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KENTUCKY CENTER FOR MATHEMATICS

Developing Multiplicative Thinking

More Assessing and Monitoring Multiplicative Thinking

Welcome

Your Host:

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KCM WEBSITE
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AGENDA

- Standards
- Research
- Assessment Task Groups
- Written Computation Methods
- Progression of Multiplication

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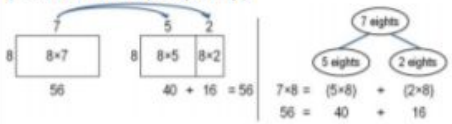
STANDARDS

Operations and Algebraic Thinking	
Standards for Mathematical Practice	
MP.1. Make sense of problems and persevere in solving them. MP.2. Reason abstractly and quantitatively. MP.3. Construct viable arguments and critique the reasoning of others. MP.4. Model with mathematics.	MP.5. Use appropriate tools strategically. MP.6. Attend to precision. MP.7. Look for and make use of structure. MP.8. Look for and express regularity in repeated reasoning.
Cluster: Understand properties of multiplication and the relationship between multiplication and division.	
Standards	**Clarifications**
KY.3.OA.5 Apply properties of operations as strategies to multiply and divide. **MP.3, MP.4**	Students need not use formal terms for these properties. If 6 x 4 is known, then 4 x 6 = 24 is also known (Commutative property of multiplication). 3 x 5 x 2 can be found by 3 x 5 = 15, then 15 x 2 = 30, or by 5 x 2 = 10, then 3 x 10 = 30 (Associative property of multiplication). Knowing that 8 x 5 = 40 and 8 x 2 = 16, one can find 8 x 7 as 8 x (5+2) = (8 x 5) + (8 x 2) = 40 + 16 = 56 (Distributive property).  KY.4.NBT.5 Coherence KY.3.OA.5→KY.4.NBT.6
KY.3.OA.6 Understand division as an unknown-factor problem. **MP.2**	Find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8. Coherence KY.3.OA.6→KY.4.NBT.6
Attending to the Standards for Mathematical Practice	
Students use strategies beyond skip counting to solve multiplication problems. They decide how to use known facts to solve facts like 6 x 9. Students use strategies like Adding a Group, thinking 5 groups of 9 (45) plus one more group (54) and Subtracting a Group, thinking 9 x 6 and reasoning 10 groups of 6 (60) minus one group of 6 (54) (**MP.7**). Students explain their selected reasoning strategy and listen and critique other students' strategies, considering which strategies make sense and are efficient (**MP.3**). Students think about 84 ÷ 4 as, "How many sets of 4 can be made from 84 items?" or "How many in a group, if there 84 items and 4 groups?" and use this relationship to solve the problem (**MP.2**).	

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Cluster: Multiply and divide within 100.	
Standards	**Clarifications**
KY.3.OA.7 Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division or properties of operations. **MP.2, MP.8**	Students determine multiplication and division strategies efficiently, accurately, flexibly and appropriately. Being fluent means students choose flexibly among methods and strategies to solve contextual and mathematical problems, they understand and explain their approaches and they produce accurate answers efficiently. Knowing 8 x 5 = 40, one knows 40 ÷ 5 = 8. Note: Reaching fluency is an ongoing process that will take much of the year. Coherence KY.3.OA.7→KY.4.OA.4
Attending to the Standards for Mathematical Practice	
By studying patterns and relationships in multiplication facts, students develop fluency for multiplication facts (**MP.8**). For example, students notice 4 x 6 is equivalent to 2 x 2 x 6 (doubling strategy). They know 9 facts can be found by thinking of the other factor x 10 and subtracting one group. For example, recognizing 9 x 8 is equivalent to 10 x 8 – 8. For each fact, the student thinks, "What reasoning strategy can I use that is more efficient than skip counting?" (**MP.2**).	

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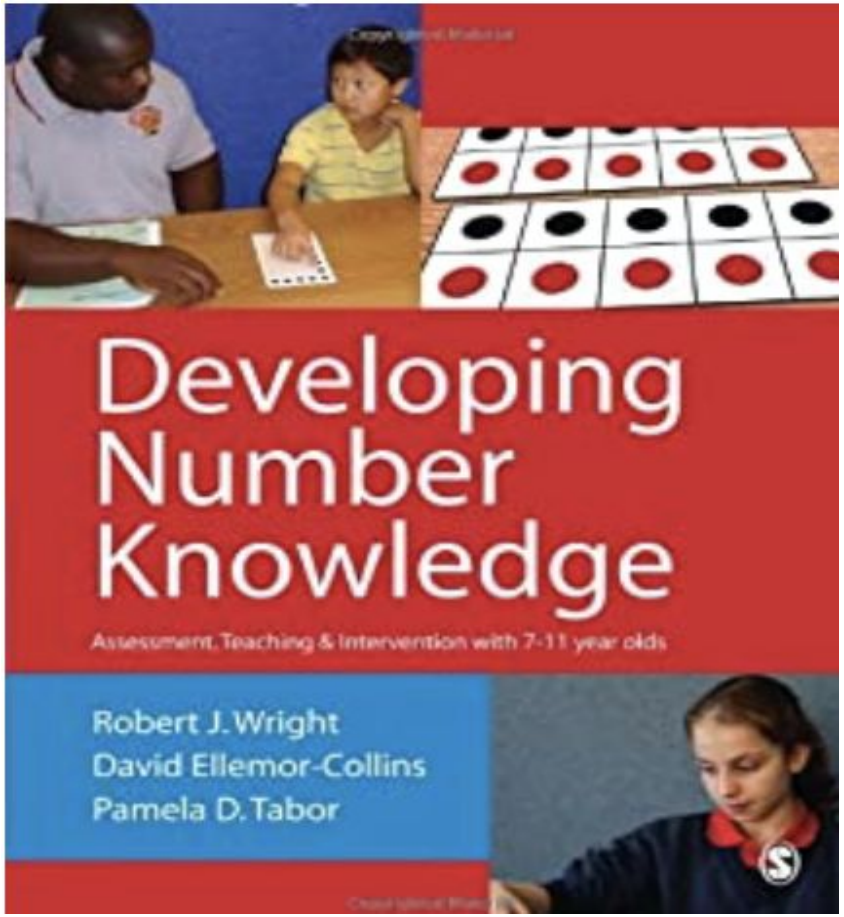
Research



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List of Assessment Task Groups

1. Multiplication with Repeated Equal Groups
2. Grouping Division with Repeated Equal Groups
3. Sharing Division with Repeated Equal Groups
4. Multiplication with an Array
5. Grouping Division with an Array
6. Sharing Division with an Array
7. Multiplication Basic Facts
8. Multiplication with Bare Numbers - 2-digit X 1-digit
9. Division with Bare Numbers - 2 digit Quotients
10. Inverse Relationship of Multiplication and Division
11. Commutative Principle
12. Distributive Principle

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Distributive Principle

Materials: Cards as follows: 23x3=69, 2x3=6, 25x3, 49x3,

What to do and say: Display the first three cards. *Read the first three cards. Can you use those to help you work out 25x3? Read this card* (49x3). *Can you think of an easy way to work this out*?

The purpose of this task is to gauge the student's facility with the distributive principle.

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Observation Tool: Multiplication Strategy

Bay-Williams, J.M. & Kling, G.G (2019) Math Fact Fluency: 60+ Games and Assessment Tools to Support Learning and Retention.

Observation Tool: Multiplication Strategy

Names	Multiplication Strategy Selected						
	Foundational Fact (known)	Doubling	Adding a Group	Subtracting a Group	Near Square	Break Apart Strategy	Other (e.g., skip counting)

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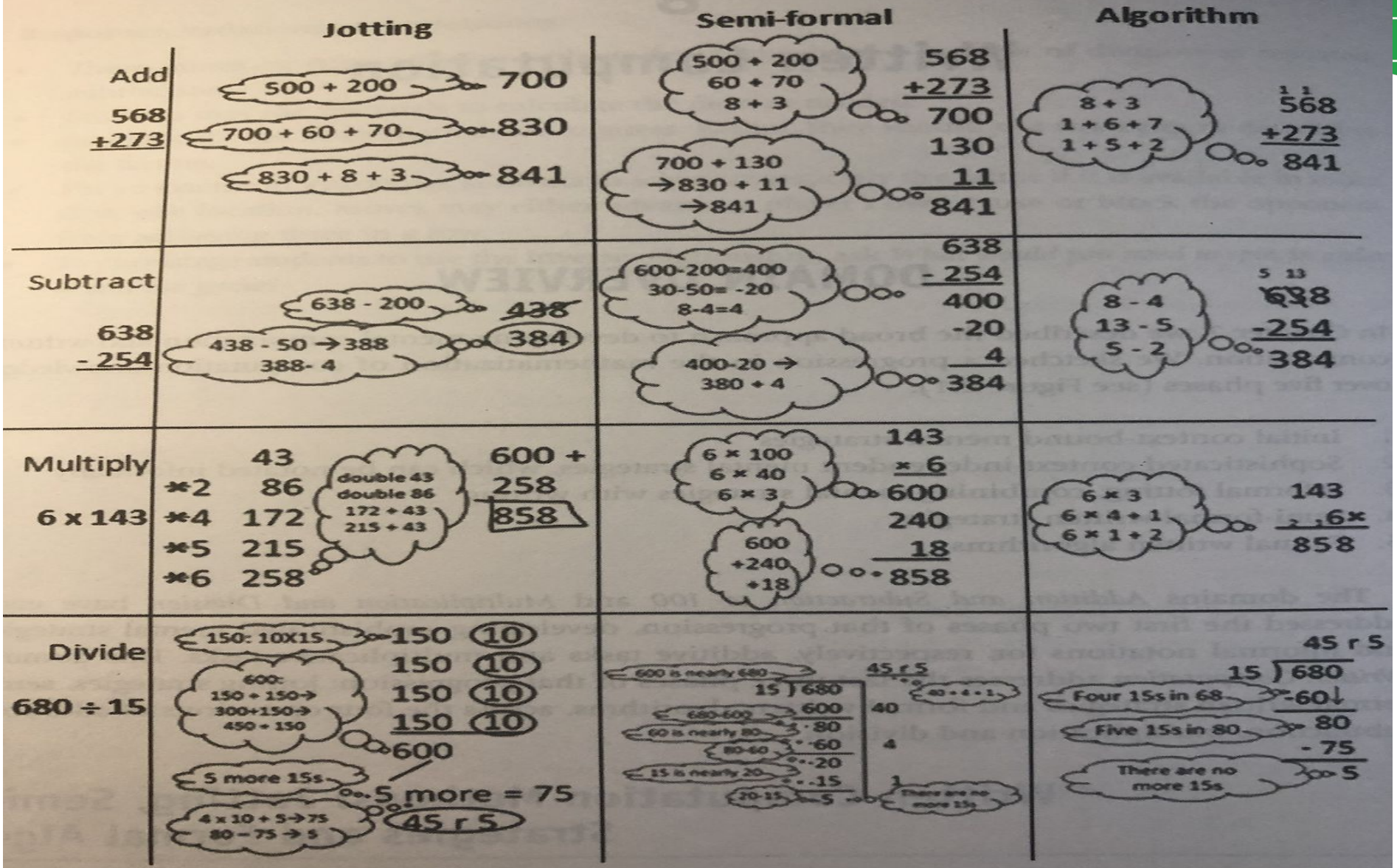

gure 8.1 An example of a jotting, a semi-formal strategy and a formal algorithm for each the four operations

Progression of Multiplication

https://youtu.be/M7T0zNCCOQQ

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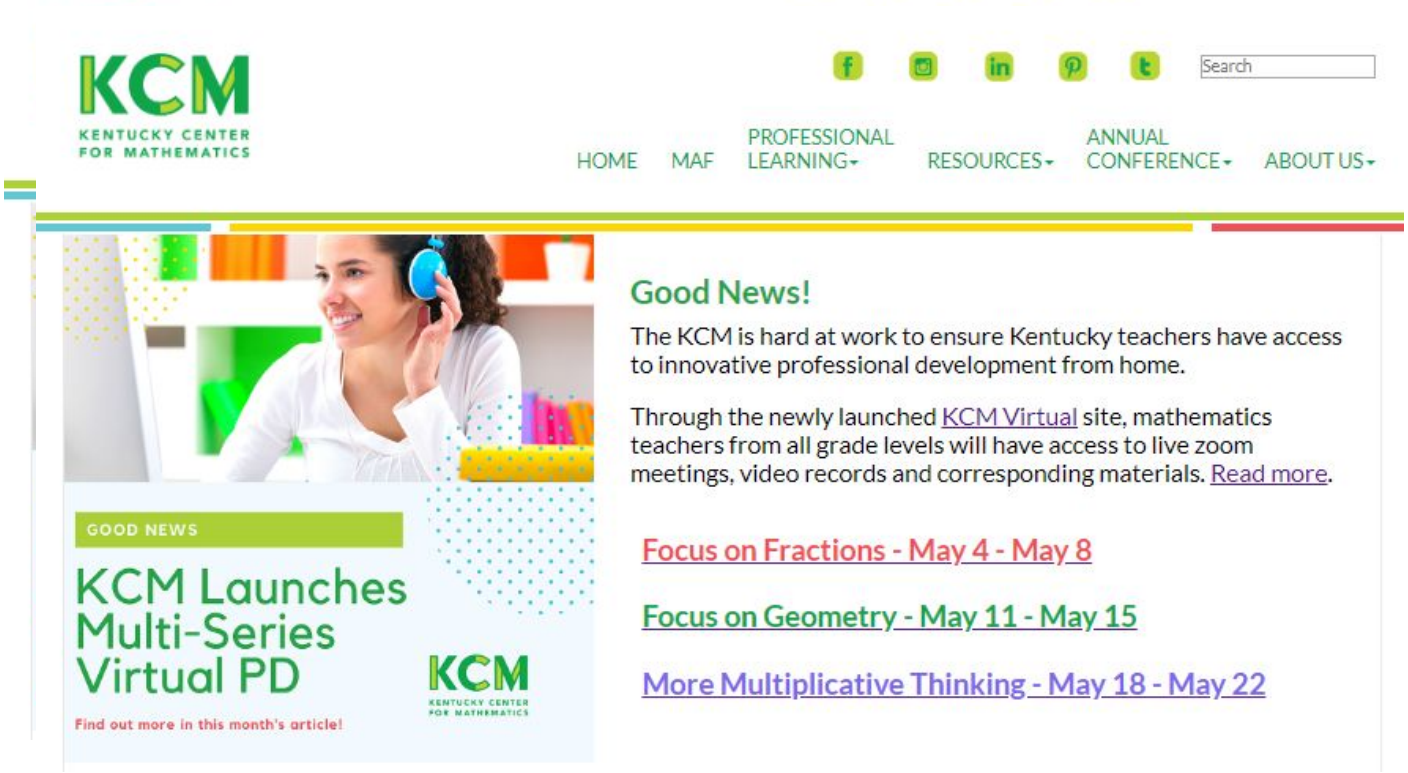

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Thank you for hanging out with KCM!

We are here to support all your math needs!

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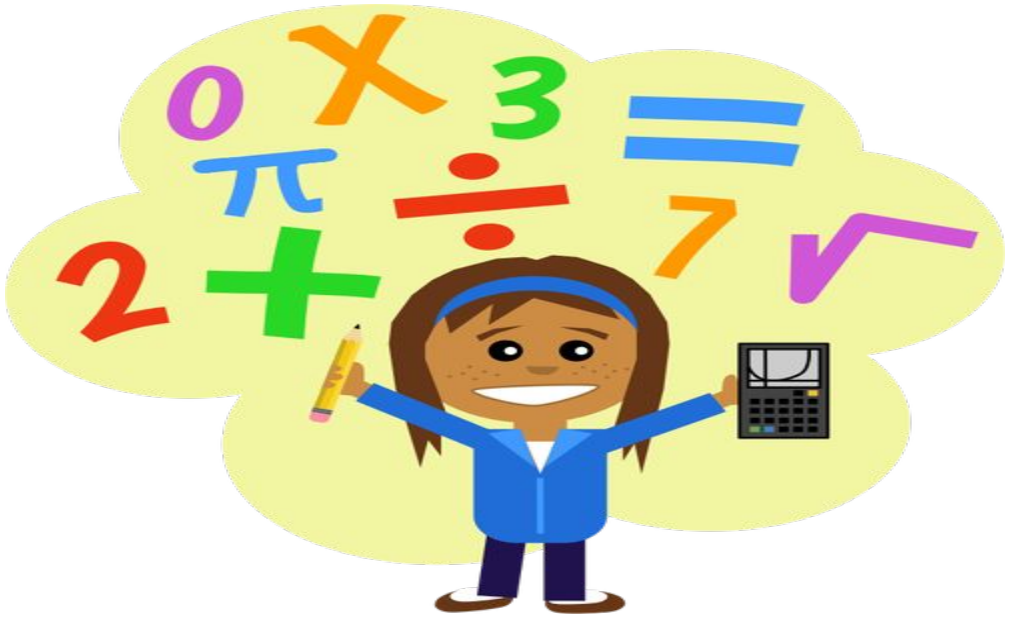

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