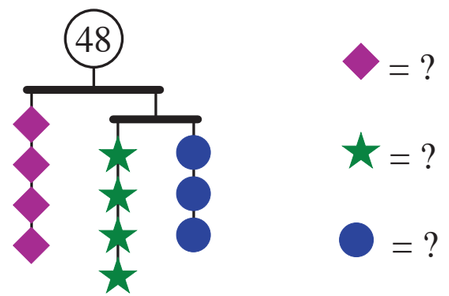
Building Puzzles

Promoting Engagement, Logical Reasoning, and Mathematical Communication

Why Puzzles?

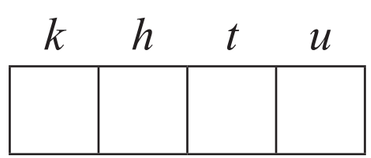
Mathematical Puzzles:

- are genuine problems
- support number sense
- encourage logical reasoning
- help students develop strategy in problem solving
- are fun and engaging
- promote constructive collaboration
- encourage perseverance



Who Am I? Puzzles

Who Am I?



- I am a 4-digit number.
- I am greater than 5000.
- *k* is my only odd digit.
- *t* is a square number.
- *tu* = *h*
- None of my digits are the same.
- The product of my digits is not 0.
- *t* + 1 = *k*

Who Am I? Puzzles

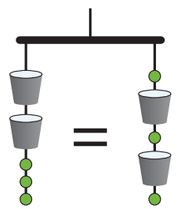
Make clues with relevant content:

- place value
- parity: evens and odds
- inequalities
- squares and roots
- multiples
- primes
- divisibility
- factors
- GCD & LCM
- algebraic expressions
- factoring (ex: $t + u = 12$ and $tu = 36$)

Mobile Puzzles:
Making the logic of algebra explicit

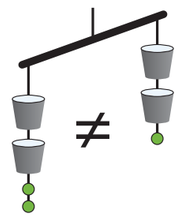
In each of these problems a dot (●) = 1.

This mobile *always balances*. Why?



Equivalence

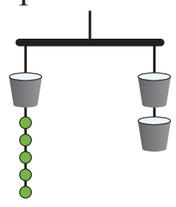
This mobile *never balances* no matter what number the bucket represents. Why?



Inequality

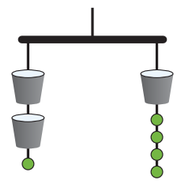
This mobile *only balances when* the buckets represent a certain number.

What number makes it balance?



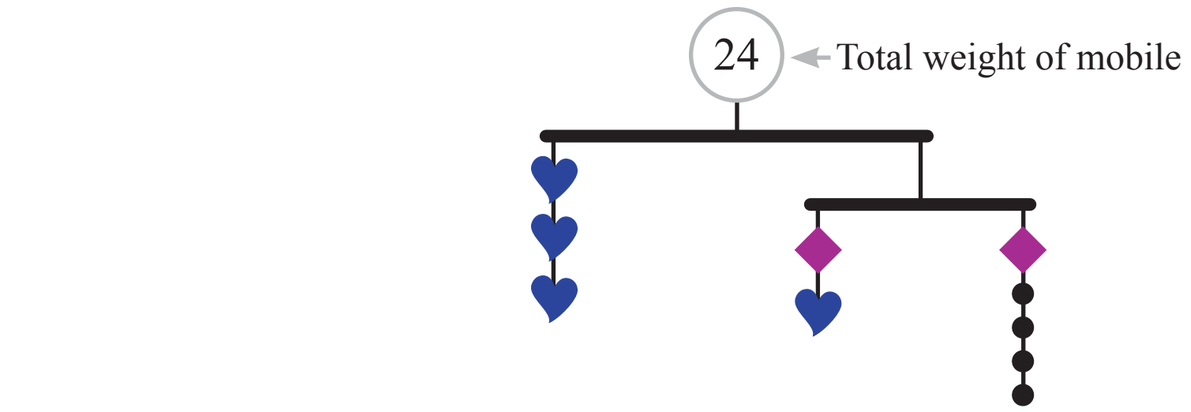
Solving

Does this mobile balance *always, sometimes, or never?* If sometimes, *when?*



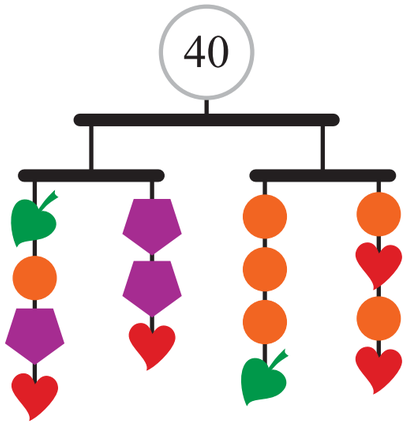
Logical Solving

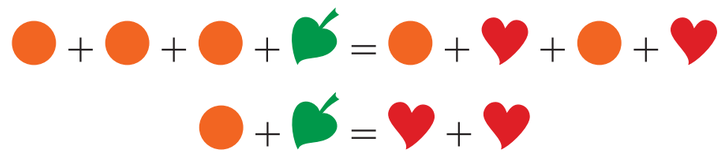
Mobile Puzzles



♥ = 4 ◆ = 2 ● = 1

Mobile Puzzles

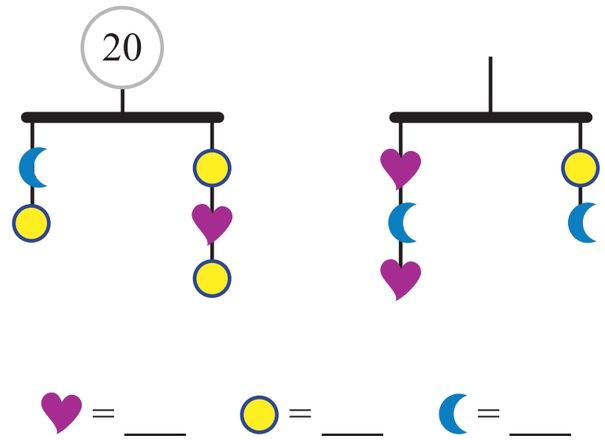




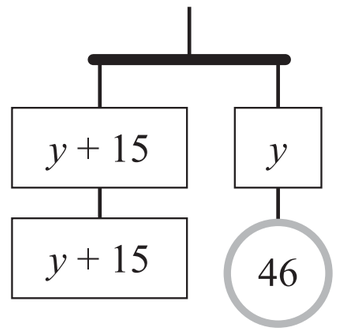
= _____ = _____

= _____ = _____

Mobile Puzzles

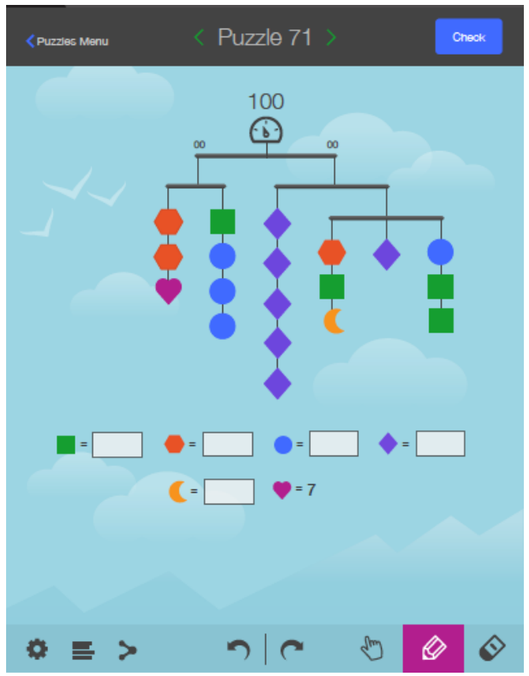


♥ = ___ ● = ___ ☾ = ___



y = ____

Mobile Puzzle App



Interactive puzzling features:

- Shape equations
- Subtraction, division, factoring
- Substitution
- Annotations
- Sharing
- “Build Your Own” mode

Latin Squares Puzzles

- Use the clues to fill in the grid so that every row and every column contains all of the elements in the title.

***r*, *s*, *t* Latin Square**

	S	
		r

MysteryGrid Puzzles

- In MysteryGrid puzzles, the numbers in each "cage" should reach the target number using the given operation.
- For example, a 3-cell, "20, ×" cage means you need to fill that cage with 3 numbers that multiply to 20.

MysteryGrid **1, 3, 4, 5**

4, +		4, ÷	1, −
20, x	12, +		
			2, −
	15, x		

MysteryGrid Puzzles

MysteryGrid **2, *x*, 2*x***

$2x+2$, $+$	$2x^2$, $\bullet$	
		$4x$, $\bullet$
$3x$, $+$		

MysteryGrid ***x*, 2*x*, 4*x***

$8x^2$, $\bullet$	$3x$, $-$	
	$5x$, $+$	
$4x^2$, $\bullet$		

MysteryGrid Puzzles

MysteryGrid a, a^2, a^3, a^4

a^6, •			$2a^4+a^3$,+
a^7, •	a^4, •		
		a^5, •	
	a^7, •		

Students Building Puzzles

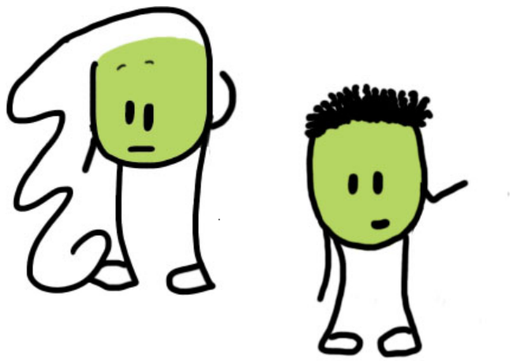
Why have students build their own puzzles?

- Supports greater depth of understanding
- Builds sense of mathematical agency

Basic strategy for creating a puzzle:

1. Design the solution first
2. Create clues
3. Check that the clues lead to a unique solution

Questions?



A Habits of Mind Curriculum

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For more information…

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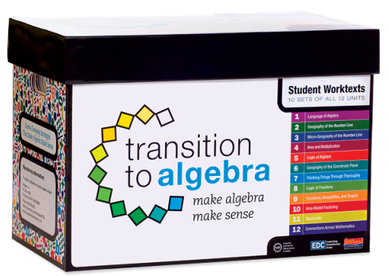
- transitiontoalgebra.com — materials



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Problem Posing: Bringing Logic to Problem Solving for At-Risk Algebra Students

Today, 3:30 - 4:30 pm, Convention Center, R03

- Learn how to turn problem solving into an exploratory, discussion-rich activity through strategies such as thinking "what if not," leaving problems headless or tailless, and presenting deductive reasoning problems.
- Change your students' thinking from "What am I supposed to do?" into "What can I do?" and see their perseverance and engagement rise.