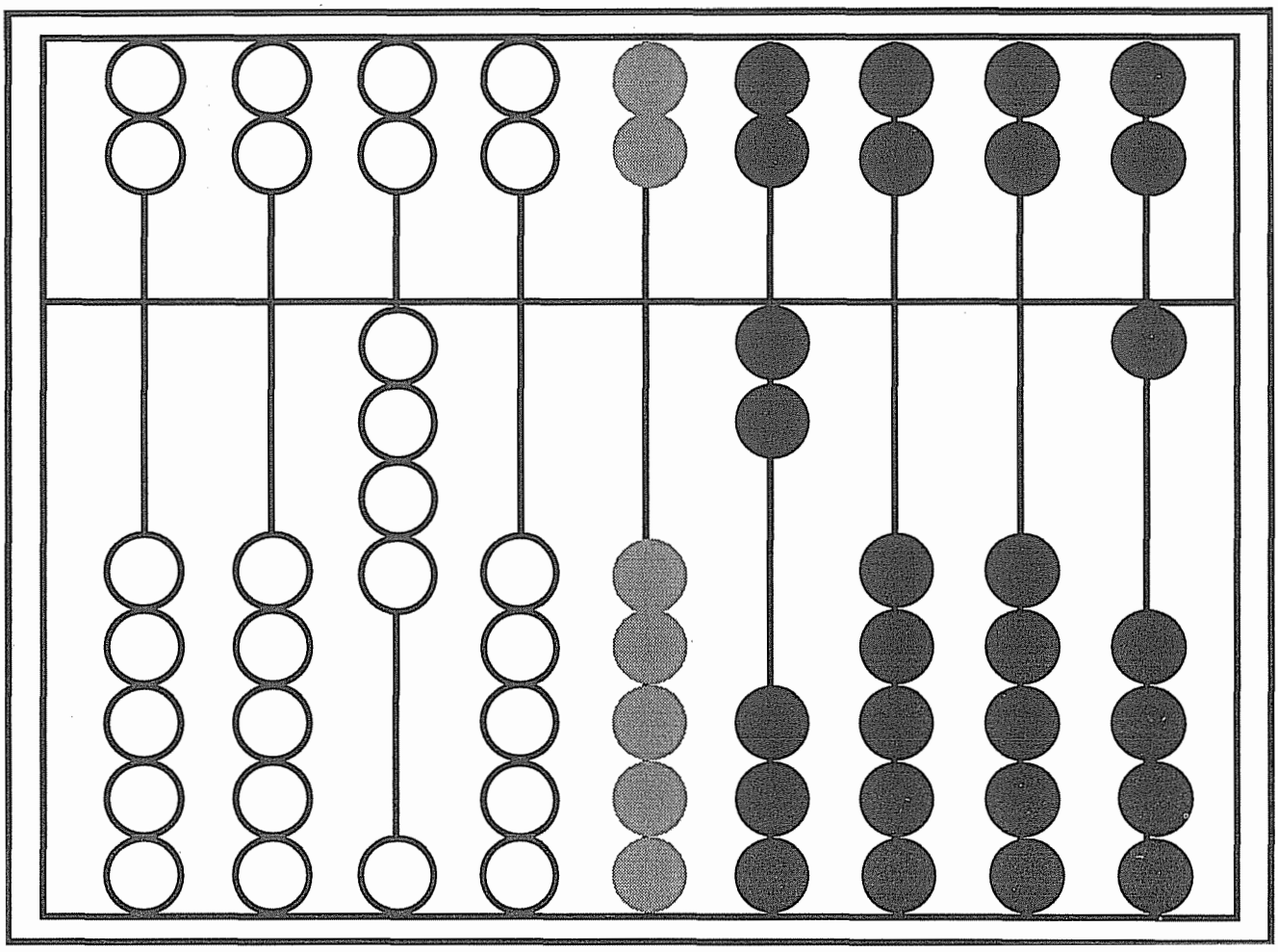
Abacus

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Edited by Frances Schatz

▲ From the Editor's Desk

In the September 2001 issue, **Caroline Rosenbloom**, a mathematics instructional leader with the Toronto District School Board, contributed a special activity called **Calling Out Outcomes** that addresses the strand *Data Management and Probability* for grades 5 to 8.

We apologize for omitting the game board mentioned in the activity description. In this issue we will repeat **Calling Out Outcomes** activity pages so you have the complete package.

The theme of this issue of the *Gazette* is "Connecting Mathematics". Caroline's activity connects *Data Management and Probability* to games that use two dice. Probability comes alive when it is connected to a real life event.

When I attended the NCTM annual in Orlando in Florida last spring, several workshops caught my interest as excellent sources of activities for *Abacus*. One was 'Giving Gifts of Math: Some Things Old, Some Things New, Some Things Borrowed, but Nothing Blue' by **Thomasenia Lott Adams** who is an associate professor in the School of Teaching and Learning at the University of Florida. She teaches methods courses to undergraduate and graduate preservice elementary school teachers. Under the subtitle, Some Things Old, she presented a gift of artwork from the Vedic Square. Professor Adams kindly wrote the activity: **The Vedic Square: A Times Table Transformation** for the *Abacus*.

Vedic India describes the historical period around 1000 BC of India. The Vedas represent some of the earliest Indian texts, from which the Vedic Square is found. The Vedic Square is an adaptation of the 0-9 multiplication table. Each entry that is greater than 9 in the multiplication table is replaced by the sum of the product's digits until a single digit is obtained. The major premise of the Vedic Square is that numbers have shapes just as objects have shapes. Number Sense and Numeration is connected to Geometry and Spatial Sense via a multi-cultural activity. A specific expectation in the grade 4 Number Sense strand is to compute and remember multiplication facts to 81. A specific expectation for grade 4 Geometry and Spatial sense is to identify, sort, and classify two-dimensional figures according to shape. Grade 4 Patterning and Algebra expects students to describe patterns encountered in any context such as this transformed multiplication in Vedic Square and expects students to discuss and defend the choice of a pattern rule. The activity could be used at the grade 4 or 5 level. A rubric would assess problem solving, application of procedures, and communication of observations.

Professor Adams listed the following sources and websites that give more information.

http://www.metmuseum.org/collections/department.asp?dep=14z gives examples of Islamic art.

http://www.sakkal.com/Sakkal_Arabic_Covers.html shows Islamic art on book covers.

http://www.vedicmaths.org gives more information about the body of mathematics developed in ancient India.

Jones, L. (1989). Mathematics and Islamic Art. *Mathematics in Schools*, 18(4):32-35.

Nelson, D., Joseph, G. G. & Williams, J. (1993). *Multicultural Mathematics: Teaching Mathematics from a Global Perspective*. New York, NY: Oxford University Press.

Last June the Ontario Mathematics Olympiads contest was held in Thunder Bay. Many talented senior elementary students gathered to solve problems as individuals, as teams, and as groups, and enjoyed Thunder Bay hospitality as well. Thank you to Wayne Fletcher, the contest coordinator, for providing a sampling of questions from the 2001 competition. Encourage your students to try these questions and send solutions to the editor at the address on page 1 of *Abacus*. Answers will be given in the March 2002 issue.

Thank you to all the writers who contributed to this issue of *Abacus*.

Frances Schultz

▲ Teacher Notes - Calling Out Outcomes

This activity has been adapted from Quest 2000. Students are collecting data and looking at trends to make decisions on what sum they are most likely to get when they roll a pair of dice.

Activity description:

1) In this activity, students will use probability to think of possible outcomes.
2) Hand out a gameboard to each pair. Player A predicts the sum of the dice and records the prediction on the chart. Roll the dice and graph the sum on the game board. If their call is correct, A scores a point. Then player B takes a turn.
3) The game is over when one of the players reaches 5 points.
4) After the game, ask students if they noticed any patterns.
5) Students should complete the worksheet to find the total possible sums.

Questions: Why do the numbers on the tally chart go from 2-12? Where is the number one?

Remedial: Look at the student's predictions if the players seem to need help in developing a strategy, encourage them to look at patterns on their graph.

ESL: Students can draw their expectations for their journal entry. The game is hand-on and can easily be followed. If they are having difficulties understanding the game, ask them to watch other students and to also record their guesses on paper.

Enrichment: Adapt the game so that each player can call out a sum or the word "double". Double refers to the same number appearing on both dice. The scoring is as follows: correct sum 1 pt;Double call 2 points; incorrect call of double minus 2 points; first one to reach 5 wins.

Change the rules using the products.

▲ Teacher Notes – Vedic Square

Materials:

- Chart for Vedic Square (see page 6)
- Pen to complete the multiplication facts.
- Tracing paper with coloured markers to mark squares.
- Ruler to join the squares for each number 0-9.

Explorations:

1. Encourage students to search for geometry patterns in the Vedic Square by examining rows, columns, diagonals, and groups of numbers. Students can describe the structure of patterns found.

2. The people of India who developed and used the Vedic Square believed that numbers have shapes just as concrete objects have shapes. To find the shape of a number 0-9 in the Vedic Square, use line segments to connect all the cells that contain a specified number. The plane figure and/or angle resulting from the connected line segments is the shape of the number. Below is the Shape of 7: Rectangle.

3. Have students add one or more factors to the table (eg 10, 11, 12). Examine the Vedic Square with these factors. What, if any, new shapes appear?

4. Create a different square by transforming the times table according to a rule different from 'equal to or less than 9". How does your square differ from the Vedic Square?

   Compare the shapes of numbers in your square to the shapes in the Vedic Square.

x	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	1	3	5	7	9
3	0	3	6	9	3	6	9	3	6	9
4	0	4	8	3	7	2	6	1	5	9
5	0	5	1	6	2	7	3	8	4	9
6	0	6	3	9	6	3	9	6	3	9
7	0	7	5	3	1	8	6	4	2	9
8	0	8	7	6	5	4	3	2	1	9
9	0	9	9	9	9	9	9	9	9	9

Shape of 7: Rectangle

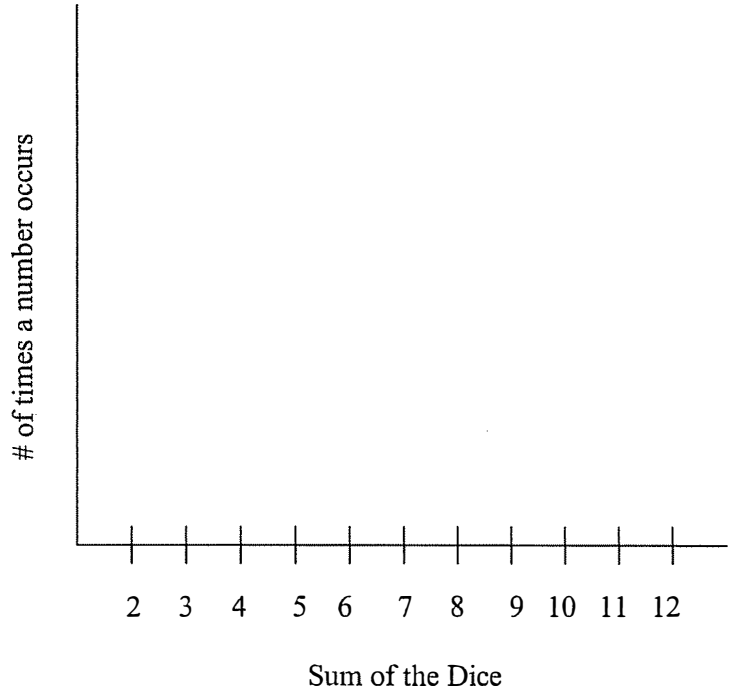
Game board

Calling Out Outcomes

Call out your prediction and record it on the tally chart below.
Graph the sum from the results of your roll.

	2	3	4	5	6	7	8	9	10	11	12
Player A											
Player B											

After rolling the dice, graph the sum below.



Points

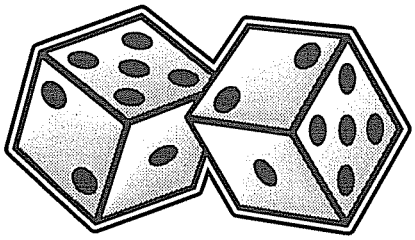
Player A	Player B

▲ Calling Out Outcomes

Caroline Rosenbloom

Find the total possible sums:

	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						



Sum	Probability of Sum
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

What is the minimum sum? _____

What is the maximum sum? _____

List the probability of all the sums occurring?
Here are a few to start:
Probability (7 occurs) = 6/36 = 1/6
Probability (9 occurs) = 4/36 = 1/9

▲ VEDIC SQUARE

Thomasenia Lott Adams

x	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

Figure A: 0-9 Multiplication Table

Instructions:

1. Complete the "times" (multiplication) table in Figure A.

2. Examine each product in your completed table.

3. If the product is less than or equal to 9, copy this product into the appropriate cell in Figure B.

4. If the product is greater than 9, that is, if it is a two-digit number, add the two digits of the product. If this sum is less than or equal to 9, write this sum in the appropriate cell in the table in Figure B. Example: 5x7=35 Since 35 is greater than 9, add the two digits 3 and 5. Enter the sum 8 in the cell for 35 in Figure B.

x	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

Figure B: the Transformed "Times Table"

5. If the sum in step 4 is still greater than 9, continue to add the digits until the sum is less than or equal to 9, and record this sum in the appropriate cell in Figure B. For example, 8x8=64, sum is 10 which is greater than 9, add the digits of 10 to get 1 and enter 1 in the cell for 64 in Figure B.

6. Repeat the steps 2-5 necessary to complete the table in Figure B. This table of new values is called the Vedic Square.

7. Choose a number 0-9 and search for its shape in the Vedic Square. Use line segments to connect all the cells that contain a specified number. Describe the shape in as many different ways as possible – number of sides, parallel sides, angles, etc.

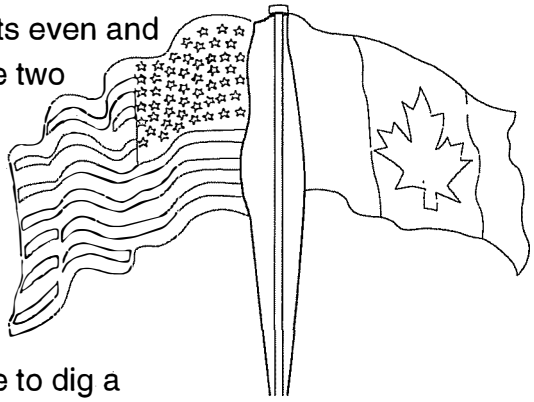
8. Describe any relationships between the shapes for different numbers 0-9.

9. Use shapes of numbers to create your own artistic expression.

▲ OMO 2001 Individual Test Problems

1. What is the number halfway between 1/2 and 9/16?

2. A two digit number greater than 80 has the sum of its digits even and the product of its digits odd. What is the smallest possible two digit number?



3. If one Canadian dollar is worth $0.60 in U. S. currency, what is one U. S. dollar worth in Canadian dollars? (Round your answer to the nearest cent.)

4. It takes one student one day to dig a 2m x 2m x 2m hole. How long does it take 2 students working at the same rate to dig a 4mx4mx4m hole?

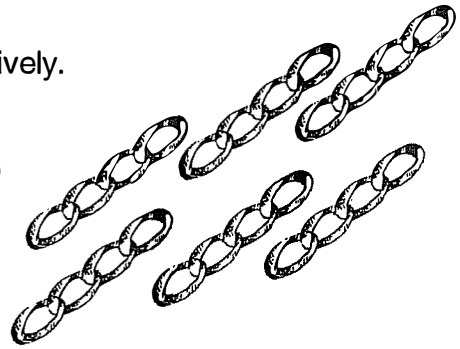
5. Sara ate 100 cookies in five days. Each day she ate 6 more cookies than the day before. How many cookies did she eat on the first day?



6. A license plate number consists of exactly four digits. How many different plates have the sum of the digits of this number 35 or greater?

7. A rectangular chalk board is 3 times as long as it is wide. If it were 3 metres shorter and 3 metres wider it would be a square. What are the dimensions of the chalk board?

8. Find the largest sum of three numbers between 5 and 17 exclusively. The numbers have a product of 1344.



9. There are 6 pieces of link chain, each having 4 links. It takes 10 seconds to cut a link and 25 seconds to weld it back together. What is the shortest possible time it takes to make the longest possible chain? (Answer in seconds.)

10. Twenty cards are numbered consecutively from 1 to 20 with one number on each card. The cards are shuffled and sorted into four piles of 5 cards each. What is the number of possible sums of the numbers on the cards in any one pile?