

P/J Mathematics

# Multiplication & Division



## AGENDA

Relationships Between the Operations

Properties of the Operations

Basic Problem Interpretations

Computation



# **DEVELOPING OPERATIONAL SENSE “MUSTS”**

**MODELLING WITH ...\*PHYSICAL MATERIALS\*  
(CONCRETE → PICTORIAL → ABSTRACT)**

**WITHIN A ...\*PROBLEM SOLVING CONTEXT\***

**INCLUDE...**

**\*DEVELOPMENT OF THINKING STRATEGIES\***  
(basic facts, estimation, reasonableness of results)

**\*DISCOURSE\***

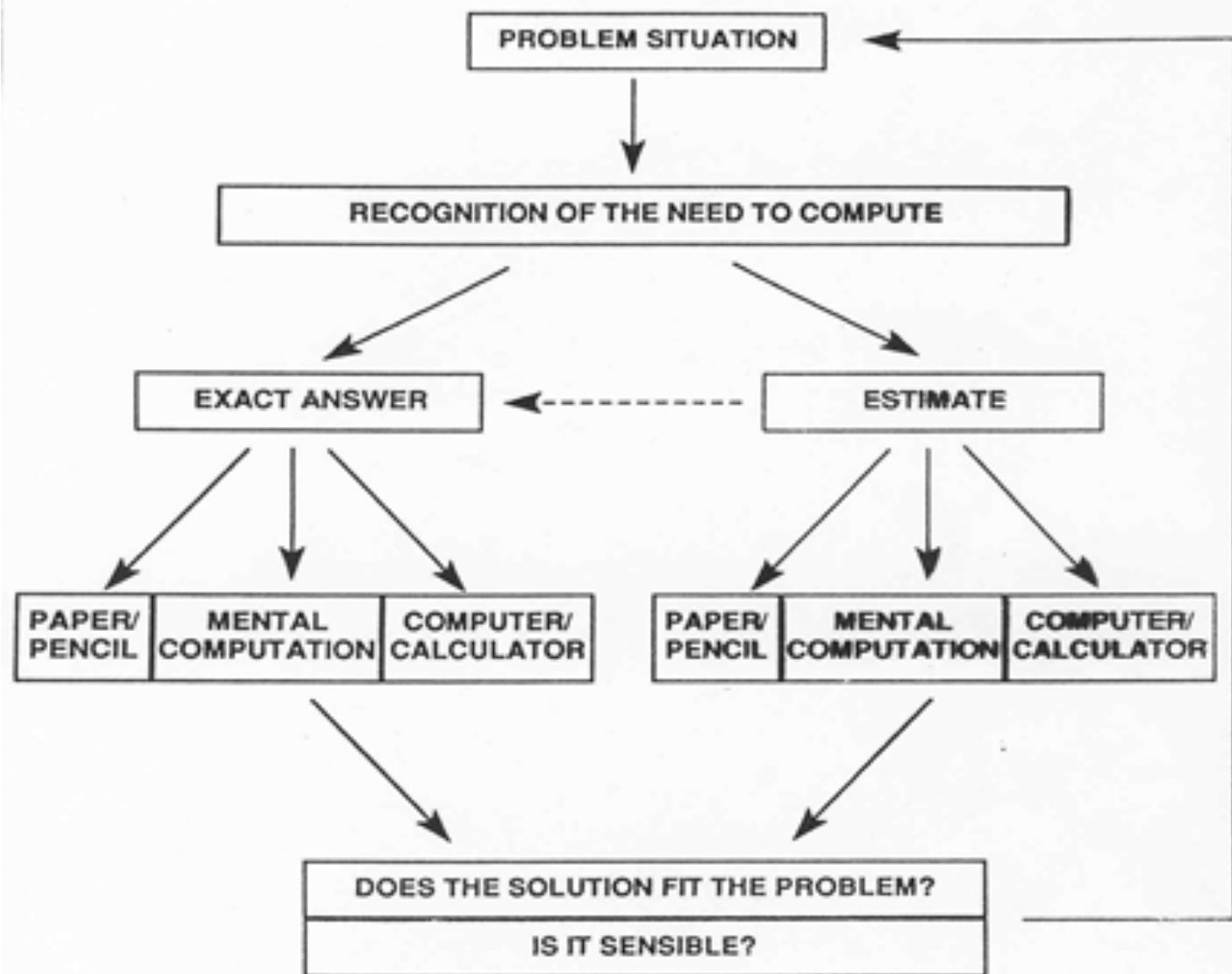


# Mathematical Properties

Property	Mathematical Language	Child's Language	How It Helps
Commutative	For all numbers a and b: $a + b = b + a$ and $a \times b = b \times a$	If $4 + 7 = 11$ , then $7 + 4$ must equal 11, too. If I know $4 \times 7$ , I also know $7 \times 4$	The number of addition or multiplication facts to be memorized is reduced from 100 to 55.
Associative	For all numbers a, b, and c: $(a + b) + c = a + (b + c)$ and $(ab)c = a(bc)$	When I'm adding (or multiplying) three or more numbers, it doesn't matter where I start.	When more than two numbers are being added (or multiplied), combinations that make the task easier can be chosen. For example, $37 \times 5 \times 2$ can be done as $37 \times (5 \times 2)$ or $37 \times 10$ Rather than $(37 \times 5) \times 2$ .
Distributive	For all numbers a, b, and c: $a(b + c) = ab + ac$	$(6 \times 15)$ is the same as $(6 \times 10) + (6 \times 5)$ $96 \div 3$ is the same as $(90 \div 3) + (6 \div 3)$	Some of the more difficult basic facts can be split into smaller, easier-to-remember parts. For example, $6 \times 15$ is the same as $(6 \times 10) + (6 \times 5)$ or $60 + 30$ The 19 addition facts involving 0 and the 19 multiplication facts involving 1 can be easily remembered once this property is understood and established.
Identity	For any whole number a $a + 0 = a$ & $a \times 1 = a$	*0 added to any number is easy - it's just that number.  *1 times any number is just that number	The 19 addition facts involving 0 and the 19 multiplication facts involving 1 can be easily remembered once this property is understood and established.
Role of Zero in (x)	For any inside number a: $0 \times a = 0$ or $a \times 0 = 0$	0 multiplied by any number is 0. Any number multiplied by 0 is 0	The 19 multiplication facts involving zero can be generalized.



# COMPUTATION MODEL





# **Exploring the Traditional Algorithm Using Base 10 Manipulatives: Area Model**

## **Up-Coming School Event**

**The social committee needs about 250 to 300 flowers for decorations. Boris orders 12 groups of 24 flowers. How many will be delivered?**



# ***TEACHING CONVENTIONAL ALGORITHMS***

- ***Let them see what it looks like***
- ***De-emphasize rote rules***
- ***Emphasize big ideas***
- ***Let the written algorithm simply be a recording***
- ***Watch our language***



*Tucker, Benny F., Singleton, Ann H., Weaver, Terry L. (2002) Teaching Mathematics to All Children: Designing and Adapting Instruction to Meet the Needs of Diverse Learners. New Jersey: Merrill Prentice Hall.*



# BIG IDEA



## MULTIPLICATION

- multiplication by ten
- partial products



## **Up-Coming School Event**

**The social committee needs about 250 to 300 flowers for decorations. Boris orders 12 groups of 24 flowers. How many will be delivered?**





# Open Arrays

	20	4
10	$10 \times 20$ $= 200$	$4 \times 10$ $= 40$
2	$2 \times 10 = 20$	$2 \times 4 = 8$

$$200 + 40 + 40 + 8 = 288$$

$$12 \times 24 =$$

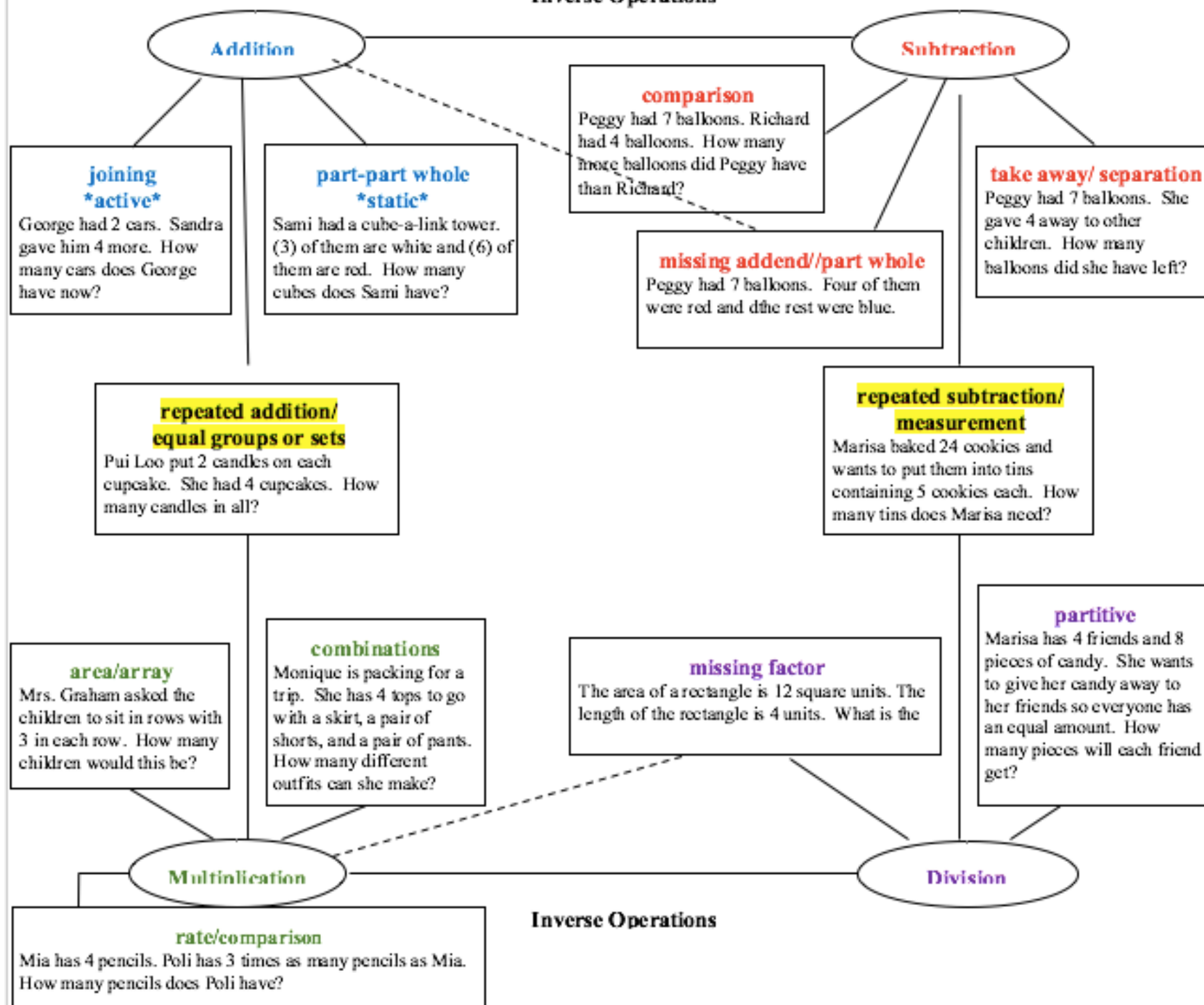
80

	20	4
12	$20 \times 12$ $= 240$	$4 \times 12$ $= 48$

$$240 + 48 = 288$$



**Inverse Operations**





# BIG IDEA



## DIVISION

- **divide one unit at a time**
- **trade remainders for smaller units**

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# Exploring the Traditional Algorithm Using Base 10 Manipulatives

## Going the Distance

The distance from Winnipeg to Lake Louise, travelling west on the Trans Canada Highway through Calgary is 1550 km. From past experiences Ben and Jen know that they can bike an average of 95 km/day. If they cycle at this speed, how many days will it take them to complete the trip?

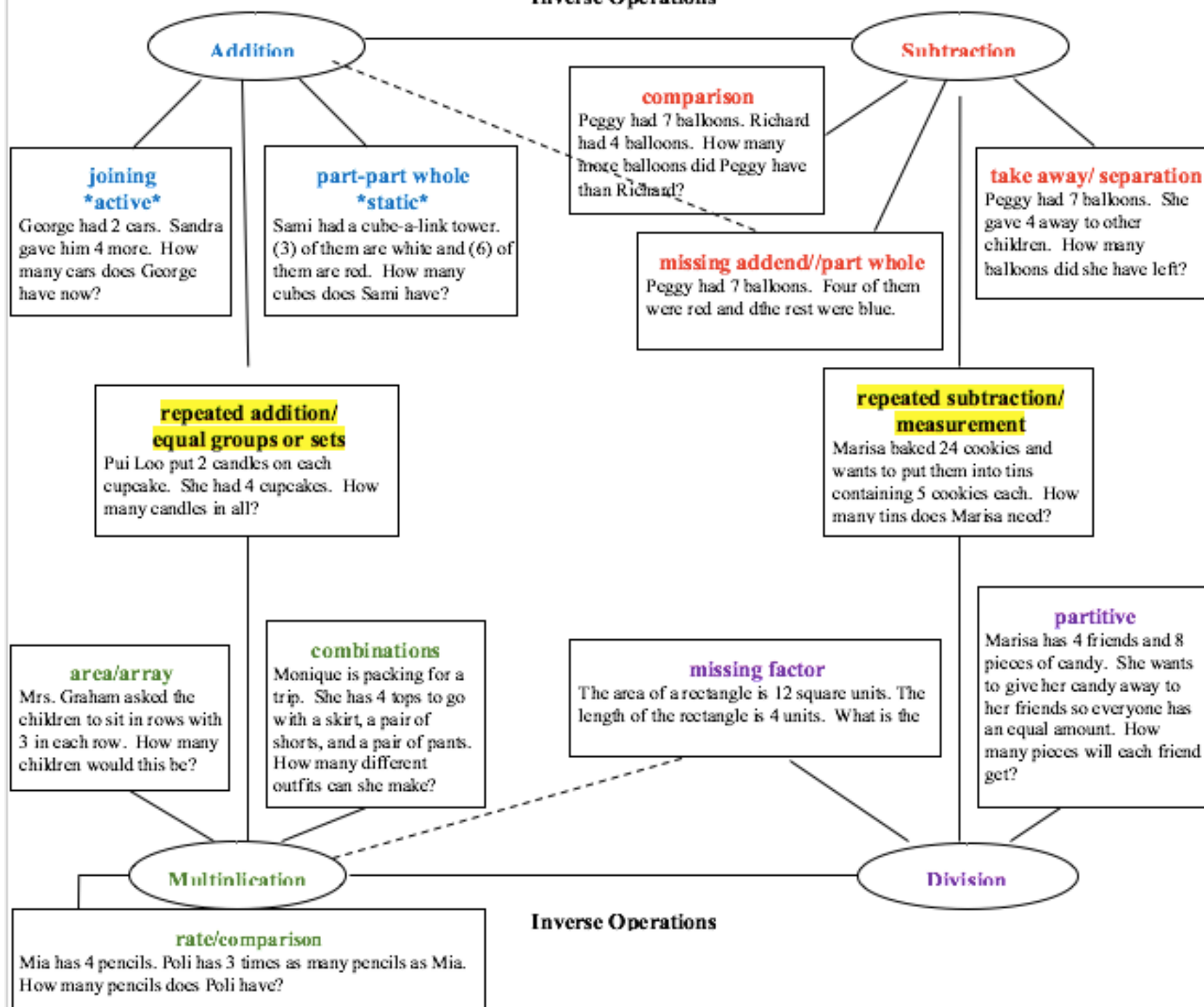


# The Questions ...

- **How many (hundreds/tens/ones) did you put in each group?**
- **How many (hundreds/tens/ones) did you put up altogether?**
- **How much is left on the board?**



**Inverse Operations**





# Traditional Division Algorithm

1	→	
25	→	
100	→	
100	→	226

$$\begin{array}{r}
 4 \overline{) 904} \\
 \underline{- 400} \\
 504 \\
 \underline{- 400} \\
 104 \\
 \underline{- 100} \\
 4 \\
 \underline{- 4} \\
 0
 \end{array}$$

$$\begin{array}{r}
 4 \overline{) 904} \\
 \underline{- 8} \quad \downarrow \\
 10 \\
 \underline{- 8} \quad \downarrow \\
 24 \\
 \underline{- 24} \\
 0
 \end{array}$$



# Open Array Division Model

$$112 \div 8 =$$

10

8

80

?

32





# Effective Numeracy

## TEACHERS ...

start with a problem and then facilitate:

- **share strategies**
- **explain reasoning**
- **listen to the thinking of others**
- **adapt their thoughts**
- **search for meaning**
- **identify and discuss patterns and a range of solutions**