Conceptual Understanding of the Order of Operations

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COABE
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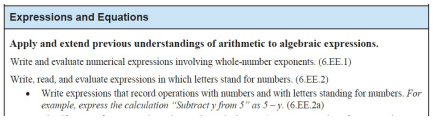
College and Career Readiness Standards for Adult Education

Standards for Mathematical Practice

Standards for Mathematical Content



Key Instructional Shifts

Focus: Focus strongly where the standards focus.

Coherence: Design learning around coherent progressions.

Rigor: Pursue conceptual understanding, procedural skill and fluency, and application—all with equal intensity.

Session Overview

Making a shift to more rigorous instruction means ***conceptual understanding*** and ***application in real-world contexts*** have importance equal to ***procedural skill and fluency***.

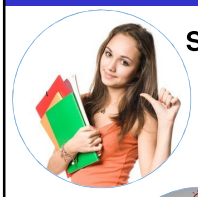
With that in mind, we will:

- Look a sample unit that uses a discovery approach to teaching mathematics.

A Discovery Approach

With a discovery approach, students construct rules and discover formulas on their own through carefully structured activities.

Lessons that **Discover** Rules and Formulas



Student-Centered

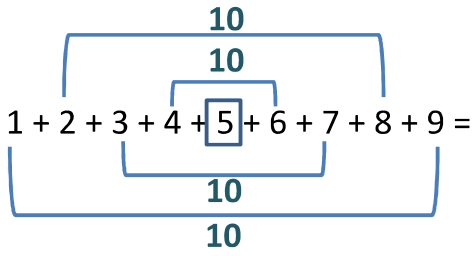
Scaffolded Exercises

Pursue *How* and *Why*

Add Mentally

1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 =

Add Mentally



Does Order Matter?

What is the answer to this question?

3 • 4 + 2 • 5 =

Does Order Matter?

I'm doing laundry. I discover $4 in each of three girls' pockets. The next day, I find $5 in each of 2 different pockets in my husband's clothes.

3 • 4 + 2 • 5 =

Does Order Matter?

15 + 2(7) + 10

15 + 7 + 7 + 10

Daijah-Tae went shopping. She bought a scarf for $15, two lip glosses for $7 each, and a cell phone case for $10.

Lesson 1: "Exploring Order in Mathematics"

Exploring Order in Mathematics

When are Multiplication and Division Done before Addition and Subtraction?"

Using Context, How Can this Equation be Made True?

$$2 + 8 = 28$$

$$2\_ + 8\_ = 28\_$$

Using Context, How Can this Equation be Made True?

$$2\_ + 8\_ = 28\_$$

2 tens + 8 ones = 28 dollars

How do you go about adding…

2,416 + 753 =

Why do many of us imagine it written vertically?

2416
+ 753

2 thousands + 4 hundreds + 1 ten + 6 ones
+ 7 hundreds + 5 tens + 3 ones

Write the Problem in Words

The football team scored 4 touchdowns, worth 6 points each; kicked 3 extra points, worth 1 point each; and kicked 1 field goal, worth 3 points. What was the team's final score?

Express the relationship using words, then use that sentence to write the situation in math language (an expression or an equation).

Total Score is 4 touchdowns + 3 extra points + 1 field goal

Write the Problem in Math

The football team scored 4 touchdowns, worth 6 points each; kicked 3 extra points, worth 1 point each; and kicked 1 field goal, worth 3 points. What was the team's final score?

Express the relationship using words, then use that sentence to write the situation in math language (an expression or an equation).

Total Score is 4 touchdowns + 3 extra points + 1 field goal

T = 4 • 6 + 3 • 1 + 1 • 3

Marquis' team made 11 successful free throws (1 point each), 25 two-point shots, and 8 three-point shots.

Express the relationship using words, then use that sentence to write the situation in math language (an expression or an equation).

Marquis' team made 11 successful free throws (1 point each), 25 two-point shots, and 8 three-point shots.

$$11(1) + 25(2) + 8(3)$$

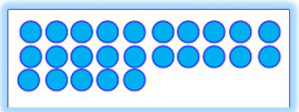
When are Multiplication and Division Done before Addition and Subtraction?"

Lesson 2: "Why are Multiplication and Division Done before Addition and Subtraction?"

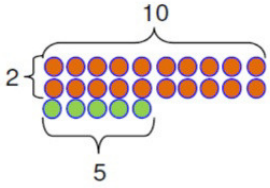
Why are multiplication and division done before addition and subtraction?

Number of Candies?

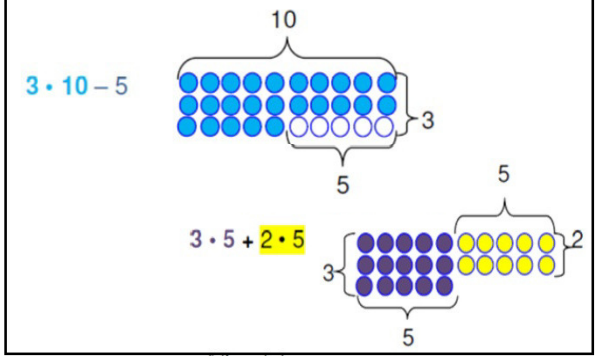
Exploring the Natural Order of Operations with Bingo Chip Arrays



$2 \cdot 10 + 5$



Exploring the Natural Order of Operations with Bingo Chip Arrays



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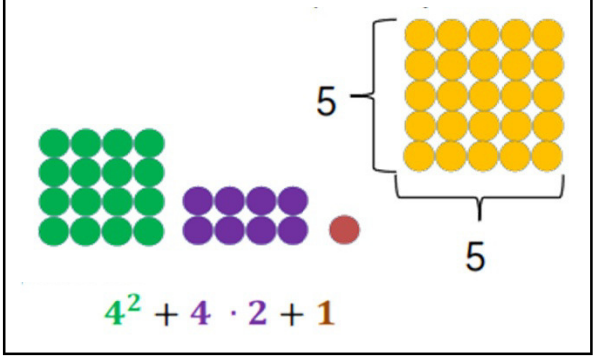
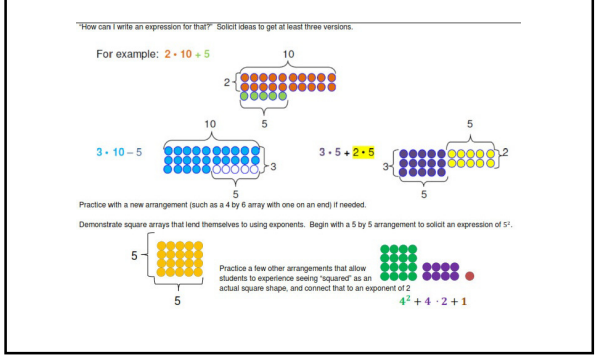
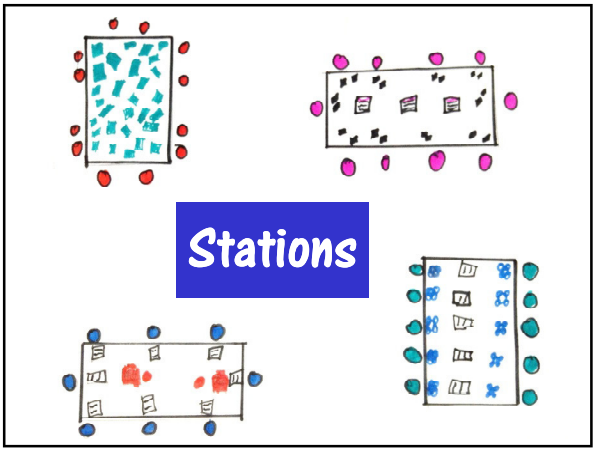


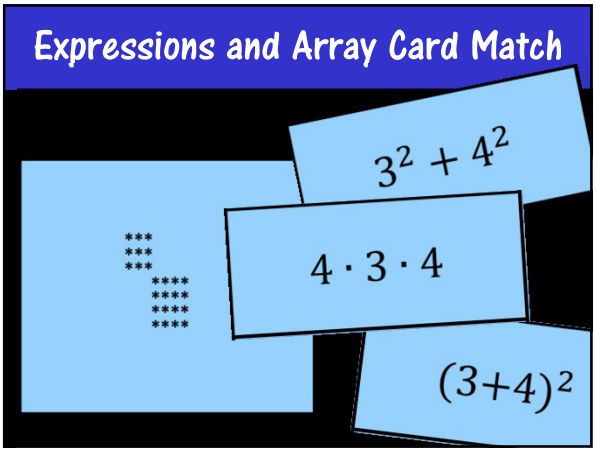
Lesson 3 "Exploring the Natural Order of Operations with Bingo Chip Arrays"



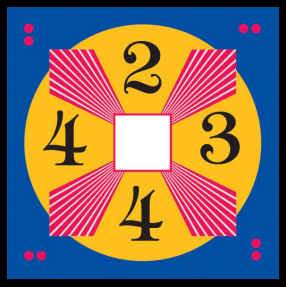


Three Aspects of Rigor

Expressions and Array Card Match

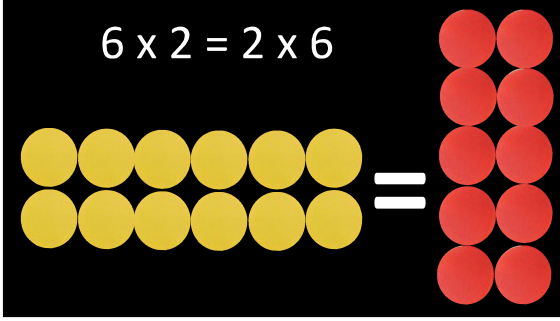


24 Game

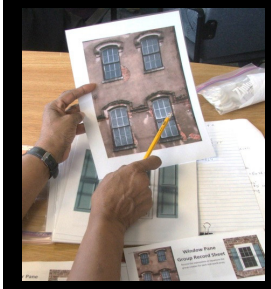


Prove It! True or False?

6 x 2 = 2 x 6



Writing Expressions for Real World Arrays

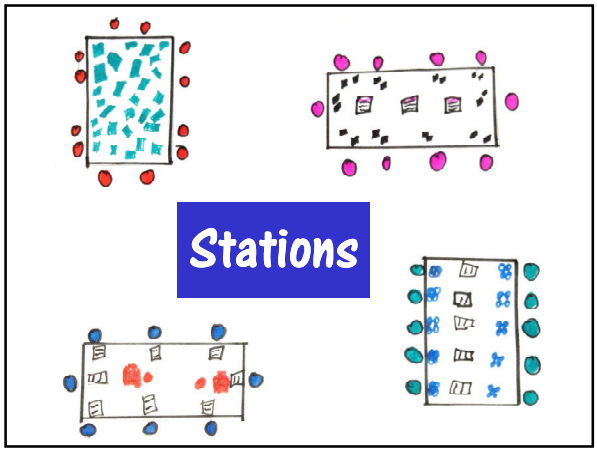


PHOTOGRAPHS as inspiration…

…for WRITING EXPRESSIONS

Hand-Outs Folder

- Find the Missing Number
- Grouping Symbols
- Creating True Equations
- Properties of Numbers Challenge
- Open Middle's *Exponents and Order of Operations*



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