Presenters: Amy Mayfield and Lu Ann Weynand

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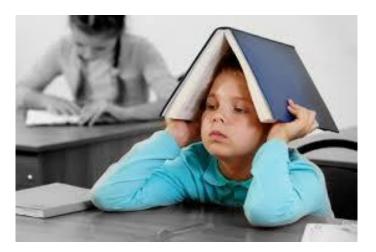
Follow the Standards to Algebra Readiness







http://facing.org/files/bored child with blocks.jpg



▲♥ HMH

http://http://legacy.lincolninteractive.org



Solve Mentally

•99 + 17 = ?



How might a student with strong number sense solve this problem?



How might a student with weak number sense solve this problem?





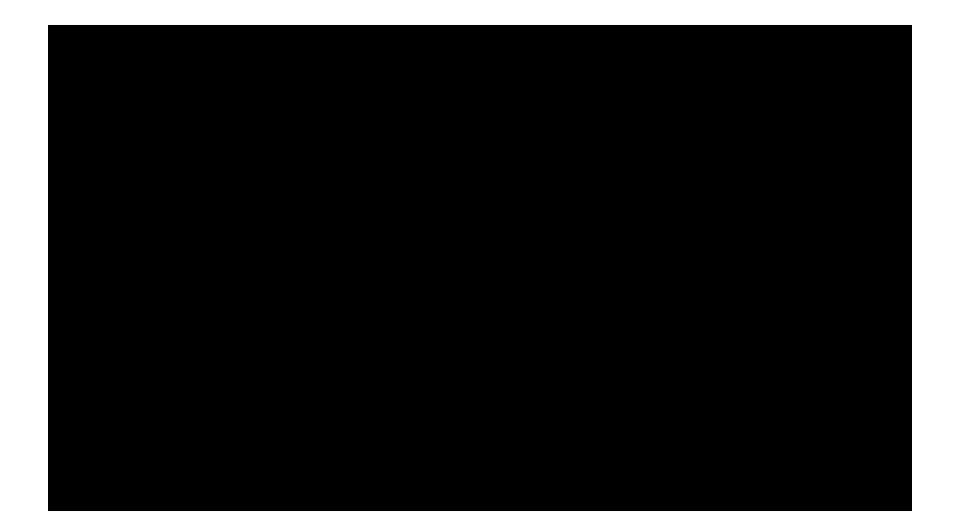
















Turn and Talk....

 What did you observe that will impact these two students as they move forward mathematically?





















Turn and Talk....

• What evidence did you see that these students understand numbers and are computationally flexible?





Pathway to Algebra

Know number name and the sequenceRegresent and solv poblems involving multiplication and subtractionMergesent and solv poblems involving multiplication and involving addition and subtractionMergesent and solv poblems involving multiplication and involving addition and subtractionMergesent and solv problems involving multiplication and involving addition and subtractionMergesent and solv problems involving multiplication and involving addition and subtractionMergesent and solv problems involving multiplication and involving the four problems involving addition and subtractionMergesent and solv problems involving multiplication and involving the four problems involving addition and subtractionMergesent and solv problems involving multiplication and subtractionMultiply and dide multiplication and subtractionMergesent and solv problems involving multiplication and subtractionMultiply and dide multiplication and propertions, and addition and subtractionMultiplication and multiplication and subtractionMultiplication and multiplication and propertions, and addition and subtractionMultiplication and multiplication and addition and subtractionMultiplicatio	к	1	2	3	4	5	6	7	8
and properties of operations to add and subtract standard units and of the full products Understand decimal notation for subtractions, and subtraction to length Represent and fractions, and compare decimal fractions Represent and analyze quantitative relationships expressions and expressions	and the sequence Count to tell the number of objects Compare numbers Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from Work with numbers 11–19 to gain foundations for	problems involving addition and subtraction Understand and apply the relationship between addition and subtraction Add and subtract within 20 Work with addition and subtraction equations Extend the counting sequence Understand place value Use place value and properties of operations to add and subtract	problems involving addition and subtraction Add and subtract within 20 Understand place value Use place value understanding and properties of operations to add and subtract Measure and estimate lengths in standard units Relate addition and	problems involving multiplication and division Understand properties of multiplication to division Multiply and divide within 100 Solve problems involving the four operations, and identify and explain patterns Develop understanding of fractions as numbers Solve problems involving measurement, time, volume & mass Understand concepts	operations to solve problems Generalize place value understanding for multi-digit numbers Use place value understanding and properties to perform multi-digit arithmetic Extend understanding of fraction equivalence and ordering Build fractions from unit fractions by applying and extending previous understandings of operations Understand decimal notation for fractions, and compare decimal	place value system Perform operations with multi-digit whole numbers and decimals Use equivalent fractions as a strategy to add and subtract fractions Apply and extend previous understandings of multiplication and division to fractions Understand concepts of volume and relate volume to multiplication and to addition Graph points in the coordinate plane to	 previous understandings of multiplication and division to divide fractions by fractions Apply and extend previous understandings of numbers to rational numbers Understand ratio concepts and use ratio reasoning to solve problems Apply and extend previous understandings of algebraic expressions Reason about and solve one-variable equations and inequalities Represent and analyze quantitative 	previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers Analyze proportional relationships and use them to solve real-world and mathematical problems Use properties of operations to generate equivalent expressions Solve real-life and mathematical problems using numerical and algebraic expressions and	and integer exponents Understand the connections between proportional relationships, lines, and linear equations Analyze and solve linear equations and pairs of simultaneous linear equations Define, evaluate, and compare functions Use functions to model relationships





Arithmetic - Algebraic Thinking

...using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction (multiplication/division).





Understanding Arithmetic: Three Pillars

- Understanding numbers
- Developing computational fluency
- Examining the behavior of the operations





Setting the Stage for Algebra Readiness

Decompose Small Numbers

$$6 = 1 + 5$$

 $6 = 2 + 4$
 $6 = 3 + 3$

Decompose to Find Sums

18 + 6 = 18 + (2 + 4) = (18 + 2) + 4 = 20 + 4 =24





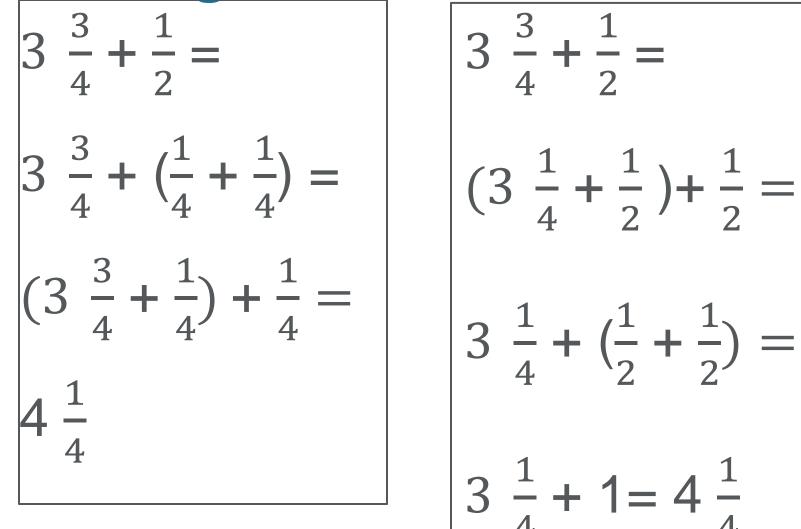
Linking to Larger Numbers

20 + 10 = 308 + 4 = 1220 + 12 = 32





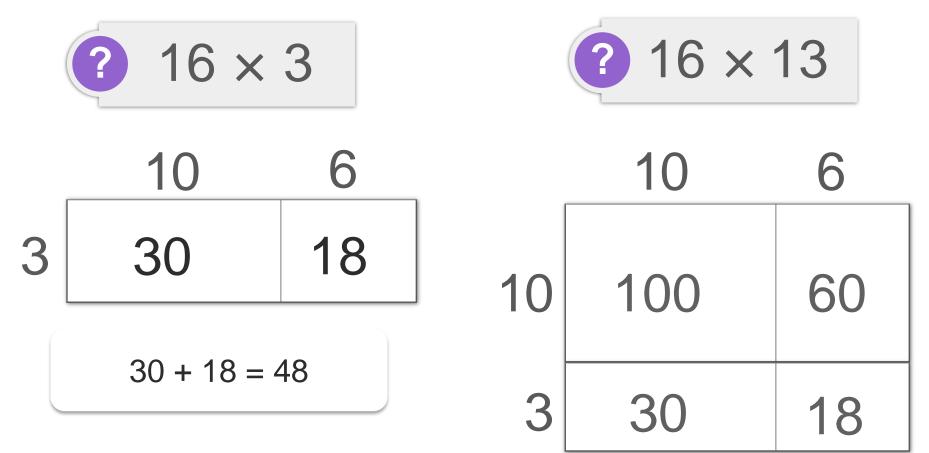
Linking to Fractions





15

Working Towards Algebra Readiness

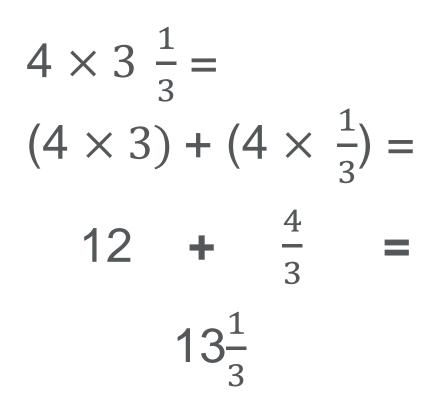


100 + 60 + 30 + 18 = 208





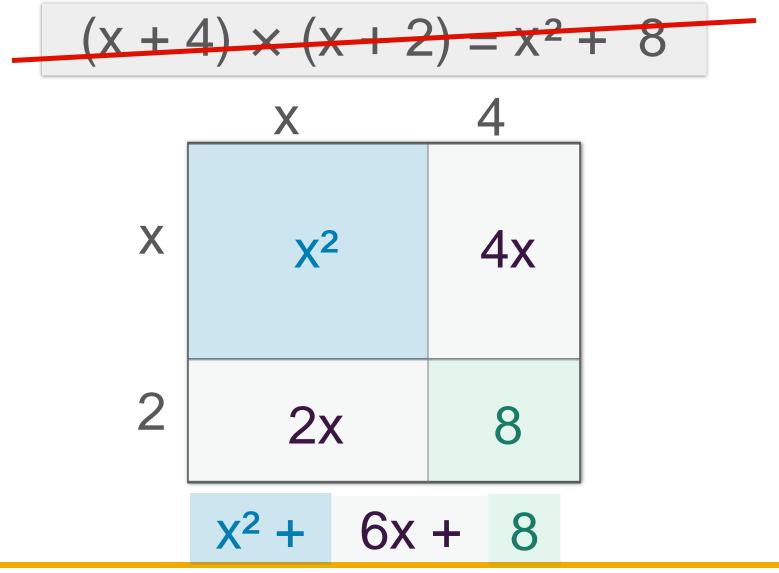
Linking to Fractions







Building Critical Algebra Foundations







Understanding Arithmetic: Three Pillars

- Understanding numbers
- Developing computational fluency
- Examining the behavior of the operations





Interpreting the Equal Sign

$$\frac{3}{3} + 3 = 6 + 5$$

1 plus 7 makes 8"

1 +

nears

to

put togo

thek





20

Interpreting the Equal Sign

8 + 4 = 🗆 + 5





Interpreting the Equal Sign

- 7 = 3 + 4
- 8 = 8

5 + 8 = 8 + 5





True or False – How do you know?

- 7 = 3 + 4
- 8 = 5 + 13
- 6 1 = 7
- 27 = 7 + 10 + 10
- 10 3 = 11 4





Grade 1 Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false.

Grade 1 Determine the unknown whole number in an addition or subtraction equation relating three whole numbers.

Grade 3 Determine the unknown whole number in a multiplication or division equation relating three whole numbers.





Relational Thinking

Relational thinking occurs when one observes and uses number relationships between the two sides of the equal sign instead of actually computing amounts.





 $\mathbf{6} + \mathbf{\Box} = \mathbf{5} + \mathbf{9}$

Since 5 + 9 is 14, I need to figure out 6 plus what equals 14. It is 8, so the box is 8. Six is one more than the 5 on the other side. That means the box should be one less than 9, so it must be 8.





57 + 22 = 58 + 21

Circle True or False and explain your choice.

57 + 22 = 58 + 21

cuse 57 Equo ircle True or False and explain your choice.

Circle True or False and explain your choice.

57 + 22 = 58 + 21

Circle True or False and explain your choice.

57 + 22 = 58 + 21 58 is 1 more then 15 1 and 21 Less than 2 evens out. 122. it





Encouraging Relational Thinking

37 + 54 = 38 + 53

48 + 63 - 62 = 49

625 + 450 = 700 + 400

64 - 38 = 66 - 40





Exploring True, False, and Open Sentences

1. Give each other think time on each number sentence before talking.

2. Share with each other your reasoning.

3. Which examples were interesting to you?





Look for and make use of structure.







True or False?

- 6 + 9 = 9 + 6
- 4 3 = 3 4
- 90 0 = 0 90
- 7 + 50 = 50 + 7
- 6 + 🗆 = 10 + 6

$10 + \Box = \Box + 10$





OTAP art

Commutative property of addition states that changing the order of the addends does not change the sum.





A child who does not see patterns often does not expect things to make sense and sees all events as discrete, separate, and unrelated." A student who expects things to 'make sense' looks for patterns and generalizations and from these develops understanding.





Supporting Teachers

$7 + 3 = \Box + 9$

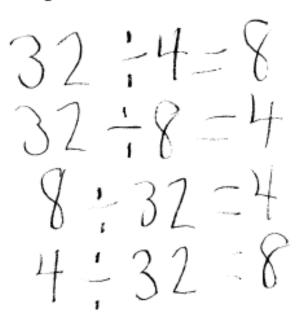
6 + 2 = 1 + 7





Inverse Operations

2. How can knowing 8 x 4 = 32 help you to understand 32 + 4?







USA:

• How can I teach my kids to get the answer to this problem?

Japanese:

• How can I use this problem to teach the mathematics of this unit?

~ Phil Daro





Understanding Arithmetic: Three Pillars

- Understanding numbers
- Developing computational fluency
- Examining the behavior of the operations





"A focus on the operations emphasizes noticing, describing, representing, and explaining consistencies across many problems. Generalizing in this way about the properties and behaviors of the operations is not about solving particular problems but about regularities that are foundational to arithmetic and algebra."

Connecting Arithmetic to Algebra by Susan Jo Russell, Deborah Schifter, and Virginia Bastable (Portsmouth, NH: Heinemann, 2011).





Impacting Teacher's Practice

- What two or three things to support algebra readiness do you want to see in your classrooms?
- What ideas do you have for making those happen?





How to Support Algebra Readiness

- Provide teachers with professional learning that builds:
 - -Robust content knowledge
 - –Understanding of how student learn
 - -Effective instructional strategies
 - Strategies for gathering information about what students do and do not understand
- Ensure teachers and students have quality materials and programs





Thank you!

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