ftp/ks2/maths/fractions/level4.htm
- http://www.visualfractions.com/GrampStrict/findgrampystrict.html
- http://www.funbrain.com/linejump/index.html



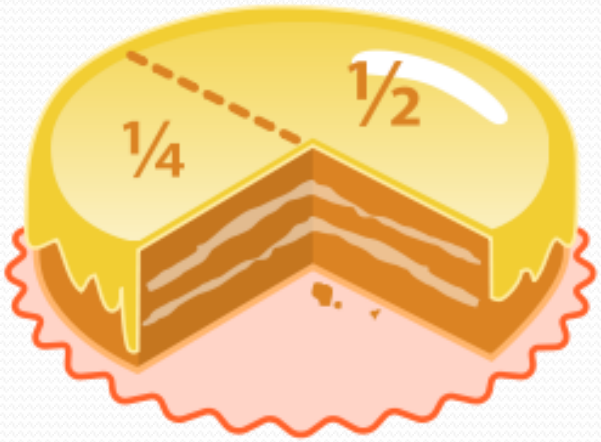
# Rational Number Project

- An ongoing research project investigating student learning and teacher enhancement
- Advocates teaching fractions using a model that emphasizes *multiple representations* and *connections* among different representations.
- In 2009 they published RNP – Initial Fraction Ideas containing *free* lesson and materials teachers can use in their classrooms.



# IES – Institute of Education Sciences

- "Mission is to provide *rigorous and relevant evidence* on which to ground education practice and policy and share this information broadly."

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# Questions and Comments

- "Teachers need to understand the *reasoning* behind computations that involve fractions so they can clearly and coherently explain to students *why* the procedures work, not just the sequence of steps to take."


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