Where is Number in Algebraic Reasoning?
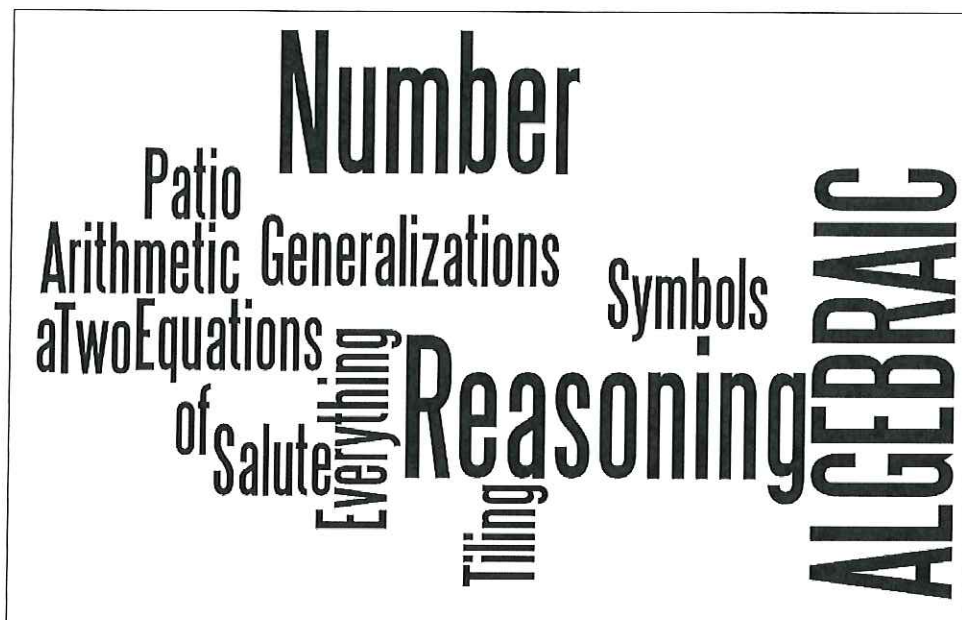
Rice University School Mathematics Project
Houston, Texas
http://rusmp.rice.edu

Susan Troutman

troutman@rice.edu
Associate Director for Secondary Programs

Carolyn L. White
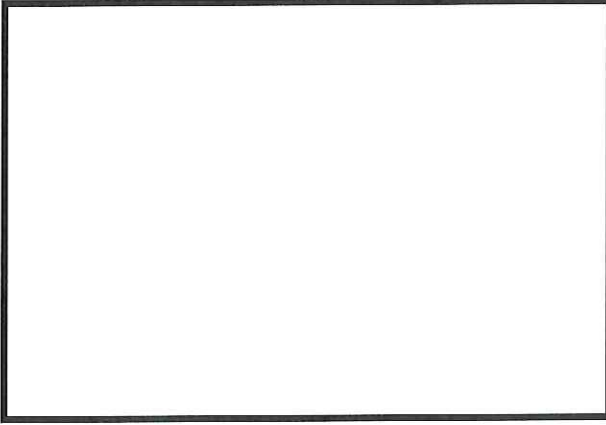
clwhite@rice.edu
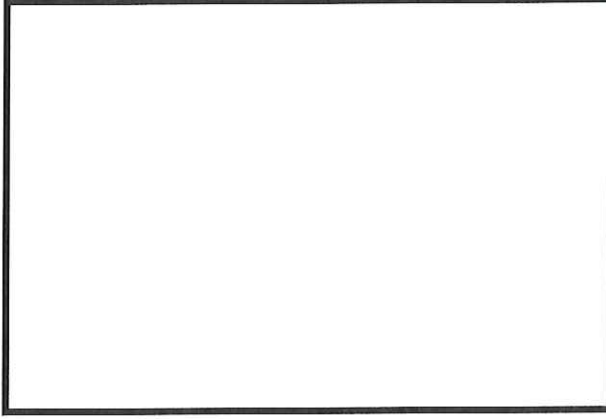Associate Director of Elementary and Intermediate Programs
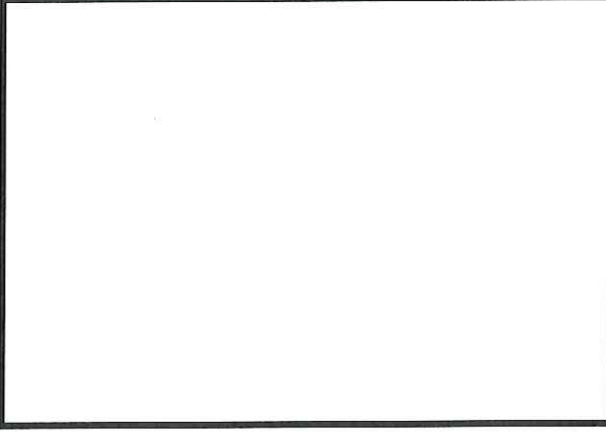
Using Playing Cards

Let's play the game 'Salute"

- Need three players on the team
- Deck of cards
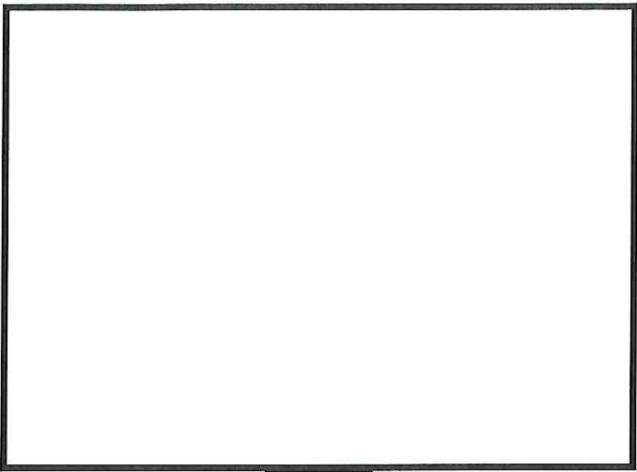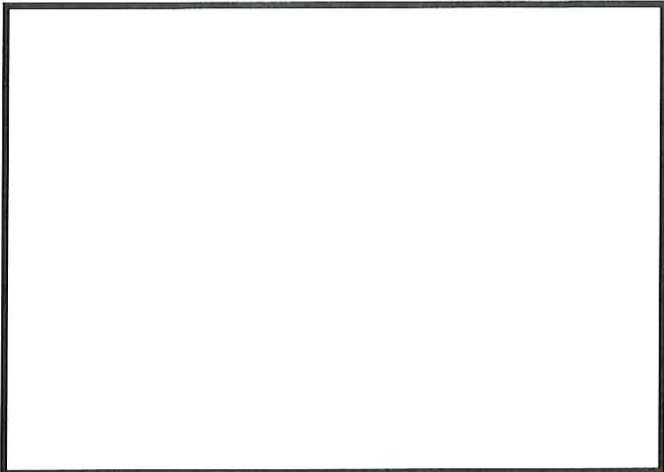- Paper to write problem

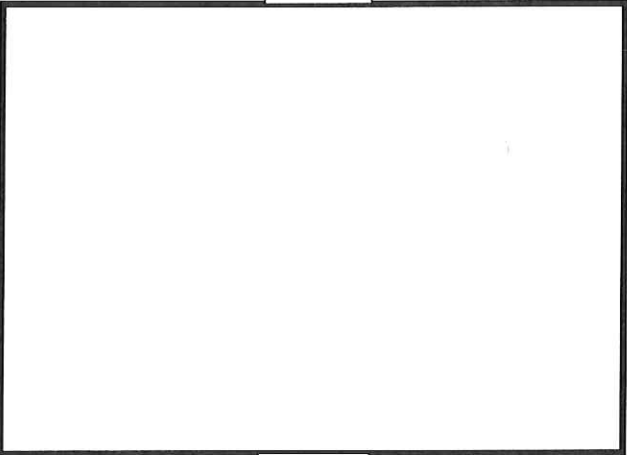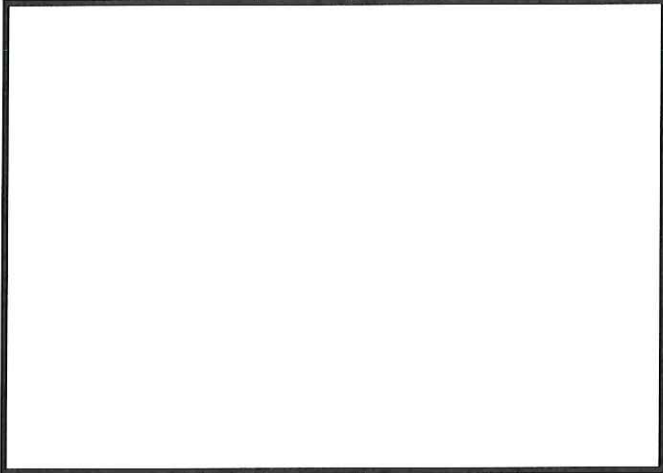$$\boxed{} \quad + \quad \boxed{} \quad = \quad \boxed{}$$

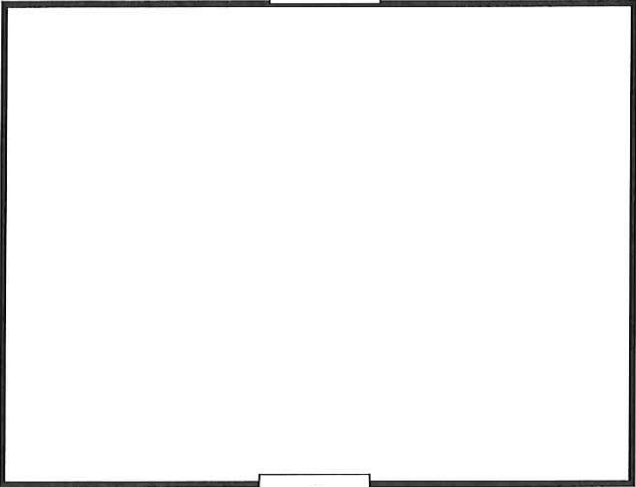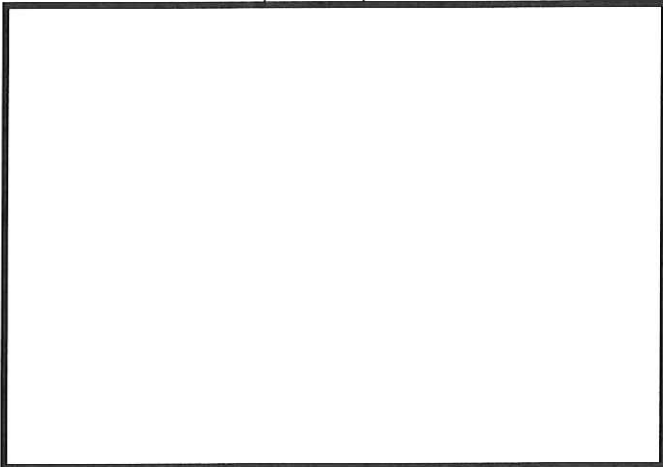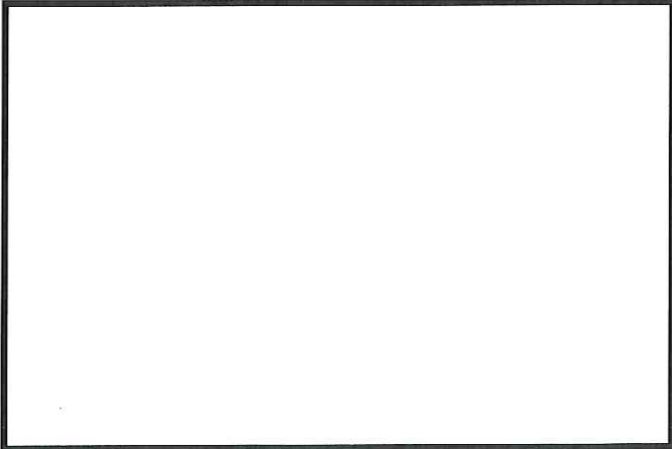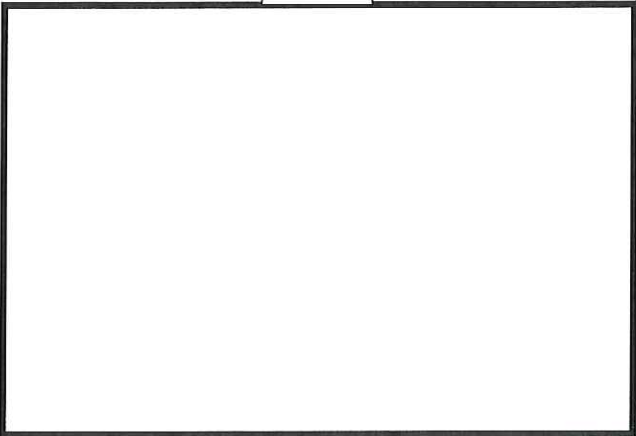|	$=$		$+$
	$+$		$=$
	$+$		$+$

Two of Everything

Input	Output

Rule_____

Activity Sheet 1. What Would You Choose?

Circle your choice.
- Choice A: 100 coins each day for 10 days

- Choice B: 5 coins and a magic pot that doubled the coins each day for 10 days

Work it out: How many coins would you have in 10 days with choice A? With choice B? Show your work on the back of this page.

Final thought: After working through the problem, would you still make the same choice? Why or why not? _____
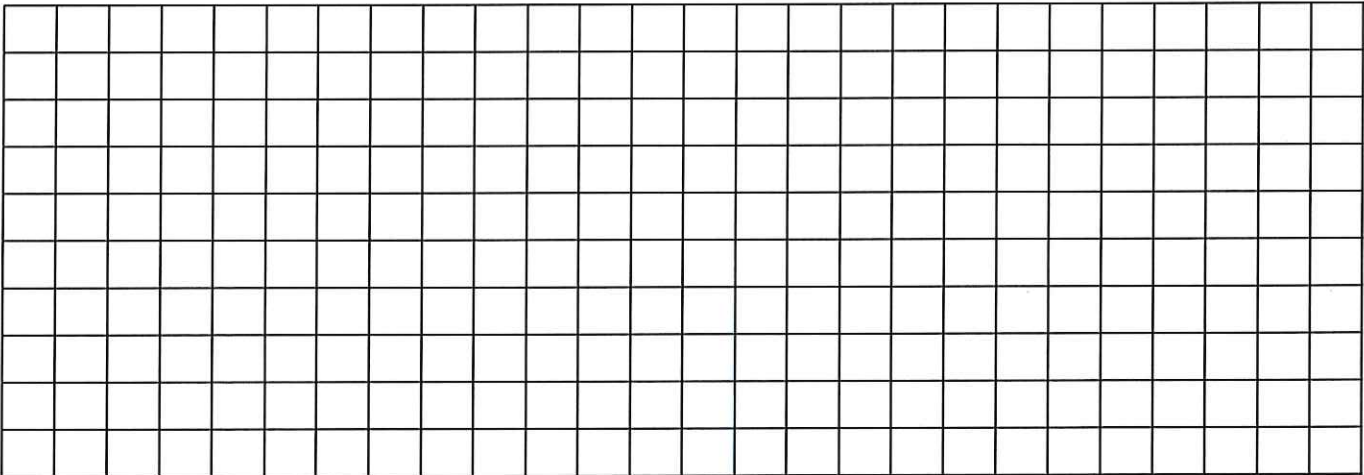
_____

_____

_____

- -

Activity Sheet 2. Pattern Seekers

1. On the graph paper below, draw the pattern you see.

2. Create a table of the pattern you see.

Step	1	2	3	4	5	6
Number of Cubes						

3. On the back of this page, describe the pattern in your own words. Then write a rule for the pattern.

The students were introduced to a system of equations.
HOW MUCH IS EACH SYMBOL WORTH?

cloud	sun	cloud	32
flower	cloud	cloud	29
sun	cloud	flower	25
sun	sun	sun	24
33	40	37	

sun   cloud   flower

How much is each symbol worth?

Sun? _____   Cloud? _____   Flower? _____

Explain your reasoning.

HOW MUCH DOES EACH FISH COST?

SUM

			SUM
			$6
			$12
			$19
			$16

SUM $13 $19 $21

Goldfish   Beta   Clown Fish

What is the cost of each fish?

Goldfish? _____   Beta? _____   Clown Fish? _____

Explain your reasoning.

Source: Cullen, C. & Gaymore, J. (2008) Ocean Quest. *Teaching Children Mathematics, 14(6), 344-350.*

HOW MUCH DOES EACH WHALE WEIGH IN TONS?

SUM

			330
			170
			200
			185

SUM   215   375   295

Right Whale   Gray Whale   Blue Whale

What is the weight of each whale?

Right Whale? _____   Gray Whale? _____   Blue Whale? _____

Explain your reasoning.

Source: Cullen, C. & Gaymore, J. (2008) Ocean Quest. *Teaching Children Mathematics, 14(6), 344-350.*

Sum

Which is worth more, a SMILE or a FROWN?
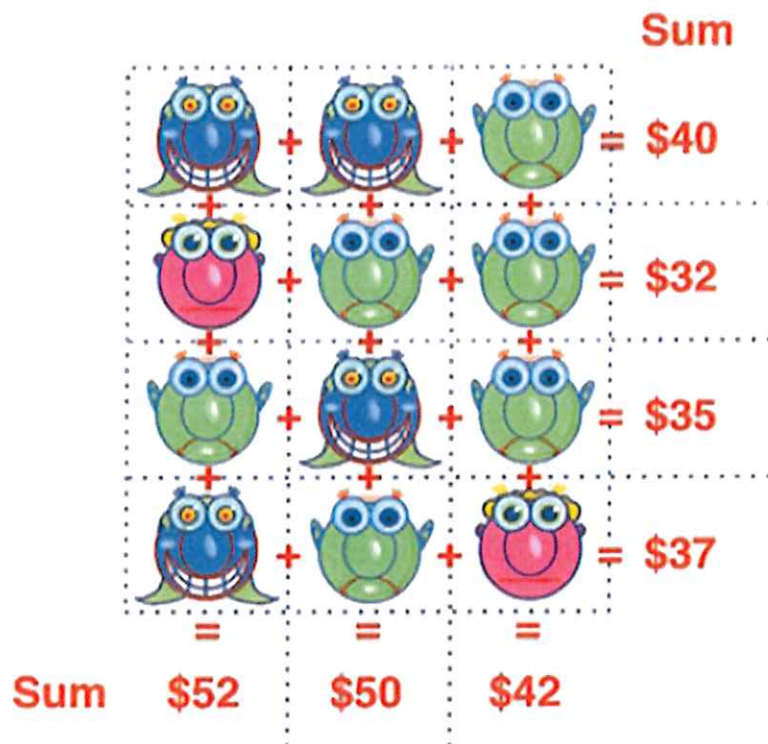
= $40

= $32

= $35

= $37

Sum $52 $50 $42
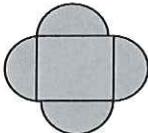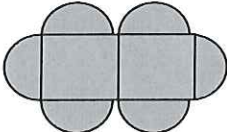
What is the value of each face?

Frown? _____   Smile? _____   Neutral face? _____

Explain your reasoning.

Source: Cullen, C. & Gaymore, J. (2008) Ocean Quest. *Teaching Children Mathematics, 14(6),* 344-350.

Dinner Tables

Dinner Tables	Show How	Number of People
1		4
2		
3		
4		
5		
6		
7		

Tiling a Patio

Patio Number	Number of Brown Tiles	Number of White Tiles	Total Number of Brown and White tiles

Graph
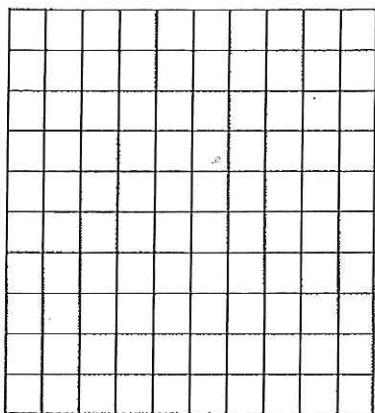
Equation

Table

Solution

Crossing the River Problem

Scenario

Eight adults and two children need to cross a river. A small boat is available that can hold one adult, or one or two children. Everyone can row the boat. How many one-way trips does it take for them all to cross the river?
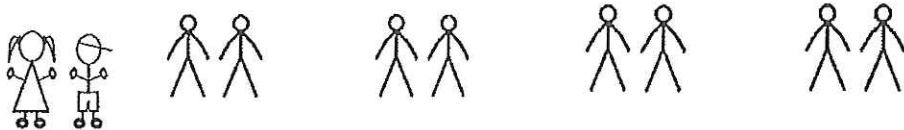
INTERNET RESOURCES

❖ **Scales and Balance**

http://nlvm.usu.edu/en/nav/frames_asid_324_g_3_t_2.html

❖ **Pan Balance Shapes**

http://illuminations.nctm.org/Activity.aspx?id=3531

❖ **Function Machine:**

http://www.shodor.org/interactivate/activities/FunctionMachine/
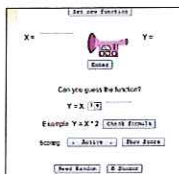
❖ **Function Machine Math Playground**

http://www.mathplayground.com/functionmachine.html

❖ **Stop that Creature!**

http://pbskids.org/cyberchase/media/games/functions/

Free Apps for the iPad

- ## Visual Algebra Puzzles

  Create your own algebra puzzles then try to solve them! This easy to use, educational tool was designed to work together with Shuttle Mission Math, an algebraic reasoning game in the app store. Puzzles can be solved with at least one of the following visual strategies: Scale Up, Scale Down (multiply or divide),

  https://itunes.apple.com/us/app/visual-algebra-puzzles/id662990649?mt=8

- ## Shuttle Mission Math

  Shuttle Mission Math is a mathematical puzzle game that makes algebraic thinking both visual and interactive. The goal is to find the weight of each space creature and assemble a team for the next shuttle mission.

  https://itunes.apple.com/us/app/shuttle-mission-math/id498617241?mt=8

- ## Algebra Champ

  Game like environment for solving linear equations

  https://itunes.apple.com/us/app/algebra-champ/id398873050?mt=8

Bibliography

Cuevas, G. J., & Yeatts, K. (2001). *Navigating through algebra in grades 3-5.* Reston, VA:

    National Council of Teachers of Mathematics.

Cullen, C., & Gaymore, J. (2008). Ocean quest. *Teaching Children Mathematics.* Reston, VA:

    National Council of Teachers of Mathematics, *14*(6), 344 - 351.

Demi. (1997). *One grain of rice: A mathematical folktale.* New York: Scholastic Press.

Driscoll, M., & Moyer, J. (2001). Algebraic thinking. *Mathematics Teaching in*

    the Middle School, 6(5), 282-287.

Friel, S., Rachlin, S., Doyle, D., Nygard, C., Pugalee, D., & Ellis, M. (2001). *Navigating through*

    algebra in grades 6-8. Reston, VA: National Council of Teachers of Mathematics.

Hong, L. T. (1993). *Two of everything*. Morton Grove, IL: Albert Whitman & Company.

Moses, B. (Ed.). (2000). *Algebraic thinking, grades K-12: Readings from NCTM's school-based*

    journals and other publications. Reston, VA: National Council of Teachers of

    Mathematics.

National Council of Teachers of Mathematics (2000). *Principles and standards of*

    school mathematics. Reston, VA: Author.

Suh, J. M. (2007). Developing algebra-'rithmetic in the elementary grades.

    Teaching Children Mathematics, 14(4), 246-253.

Van de Walle, J. A., Karp, K. S., & Bay-Williams, J. M. (2010). *Elementary and middle school*

    mathematics: Teaching developmentally. Boston: Allyn & Bacon.