Diving Deeper into Decimals

NCTM 2016 Conference

Randi Blue
Kelly Krownapple

1213
10:45 AM to
11:45 AM
OCC 210/11
Intermediate
(3 - 5)
Regular Presentation (60 minutes)
Coaching That Matters

D3: Diving Deeper Into Decimals
How do you build a strong understanding of decimals so that computation makes sense? What is involved in teaching decimals that will ensure student concept attainment? Participants will discover and play games to see how place value, estimation, and an understanding of decimal notation build a strong foundation that leads to accurate computation.

Lead Speaker: Randi Blue
Co-Presenter: Kelly Krownapple

Use the following numbers to fill in the blanks. The story must make sense when you are done. Groundworks 6 page 21

2.75 33 2 7.5 .25 8

The height of a person is about _(1)_ times the length of his or her head. Jack is 5 feet tall. The length of his head is about _(2)_ inches. The length of a person's head is about 1/3 of the length of that person's arm. Jack's arm is about _(3)_ feet long. The length of a person's head is about _(4)_ the length of that person's leg. Jack's leg is about _(5)_ inches, or _(6)_ feet long.

Greenes, C. E., & Findell, C. (1999). *Groundworks: Algebraic Thinking* (Vol. 6). Chicago, IL: Creative Publications.

Use the following numbers to fill in the blanks. The story must make sense when you are done. Groundworks 6 page 21

2.75 33 2 7.5 .25 8

The height of a person is about_(7.5)_times the length of his or her head. Jack is 5 feet tall. The length of his head is about _(8)_inches. The length of a person's head is about 1/3 of the length of that person's arm. Jack's arm is about _(2)_feet long. The length of a person's head is about_(.25)_the length of that person's leg. Jack's leg is about_(33)_inches, or_(2.75)_feet long.

5.NBT.7

Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

Learning Targets:

I can add, subtract, multiply, and divide decimals.

I can explain how I computed with decimals using concrete models or drawings.

6.NS.3

Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Learning Targets

I can add, subtract, multiply, and divide multi-digit decimals.

I can use the standard algorithm.

How did you learn to add and subtract decimals? Discuss with someone near you.

- Did your teachers teach the algorithm or did they explain why certain methods work?
- Did place value play a role?
- Did you investigate how it connected to whole number computation?

Evaluate 3.4 - 1.07

- How would your students set this problem up?
- What difference would your students find?
- What misconceptions could occur?
- Would estimation play a role for your students? Would estimation help?

3.4 - 1.07

Solve this problem mentally.

Share your solution with the person next to you.

$$\begin{array}{r} 3.4 \\ -\ 1.07 \\ \hline \end{array}$$

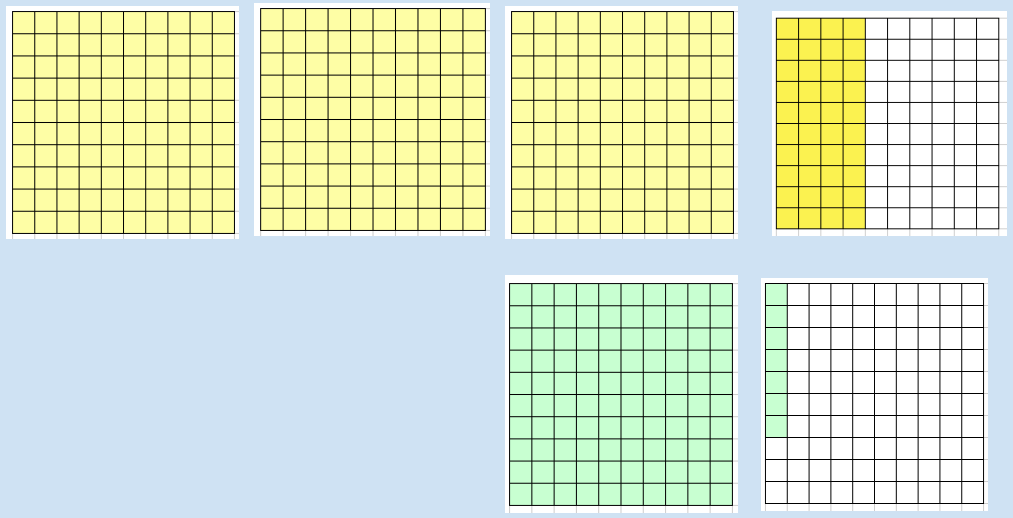
Build it with base ten blocks.

Find the difference between the number of blocks in the 3.4 model and the number of blocks in the 1.07 model?

Share your findings with another group.

What did you need to do to find the difference?

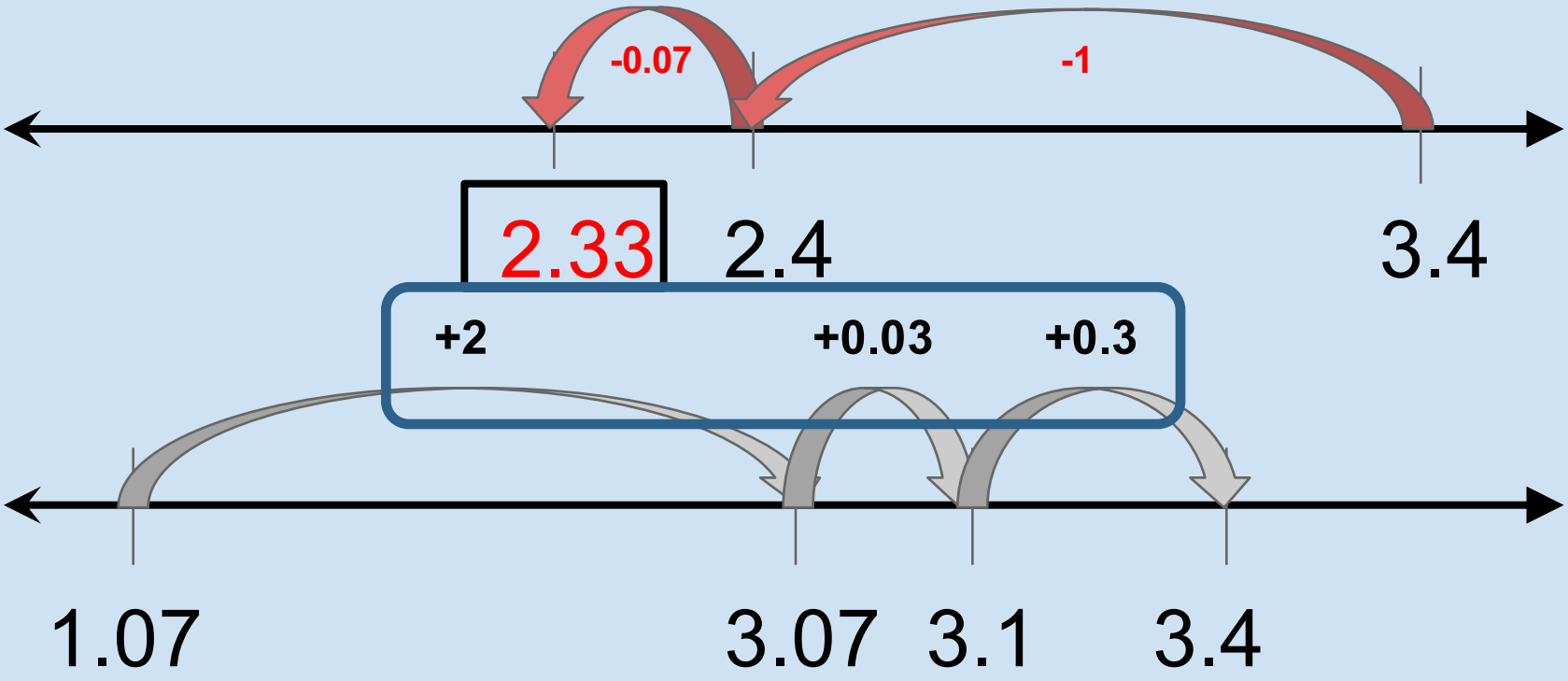
A special thanks to ETA hand2mind for providing the materials today.



$$3.4 - 1.07 = \_\_\_$$

Move from concrete to a drawn model with transparency paper. Use the 10X10 grids to model this problem.
Use a drawn representation of ones, tenths, and hundredths.

Look at 3.4 - 1.07 on a number line.



Use what we have just discussed to identify the misconceptions in these two equations.

$$0.3 + 0.07 = 0.10$$

$$1.0 - 0.07 = 0.3$$

Tie it all together. Have your students create both sides for a given problem and talk about the connection between each side.

Evaluate 3.2 - 1.57

Model

Estimate: _____

Algorithm

Target One: Game for adding decimals. Start with 0 and get as close to 1 as possible.

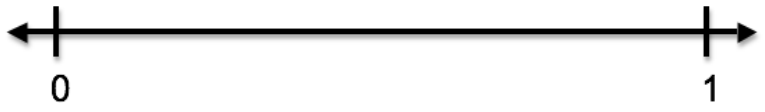
OR

Target Zero: Game for subtracting decimals. Start with 1 and get as close to 0 as possible.

Tenths	Hundredths

My final sum is

_____



Pinch Card Questions:

1. State your total as a fraction. ___/ ___
2. Are you close to 0, ½, or 1?
3. How much greater than ½ or less than ½ are you?
4. What fraction or percent represents your total so far?

Multiplication

I am buying 4 pencils. Each pencil costs $.23.
How much money did all 4 pencils cost?

Think about how you were taught as we go forward.

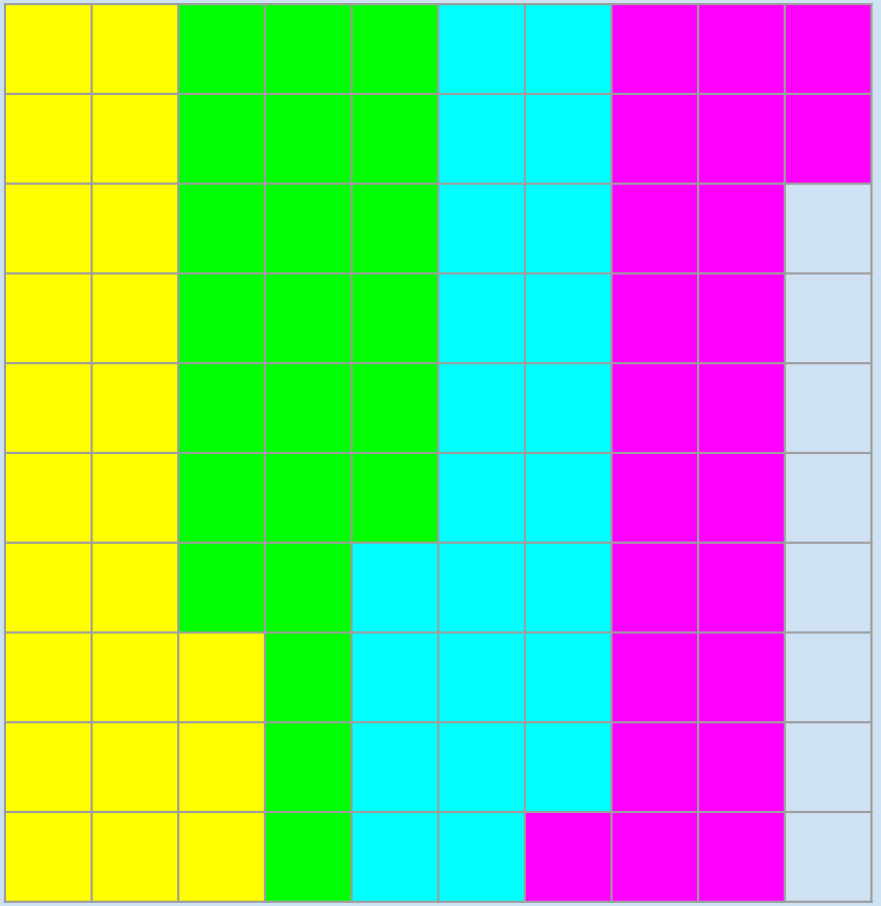
0.23 X 4 =

Where does the decimal go?

Estimate: 0.23 is close to 2 tenths

2 tenths (4 times) is 8 tenths

So the answer should be close to 0.80 but greater



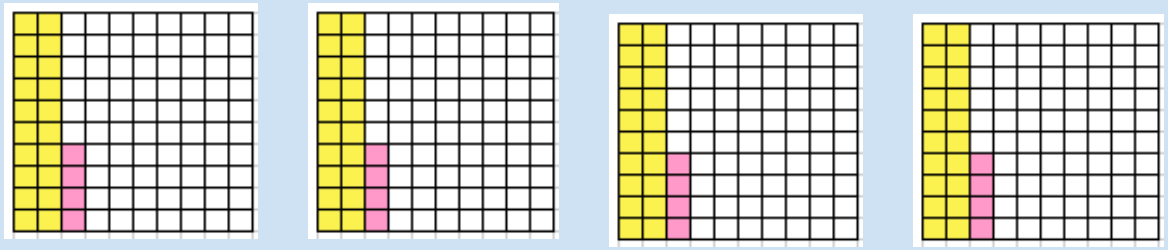
0.23 + 0.23 +0.23 + 0.23 = 0.92

0.23 X 4 = Where does the decimal go?

Estimate:

It has to be less than 1 because 0.25 four times is one whole and 0.23 is less than 0.25.

0.23 is close to 2 tenths, 2 tenths (4 times) is 8 tenths so the answer should be close to 0.80 but greater

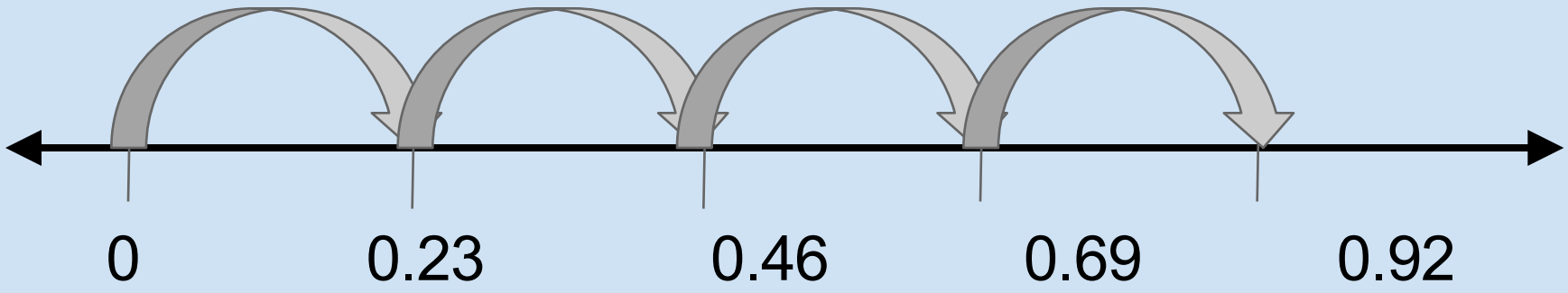


8 tenths + 12 hundredths = 0.92

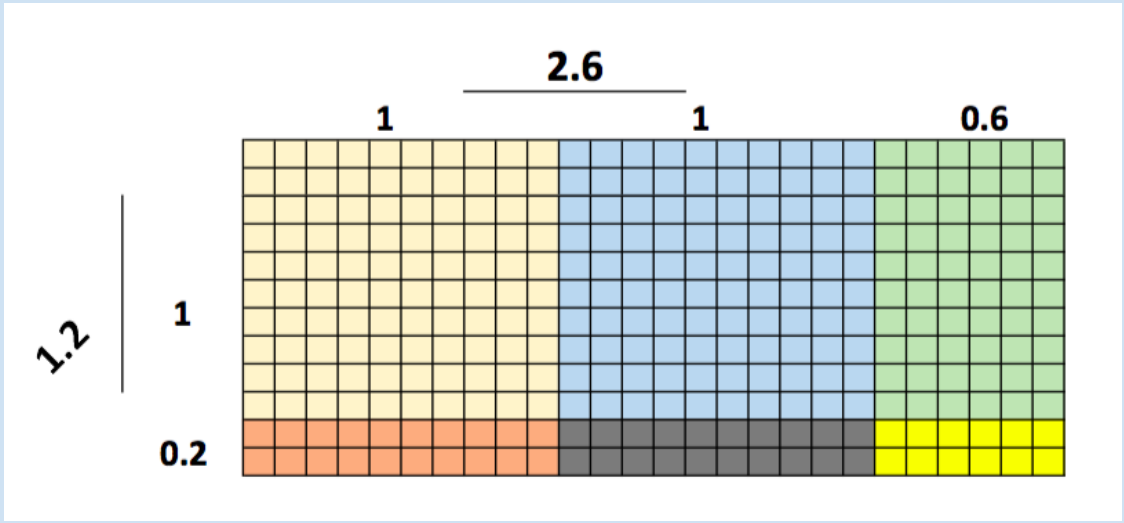
(0.2 X 4) + (0.03 X 4) = 0.92

Number Line

0.23 X 4



Model with the array.



Your turn.
Use the base ten blocks to build an array of

1.5 X 1.4

= 3.12

Learn Zillion: Extend multiplication to different types of decimal numbers (FP)

What happens to the decimal point?

1. 3.24 X 10

2. 5 X 10

3. .386 X 10

What happens to the decimal point?

1. 3.24 X 10 = 32.4
2. 5 X 10= 50
3. .386 X 10= 3.86

5.NBT 1
Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.

“Estimation and concrete experiences are needed to build a strong understanding. In fact, the best approach to a division estimate generally comes from thinking about multiplication rather than division.”

(We would add: Estimation for all operations is imperative!)

Let’s look at division.

Look at the following expressions in a different format.

$3 \div 4$ is the same value as

$\frac{3}{4}$ or $4\overline{)3}$

$18 \div 6$ is the same value as

$\frac{18}{6}$ $6\overline{)18}$

$\frac{3}{4}$ and $\frac{30}{40}$

What happens to the decimal when I multiply by $\frac{10}{10}$?

$$\frac{3.572}{8.4} \times \frac{10}{10} = \frac{35.72}{84}$$

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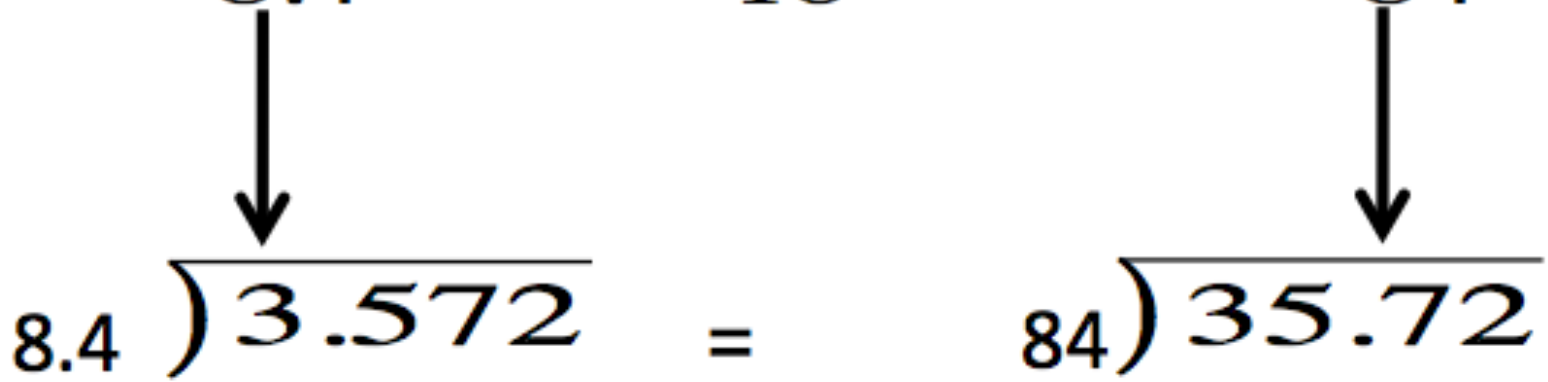

See the connection?

Make an estimate of 45.7 ÷ 1.83

Think only of what times 1 8/10 is close to 46.

Will the answer be more or less than 46?
Why?
Will it be more or less than 20?
Now think about 1.8 being close to 2. What times 2 is close to 46?
Use “think multiplication” to produce an estimate.

Consider this problem.

The trip to Washington was 282 miles. It took exactly 4.5 hours to drive. What was the average rate in miles per hour?

To make an estimate of this quotient, think about what times 4 or 5 is close to 280. You might think 60X4.5 = 240+30=270, so maybe about 61 or 62 miles per hour

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$3 \div 4$ is the same value as

$\frac{3}{4}$ or $4\overline{)3}$

$18 \div 6$ is the same value as

$\frac{18}{6}$ $6\overline{)18}$

Write the following expressions in a different format.

$6320 \div 10$ is the same value as

$$\frac{6320}{10} \qquad 10\overline{)6320}$$

$3.572 \div 8.4$ is the same value as

$$\frac{3.572}{8.4} \qquad 8.4\overline{)3.572}$$

$3.572 \div 8.4$

Is the same as $\dfrac{3.572}{8.4}$

What happens to the decimal when I multiply by $\frac{10}{10}$?

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$$8.4\overline{)3.572} \quad = \quad 84\overline{)35.72}$$