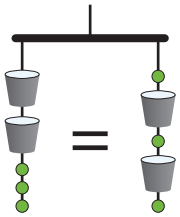
"Puzzling through Problems" as a Habit of Mind

Think-of-a-Number Tricks

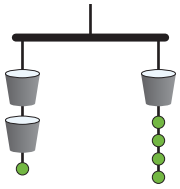
Words	Pictures	Description of Pictures	Abbreviation
Think of a number.		a bucket	b
Add 5.		a bucket and 5	$b + 5$
Multiply by 2.			$2b + 10$
Subtract 2.			
Divide by 2.			
Subtract your original number.			

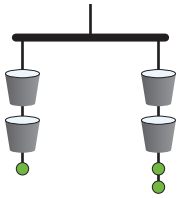
Mobile Puzzles

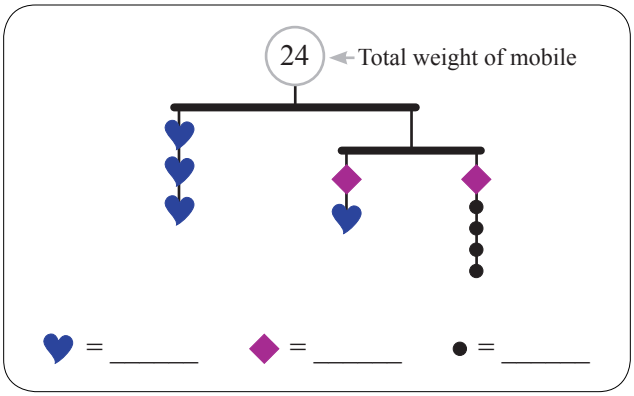
This mobile *always balances*. Why?

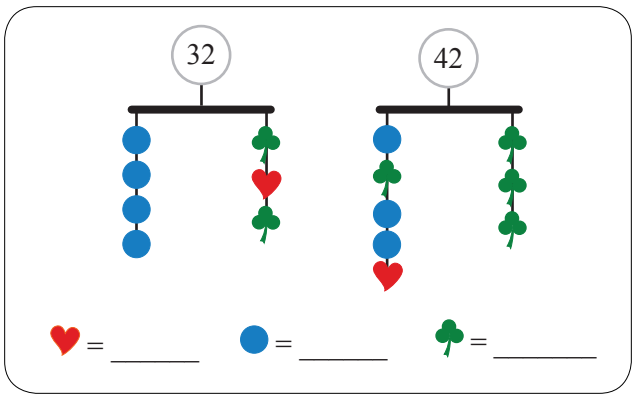


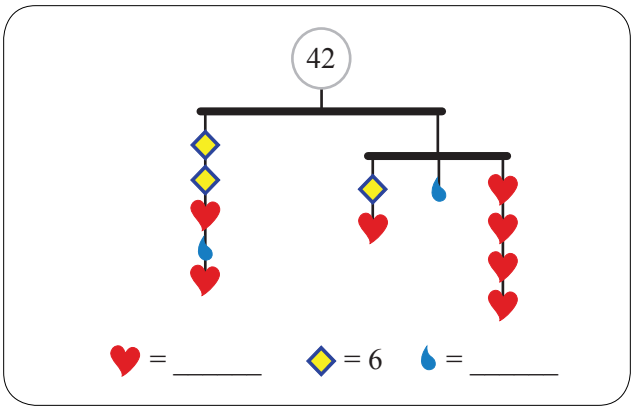
Do these mobiles balance *always, sometimes, or never*? If sometimes, *when*? If never, *why not*?

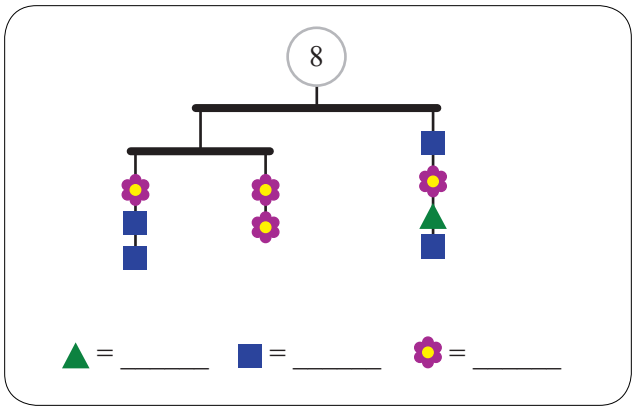












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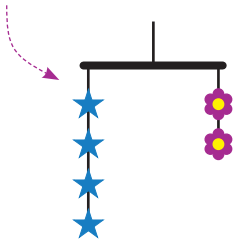
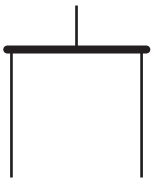
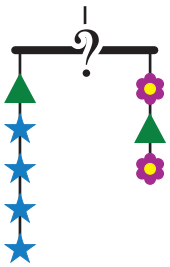
This mobile is balanced. What does that tell us about these?



Which mobiles can you say balance for sure?

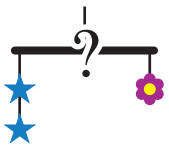
Create a balanced mobile based on the mobile above.





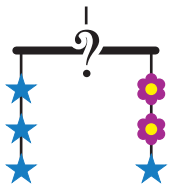
Do we know if this mobile is balanced?

Why or why not?



Do we know if this mobile is balanced?

Why or why not?



Do we know if this mobile is balanced?

Why or why not?

Creating Mobiles

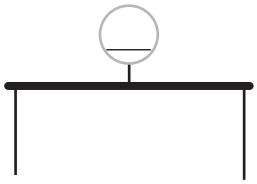
Make a small mobile with two shapes and one beam.

(a) You're making the puzzle, so work backwards. Start by making up the answers first:

● = _____

☆ = _____

(b) Now make up a balanced mobile, and write in the total weight at the top:



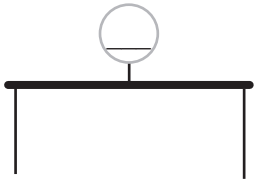
(c) Try to solve your mobile. Is it solvable? Does it have exactly *one* solution?

(d) If your mobile doesn't have exactly one solution, change it or make a new one. Then cover your answer and give your mobile to someone else to solve here:

● = _____

☆ = _____

(e) Now make a more ambitious puzzle. Good puzzles are generally just easy enough to be solvable and just difficult enough to be fun. The 'hard' part should be figuring it out, not performing the arithmetic.



Area Puzzles

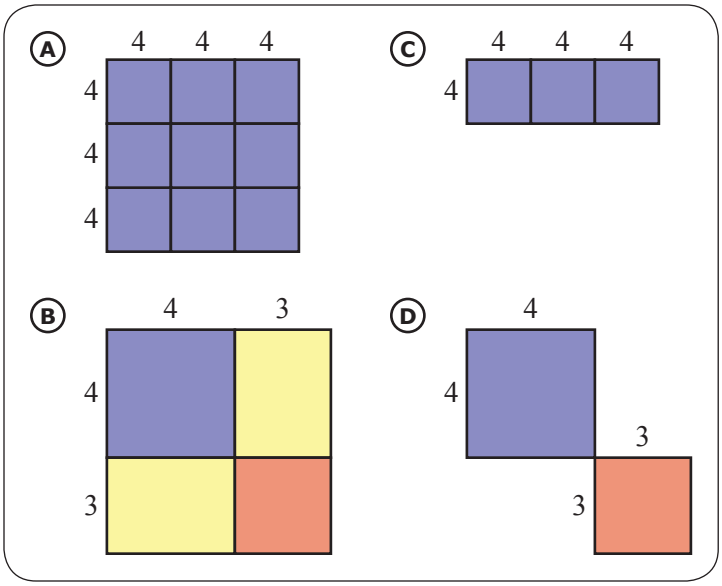
If we agree that...  = 1

Find the area of each of these shaded sections.

 =  =  =  =

Match each numerical expression with an area model.
You may use the same model more than once.

1. $(3 + 4)^2$
2. $3 \cdot 4^2$
3. $(3 \cdot 4)^2$
4. $3^2 + 4^2$
5. $3^2 + 4^2 + 2 \cdot 3 \cdot 4$
6. $3^2 \cdot 4^2$



Find the total area of each of the shapes.

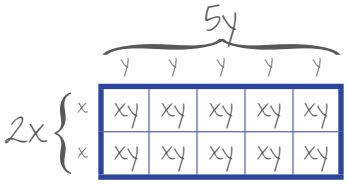
Shape A

Shape B

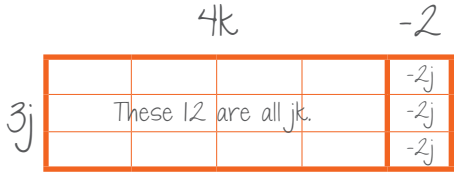
Shape C

Shape D

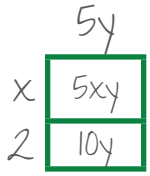
What multiplications are shown here, and what are the answers?



$2x \cdot \_\_\_\_ = \_\_\_\_$



$3j(\_\_\_\_) = \_\_\_\_ - 6j$



$5y(\_\_\_\_) = \_\_\_\_$

Complete these area models.

____	5
6	18*b*
-7*a*	-35*a*

	2*c*	-3
____		-3*d*
5		

____	____
7*g*	21*g*
5	10*g*

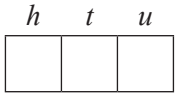
"Puzzling through Problems" as a Habit of Mind

Who Am I? Puzzles

Who Am I?

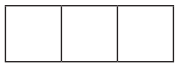
- The product of my digits is 7.
- The sum of my digits is 8.
- My units digit is greater than my tens digit.

Who Am I?



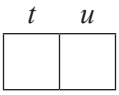
- I am even.
- My tens digit is 1.
- The product of my three digits is 12.
- h is four less than my units digit.

Who Am I?



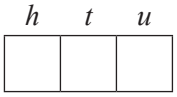
- I am odd.
- $u > t$
- My hundreds digit is prime.
- $t = 2h$
- Two of my digits are square numbers.

Who Am I?



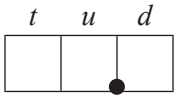
- The product of my digits is 16.
- The sum of my digits is 8.

Who Am I?



- I am a multiple of 10.
- My hundreds digit is one more than my tens digit.
- The sum of my three digits is 7.

Who Am I?



- I am in the thirties.
- $d < t$
- My units digit is twice my tens digit.
- d is four less than u.
- The product of d and t is u.

You can make up problems like these using clues with relevant content.

Creating Who Am I? Puzzles

Who Am I?

Who Am I?

Mystery Number Puzzles

What are the only two numbers that ⬟ could be if ⬟ • ⬟ = ⬟ ?

What is the only number that ♦ could be if ♦ + ♦ = ♦ ?

What could ♥, 💧, and ☆ be if all the shapes are different numbers?

♥ • 💧 = 💧

💧 • 💧 = ☆

💧 + 💧 = ☆

♥ = _____

💧 = _____

☆ = _____

What could ●, 🍃, and ◇ be if all the shapes are different numbers?

🍃 • ◇ = ●

◇ + ◇ = ●

🍃 + 🍃 + 🍃 = ●

● = _____

🍃 = _____

◇ = _____

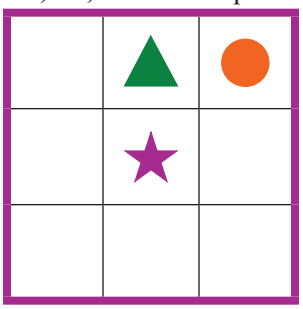
Latin Squares and MysteryGrids

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

5, 7, 9 Latin Square

	5	
7	9	
		9

●, ▲, ★ Latin Square



MysteryGrid **1, 2, 3, 4**

8,×		6,×	4,×
4,+			
3,−	5,+	7,+	
		3,+	

MysteryGrid **3, 4, 5**

2,−		7,+
20,×	4	
	8,+	

MysteryGrid **0.1, 0.2, 0.3, 0.4**

.6,+		.08,×	
	.016,×	3,÷	
.12,×			.5,+
	.02,×		

MysteryGrid **1, 2, 3**

2,−	2,÷	
	12,×	3,÷

MysteryGrid **0, 1, x, x^2**

2, +		$2x^2+x$, +	
	2x, +		
0, •			1, +
x	x^2+1, +		

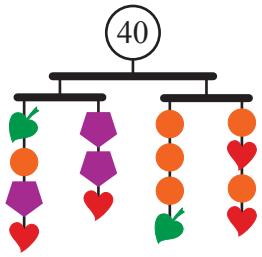
MysteryGrid $\frac{1}{3}$, **1, 3**

$4\frac{2}{3}$, +		
	1	3, x
1, x		

MysteryGrid **a, a^2, a^3**

a^4, •	a^2+a, +	
	a^6, •	a^5, •

Transition to Algebra curriculum information and presentation documents: **ttalgebra.edc.org**



Related EDC projects:

- Implementing the Mathematical Practice Standards: mathpractices.edc.org
- ThinkMath! Elementary Curriculum: thinkmath.edc.org
- CME Project High School Curriculum: cmeproject.edc.org

Other Puzzle Sites:

- BrainBashers: brainbashers.com/logicpuzzles.asp
- Interactive Mathematics Miscellany and Puzzles: cut-the-knot.org
- KenKen® puzzles: kenken.com

A Few of Our Favorite Math Apps:

- Math Doodles: system of equations puzzles
- Motion Math HD: fractions, percents, decimals, and pie charts
- Motion Math Zoom: number line zooming with animals
- Panasonic Prime Smash!: like Fruit Ninja, but with primes

EDC Learning transforms lives.

Transition to Algebra student and teacher materials will be available from Heinemann in spring of 2014.