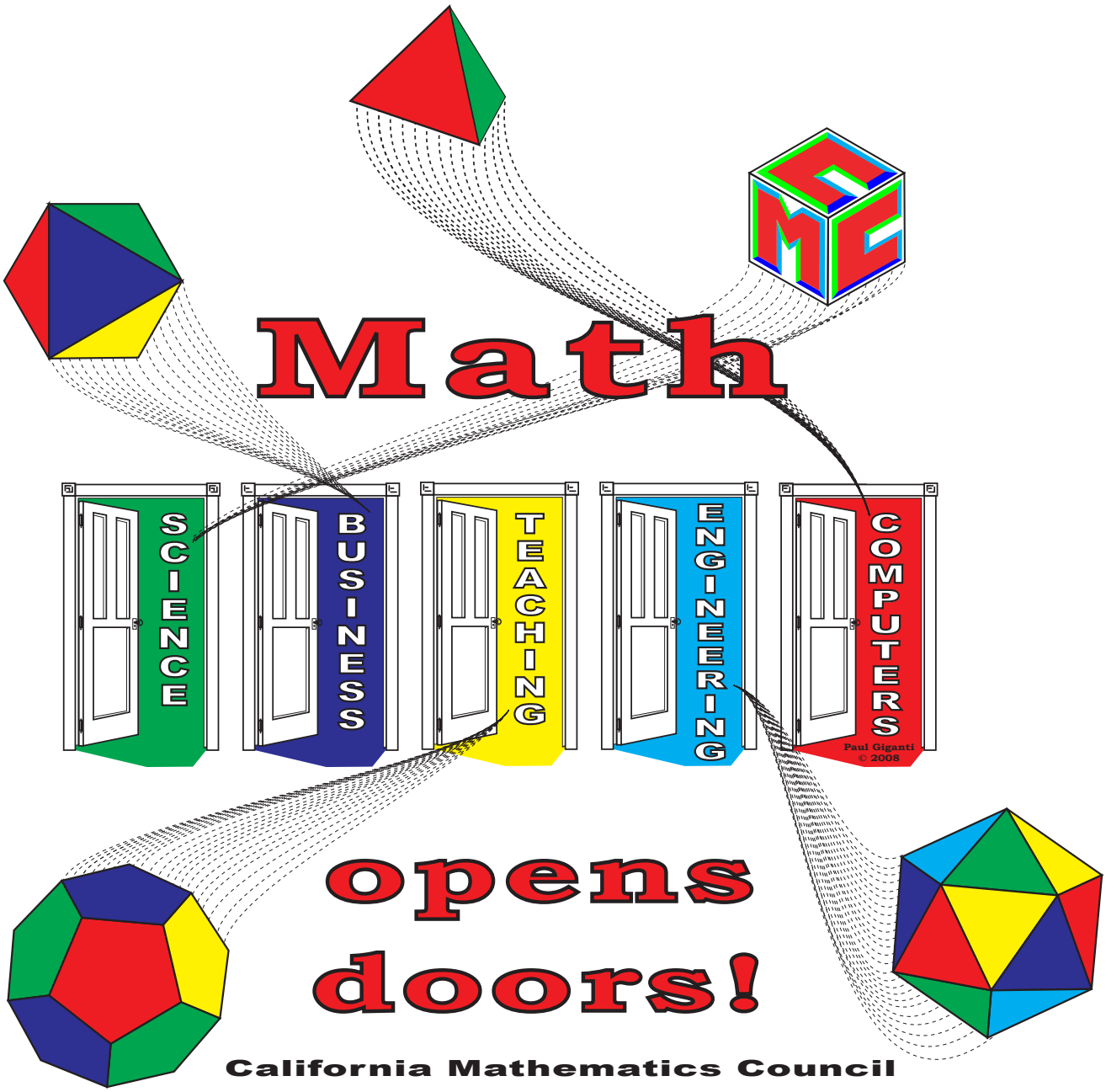
The California Mathematics Council

ComMuniCator

Special Promotional Issue



An Affiliate of
THE NATIONAL COUNCIL of TEACHERS of MATHEMATICS

CMC *ComMuniCator* Promotional Issue

This special promotional issue of the *ComMuniCator* is designed to encourage teachers and others interested in mathematics education to become members of the California Mathematics Council (CMC). While the *ComMuniCator* is but one benefit of membership in CMC, we hope that through the information, articles, and activities presented here many will think about becoming members and sharing in the support that teachers of mathematics at all levels, kindergarten through college, receive as CMC members.

Our hope is to distribute this promotional issue of the *ComMuniCator* far and wide. If you are a teacher educator, coordinator, professor, or supervisor of preservice or inservice teacher programs, please request copies of this *ComMuniCator* for your teachers.

Copies of the promotional issue of the *ComMuniCator* are available without charge. If you would like to receive copies, please contact:

Mike Contino
CMC Membership
PO Box 880
Clayton, CA 94517-0880.

For CMC membership information, call 1-888-CMC-Math or go to the CMC web site at ***www.cmc-math.org.***

• CMC MEMBERSHIP FORM •

You can sign up or renew your membership in several ways, depending on the method of payment:

✔ online at **cmc-math.org/membership** with a credit card;

✔ by phone/fax to **888-CMC-MATH (888-262-6284)** with a credit card;

✔ by filling out and mailing the following to **CMC • PO Box 880 • Clayton CA 94517** with check, credit card, or purchase order.

Name _____

Address _____

City _____ State_____ ZIP _____

Phone _____ E-mail _____

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Position _____ Level(s) of Interest _____

Member Rates (*as of April 2010; go to www.cmc-math.org/membership for the current membership rates*):

____ Regular, $50 (one year) ____ Regular, $95 (two year) ____ Student/Retired, $25 (one year)

Life Membership Rates (*as of April 2010; go to www.cmc-math.org/membership for the current membership rates*):

____ $700 (age 40 & under) ____ $600 (age 41 to 55) ____ $400 (age 56 & over)

Welcome to CMC

by the CMC Board

The California Mathematics Council (CMC) is an organization that serves mathematics educators at all levels—teachers, parents, students, paraprofessionals, student teachers, administrators, and college and university staff.

CMC is an association of people who appreciate the beauty and fascination of mathematics and enjoy sharing that wonder with students of all ages.

As you read through this mini-edition of the *ComMuniCator*, the journal of the California Mathematics Council, keep in mind the many ways that CMC might serve you.

Advocacy. . .

Through its work at the state level, CMC creates opportunities for its members' voices to be heard on issues critical to the teaching of mathematics: a standards-revision process, more flexibility of when a student takes Algebra 1, policy changes to better serve teachers and students, and a broader professional development focus for K–12 teachers in the areas of mathematics pedagogy, instructional strategies, content, and instructional materials.

Through CMC, members have a large role in the decision-making process as our state crafts the plan for rigorous and relevant mathematics instruction.

Bigger issues are on the horizon, such as Race to the Top and STEM (Science, Technology, Engineering and Mathematics), as CMC strives to represent your views in work with the California Department of Education.

Professional Awareness. . .

CMC keeps its members informed of actions that directly affect the teaching and learning of mathematics, such as *California Mathematics Framework* revisions, development of long-term mathematics policies, implementation of new national standards, and changes in assessment at the state and national levels.

CMC has direct communication with the California State Department of Education and representation in Sacramento.

As a CMC member, you are represented in state committees, task forces, and work groups that are considering issues related to mathematics education in California.

School and Community Support. . .

The Math Festival Program
www.cmc-math.org/activities/math_festival.html

The CMC Math Festival Program is a way for schools to celebrate mathematics.

K–8 students can enjoy a multitude of challenging problem-solving activities during the day, then bring their families to a Family Mathematics Festival that evening.

A Math Festival is an exciting school-wide event that exposes students, teachers, and parents to key mathematics topics in a positive, self-explanatory, festival-like atmosphere.

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Conferences. . .

CMC organizes and sponsors local and regional conferences that allow concerned individuals to keep current in mathematics education.

CMC offers conferences of national renown in the fall and spring of each year.

Northern Section
ASILOMAR

Central Section
SEASIDE

Southern Section
PALM SPRINGS

Inservice sessions feature current techniques and materials. Members of CMC receive special considerations, such as early program mailing.

Awards, Grants, Scholarships. . .

CMC recognizes people who have made outstanding contributions to the teaching of mathematics.

George Polya Award

Presented yearly to one or more members who are classroom teachers of mathematics and who have been visible as leaders in a state-wide context.

Edward Begle Award

Presented yearly to one or more California mathematics educational leaders who are actively supportive of CMC's goals.

Walter Denham Award

Beginning in 2005, presented to a person who regularly advocates for excellence in mathematics education. This Award is for an individual who champions excellence in mathematics teaching and learning by engaging policy makers in rational, respectful discourse supported by data while remaining steadfast in the face of adverse circumstances.

Presidential Awards

One award each year to a teacher of mathematics—secondary teachers in odd years and elementary teachers in even years. The process is managed by CMC under the auspices of the National Science Foundation (NSF). Each winner receives a trip to Washington, D.C. and cash awards from the NSF and CMC.

Lurie Center Scholarship

Awarded yearly to teachers of color to attend each of the CMC Conferences.

CMC Section Grants and Awards

Each of the CMC sections—North, South, and Central—offer grants and awards for preservice and current teachers who reside in their geographic areas.

To read more about these opportunities and to access other mathematics education resources, go to the CMC web site: **www.cmc-math.org**.

CMC's Affiliates. . .

CMC has local affiliates throughout the state that offer a wonderful variety of mathematics activities for both teachers and students during the school year. We have local county-wide affiliates plus a few state-wide interest groups.

Visit the CMC web page for updates to the activities, dues, and links for these organizations. You will find the affiliates listed under each section in the Organization link.

Get involved and extend your influence in improving mathematics education beyond your immediate classroom, school, and district by joining one or more CMC affiliates. You can include membership in an affiliate when you renew or join CMC via the online membership link.

Support for Students. . .

CMC promotes student involvement and interest in the field of mathematics through student mathematics activities and recognition of outstanding students in mathematics.

Student Activities Trust Fund

The Student Activities Trust Fund (SATF) helps qualifying applicants sponsor activities directly dealing with students, such as mathematics field days, problem-solving contests, and mathematics olympiads.

Recognition of Outstanding Students

A certificate signed by the CMC President and the State Superintendent of Schools is provided to each high school in the state to award to an outstanding mathematics student.

Publications. . .

CMC publishes information of interest to all individuals involved in mathematics education.

The ComMuniCator, our professional journal, is published quarterly and features articles on current topics of interest to teachers and new activities that are ready for use with students.

Look to the *ComMuniCator* for teaching ideas, resources, and notices of professional meetings, seminars, and conferences.

CMC on the Internet. . .

www.cmc-math.org

The CMC web site is updated regularly and helps our members stay current on important events affecting all our classrooms and students—public and private. Find out and register for our annual conferences, see a calendar of mathematics education events offered by local affiliates and partner organizations, learn about newsworthy mathematics issues in California and across the nation, and access the members-only section to view the *ComMuniCator* online.

CMC is on the Web and on Facebook and has a blog, in order to keep its members informed and involved through the use of older and newer media.

You can post questions, announcements, or contribute to the collective knowledge of our CMC Facebook group. Visit the web site to find out more about the projects and activities CMC is involved with and to get a complete list of the CMC leadership.

Networking. . .

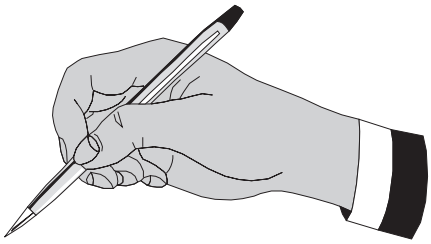
The strength of any organization lies in its membership. If *you* join CMC, we can all do more. CMC requests your participation in our organization and its activities. CMC needs your membership to develop and maintain an effective state organization.

CMC works!
Let CMC work for you.
Join the California Mathematics Council and get connected!

CMC President's Report:

Writing in Mathematics

by Harold Asturias, CMC-State Past President



What is writing?

When I started thinking about this article, I began to reflect on how my own understanding of writing and its importance in mathematics education has changed over the years. I realized that older definitions of writing have necessarily changed, in part due to advances in technology. The New Oxford American Dictionary defines writing as "the activity or skill of marking coherent words on paper and composing text." This seemed narrowly constrained to paper. Merriam-Webster (**www.m-w.com/dictionary/writing**) says, "writing is the act or art of forming visible letters or characters." By leaving the medium on which those words or letters are to be formed unstated, this definition leaves room for media other than paper. The definition on Wikipedia (**en.wikipedia.org/wiki/Writing**) seemed to accommodate best my current thinking about the need for a broader definition:

> writing is a process which may refer to two activities: the inscribing characters on a medium, with the intention of forming words and other lingual constructs that represent language and record information, or the creation of information to be conveyed through written language.

I contend that writing, particularly in mathematics, has become a more complex but rich activity. Students need to learn to use all the media at their disposal to communicate their mathematical ideas clearly and effectively. Writing in mathematics is an essential ability students need to learn and use if they are to succeed in the 21st Century.

Why is writing important in mathematics?

First, writing is an essential tool for communicating mathematical ideas clearly—and students should be expected to communicate their ideas and thinking clearly. The National Council of Teachers of Mathematics (NCTM) includes a Communication Standard in its *Principles and Standards for School Mathematics* (2000):

> Instructional programs from pre-kindergarten through grade 12 should enable all students to—
>
> - organize and consolidate their mathematical thinking though communication;
> - communicate their mathematical thinking coherently and clearly to peers, teachers, and others;
> - analyze and evaluate the mathematical thinking and strategies of others;
> - use the language of mathematics to express mathematical ideas precisely (p. 60).

Although there is no separate Communications Standard in the *Mathematics Content Standards for California Public Schools* (1999), the document does state the following expectation:

> By grade eight, students' mathematical sensitivity should be sharpened. Students need to start perceiving logical subtleties and appreciate the need for sound mathematical arguments before making conclusions. As students progress in the study of mathematics, they learn to distinguish between inductive and deductive reasoning; understand the meaning of logical implication; test general assertions; realize that one counterexample is enough to show that a general assertion is false; understand conceptually that although a general assertion is true in a few cases, it is not true in all cases; distinguish between something being proven and a mere plausibility argument; and identify logical errors in chains of reasoning (p. 36–37).

Students will not be able to demonstrate meeting such an expectation without using writing.

A second reason is that writing is a technical skill needed in today's workplace. Effective communication skills are an essential prerequisite for employees' success in business and industry. Several researchers have pointed this out. Barclay, Pinelli, Keene, Kennedy, and Glassman (1991) asserted: "the ability to communicate technical information effectively is important to workplace performance and professional advancement" (p. 330). Andrews and Andrews (1992) emphasize the importance

of good communication skills given the fact that in the 21st Century communication has become central to everything we do. Many employers in business and industry complain that far too many entry-level employees do not have the communication skills to perform their jobs effectively. Kandebo, Phillips, and Kernstock (1991) report that aerospace companies were concerned about the number of entry level engineers not able to write reports or make effective presentations about their ideas (p. 46). We need to teach students to communicate effectively from the beginning of their school life. In addition, we need them to become critically literate. They must learn to question and critique the conditions for participating in communities and know how best to help improve the communities in which they live.

How do we help students become better writers in mathematics?

There are many books and articles full of strategies for helping students improve their writing. Here are a few questions specific to mathematics that will help students improve communicating their mathematical ideas in writing. In addition to following all the general advice about effective writing, when writing in mathematics, students should ask themselves:

- ✔ *Did I state all of my assumptions?*
- ✔ *Did I define all of the variables? Did I describe them properly?* For example, there are two problems with the statement, "The area of a right circular cylinder is $2\pi rh$." The more obvious is that r and h have not been defined. A less obvious problem is the meaning of *area*. It is not clear whether the area includes or excludes the top and bottom. A better statement would be: "The lateral surface area of a right circular cylinder is $2\pi rh$, where r is the radius and h is the height of the cylinder."
- ✔ *Did I use mathematical symbols correctly?* Remember to reserve symbols that have a specific mathematical meaning for mathematical use. Always respect the equals sign; do not use it outside of a formula. Mathematics is case sensitive so do not use lower case letters and capital letters in the same sentence. They are not necessarily interchangeable (e.g., in the statement: "if $a = 1$, then $A + 4 = 5$," A is not defined, a is).
- ✔ *Did I use words correctly and precisely?* Everyday English tolerates a level of ambiguity that is not appropriate when communicating mathematical ideas. Mathematics is very precise. For example, the definite article *the* implies that there is only one object that is being described. So, do not use *a* or *an* when you mean *the* and vice-versa.
- ✔ *Are my diagrams, tables, graphs, and any other pictures clearly labeled?*
- ✔ *Is the mathematics correct?* Make sure that every statement you make is mathematically correct. If you are not sure of the validity of a claim, first convince yourself. The worst mistake is to make a false assertion.
- ✔ *Did I solve the problem?*

Writing about thinking is challenging and it requires a lot of practice. The challenge of writing in mathematics is similar to the challenge of writing in other subjects—the problem is to communicate ideas and thinking clearly. Provide students ample opportunities to practice writing in your mathematics classroom by ensuring that they have ideas to communicate, have someone to whom they communicate those ideas, communicate in an organized way, and pay attention to the form and function of the language they are using.

References

Andrews, D., and W. Andrews. *Business Communication (2nd ed.)*. New York: Macmillan, 1992.

Barclay, R., M. Pinelli, M. Keene, J. Kennedy, and M. Glassman. "Technical Communication in the International Workplace: Some Implications for Curriculum Development." *Technical Communication* 38 (3)(1991): 324–335.

California Department of Education (CDE). *Mathematics Content Standards for California Public Schools: Kindergarten Through Grade Twelve*. Sacramento, CA: CDE, 1999.

Kandebo, S., E. Phillips, and N. Kernstock. "U. S. Faces Potential Shortage of Engineers." *Aviation Week & Space Technology* 129 (23)(1991): 46–54.

National Council of Teachers of Mathematics (NCTM). *Principles and Standards for School Mathematics*. Reston, VA: NCTM, 2000.

Algebra and Patterning for Kindergarten/ First Grade Students

by Fran Threewit, Kenwood Elementary

CONCEPTS: Algebra, Data Analysis, Probability
SKILLS: Identifying, describing, and extending simple patterns; collecting data and recording results; using operational symbols
MATHEMATICS STANDARDS: Gr K: AF 1.0, SDAP 1.1, 1.2; Gr 1: AF 1.1, 1.2, SDAP 2.1
GRADES: K–1
MATERIALS: Classroom objects, manipulatives (pattern blocks, linking cubes, beads, etc.), stickers, rhythm instruments, pocket chart, classroom calendar

BACKGROUND

It is important for Kindergarten/First Grade students to use a variety of concrete materials and hands-on experiences as they embark on the early study of algebra. They should begin the process of learning about variables by using pictures and symbols to look for and describe patterns. While they work toward relating to addition and subtraction they can look for unknown numbers and they can write number sentences about real-world situations.

DESCRIPTION

Listed below are some activities that illustrate how algebraic concepts can be introduced and integrated in the K/1 classroom.

- Sort and pattern objects by color, size, shape, and kind. Use objects found in the classroom, such as crayons, pens, pencils, chairs, etc.
- Identify patterns in the environment, in pictures, and in lines of objects, and explain how the items are arranged. Use linking cubes, beads, macaroni, pattern blocks.
- Create and describe a pattern of objects or numbers. Extend the pattern up to three or more times. Use pattern strips made from stickers or stamps and stamp pads for students to continue the pattern.
- Create rhythmic patterns with claps, taps, or on a rhythm instrument. Echo a short invented rhythmic pattern played by another student.
- Relate patterns to number.
  - —Use the pocket chart to sequence number cards on a number line. Gradually replace the number line with number strips that follow a pattern or have a missing number in the pattern sequence.
  - —Use the classroom calendar to create numerical patterns with pictures and numbers. Count by 1s, 2s, 5s, and 10s. Find odd and even numbers.
  - —Connect unknown numbers by drawing pictures and writing number sentences that describe a pattern of pattern blocks, linking cubes, or beads.

CONCLUSION

There are many web sites that will extend already introduced patterning or numerical lessons. Many such web sites are available by doing a search for "kindergarten + mathematics + patterning." A few examples are:

www.primarygames.com/patterns/start.htm

www.bbc.co.uk/education/laac/music/fdl.html

www.literacycenter.net/lessonview_en.htm#

With consistent experiences and activities and through the use of concrete materials, students can develop a beginning understanding of algebraic concepts. Not only will students enjoy each of the described activities, they will also be introduced to new understandings.

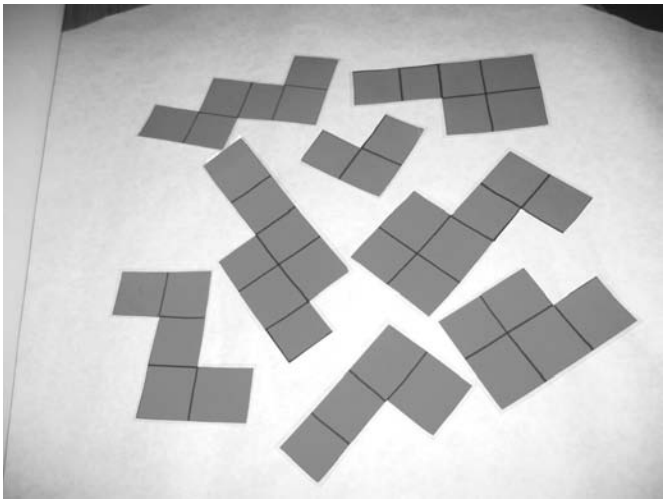
Number Chart Puzzles

by Scott Farrell, Conejo Valley USD

CONCEPTS: Number, Algebraic Thinking
SKILLS: Understanding place value, counting, applying number patterns
GRADES: 1–3
MATERIALS: Large hundreds chart, puzzle pieces, dry erase pens

BACKGROUND
This activity provides practice in reconstructing number charts using number patterns. Before playing the game children need to be familiar with a hundreds chart and have had several opportunities to record to 100 on a blank number chart. Also whole group activities where students are required to identify missing numbers by covering them with a puzzle piece are beneficial.

DIRECTIONS
Before the lesson the teacher makes several puzzle pieces from laminated construction paper. Each piece needs to be a different shaped puzzle piece that covers five to eight number spaces on the large hundreds chart. The pieces are reused during the game since they are erased and flipped and placed in different locations on the number chart.



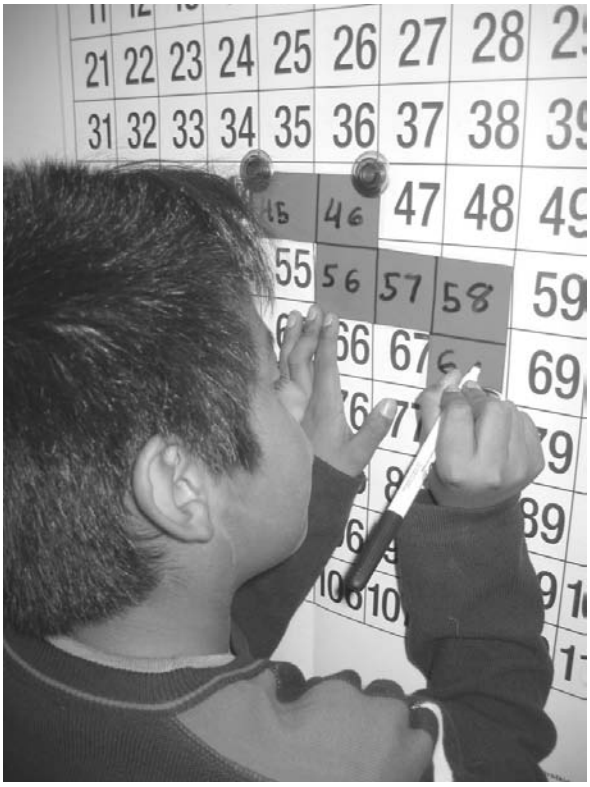
Playing the Game

1. The class is divided into two equal teams.

2. Each team will select one member to choose a puzzle piece to place anywhere on the large number chart. Fasten the puzzle piece using tape or magnets.

3. The opposing team will pick one member to write in the missing numbers using a dry erase pen.

4. The teams will then switch roles and continue so that all students have the opportunity to fill in a puzzle piece.



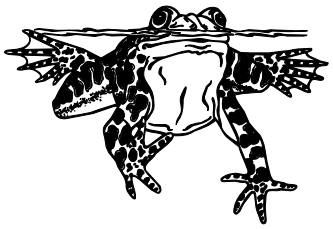
Variations

- Larger numbers such as 101 to 200 can be used on the number charts.

- Students can play with a partner using individual number charts and creating their own puzzle pieces from grid paper.

What If You Hopped Like a Frog?

by Patty Montgomery, Ditmar Elementary School, Oceanside USD



CONCEPTS: Number, Measurement
SKILLS: Multiplying and dividing, measuring weights and heights
GRADES: 4–6
MATERIALS: *If You Hopped Like a Frog* by David Schwartz, measuring tapes, bathroom scale, copies of the proportional reasoning problems (Student Activity Sheet, page 11)

BACKGROUND
Author David Schwartz uses proportional reasoning to determine what it would be like if we had the abilities or dimensions of familiar animals. For example: "If you hopped like a frog, you could jump from home plate to first base in one mighty leap." Artist James Warhola easily captures the attention and imagination of fourth and fifth grade students. After twelve of these fascinating proportions, Schwartz provides some factual data on which the proportions are based.

Many students at this age are still very literal and can be confused by the proportional reasoning aspect. When I read this book to my class, my students were all "a-buzz" about each possibility presented in the book. After the page, "If you were as strong as an ant. . . you could lift a car!" I heard a child comment, "An ant can't do that!"

PREPARATION
Copy one set of problems for each student. Attach measuring tapes to the walls in a few different locations to cut down on waiting time.

DIRECTIONS
Read the book to the class and show the pictures as you read the story. Pass out the problems. After reading a few of the problems, ask the students what information they would need to know about themselves to solve these problems. They will quickly realize that they need to know their height and weight.

Since height and weight can be sensitive issues for some children, allow them to work alone and keep their answers to themselves. Some students already know their height and weight so they may use those numbers.

Since problem five doesn't require any measuring, I encouraged students to begin with it while I assisted other students with finding their weight. Give all students the opportunity to find their weight in private. I had one table group at a time come up, but kept a distance between the person getting weighed and the rest of the students. Since most had never used this type of scale, I assisted the children individually and helped them read their weights privately.

Allow students to choose to use metric or U.S. customary units when finding their heights. My students realized that using the metric units would give them larger numbers. I was pleased that some students chose to challenge themselves by using the larger numbers.

After students know their height and weight, discuss the advantages of rounding their numbers and why rounding is close enough for this activity.

Tell students to solve the problems any way they can, showing all their work. My students had a great time figuring out what they would be able to do if they were built like these animals.

EXTENSIONS
- Using answers from problem number one, ask students to determine where they would land if they hopped out the classroom door.
- Using answers from problem number two, ask students to determine how many servings of their favorite food would be equivalent to the amount of food they could eat.
- Using answers from other problems, have students convert answers to other units of measurement.

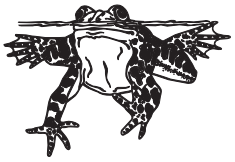
Reference
Schwartz, David. *If You Hopped Like a Frog*. New York: Scholastic, 1999.

Student Activity Sheet, page 11 . . .

If You Hopped Like a Frog

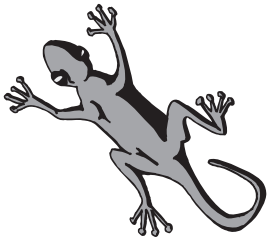
by Patty Montgomery

1. A 3-inch frog can hop 60 inches. That means the frog is jumping **20 times** its body's length. How tall are you? _____ If you could jump 20 times your body length, how far could you go? _____

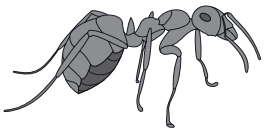


2. A shrew that weighs 1/5 of an ounce eats about 3/5 of an ounce of insects and worms each day. That means the shrew eats **3 times** its own weight daily! How much do you weigh? _____ How many pounds of food would you eat if you ate 3 times your weight? _____

3. A 1-foot chameleon may have a 6-inch tongue. Its tongue is **half as long** as its body. How tall (long) are you? _____ How long would your tongue be if you had a tongue like a chameleon's? _____

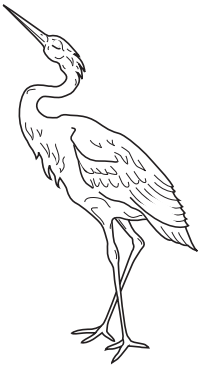


4. An ant weighing 1/250 of an ounce can easily lift a breadcrumb weighing 1/5 of an ounce. That means the ant is lifting **50 times** its own weight. How much do you weigh? _____ How much weight could you lift if you could lift like an ant? _____



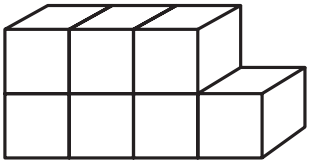
5. An eagle sees about **5 times** as well as you do. From the air, you can spot a rabbit about 300 meters away. With eagle eyes, you could spot it 5 times as far as that. How far away would you be able to see if you could see like an eagle? _____

6. A whooping crane's neck is about **1/3 of its height**. How tall are you? _____ How long would your neck be if it were 1/3 of your height? _____



Counting on Cubes

by Beth Schlesinger, San Diego

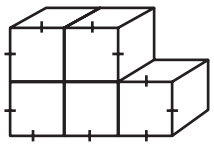


CONCEPT: Mathematical Reasoning, Algebra
SKILLS: Extending patterns, finding a general rule using variables
MATHEMATICS STANDARDS: Gr 4: AF 1.4, MR 2.0; Gr 5: AF 1.1, 1.2, MR 2.0; Gr 6: AF 1.2, 3.1, 3.2, MR 2.0; Gr 7: AF 1.1, MR 2.0
GRADES: 4–8
MATERIALS: Paper, pencils, small cubes such as snap cubes, Student Activity Sheet

DESCRIPTION
In this activity students build models out of cubes to represent sequences of perimeters, volume, and surface area. For each sequence on the Student Activity Sheet, have students work in pairs to build the next three cube models using small cubes such as snap cubes to continue the sequence. Then have them use the cube models to gather data and complete the table, not including the nth row. Encourage students to verbalize the rule for the nth term using the previous number, i.e., "Add two to the number that comes before." Then have them write a rule using the variable n. Discovering and formulating these rules is a challenge, but this task is the heart of the activity.

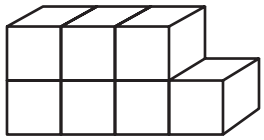
Some Helpful Suggestions

◆ **Counting Perimeter, Volume, and Surface Area.** This model is the second model in Sequence 2 on the Student Activity Sheet. It has a front face perimeter of ten units and a volume of five cubic units. To find the surface area, you have five square units on the front face, five on the back face, three on the top face, three on the bottom face, and two on each side face for a total surface area of 20 square units.



◆ **Helping Students Formulate and Write Variable Expressions.** You will probably need to guide students when they are trying to find expressions representing the nth term. They may come up with algebraic expressions that are valid but not in the simplest form. If so, this is a good opportunity to talk about equivalent expressions.

First, students need to understand what n represents. The table on the Student Activity Sheet indicates that n represents the model number or the term number in the sequence. The model shown here is the third model in Sequence 2. Sometimes by looking at the model students can figure out an expression. For example, to find the volume of this model, for which $n = 3$, they might see two rows of three cubes plus one cube and write the expression $2n + 1$. Next they should check to see whether this expression works for the other models in the sequence.



To find the total surface area for this piece, they would count seven front squares, seven back squares, two squares on each side, four squares on the top, and four squares on the bottom to get a total of 26 square units. Using variables they might get $2n + 1$ square units for the front face, $2n + 1$ for the back face, $n + 1$ for the tops, $n + 1$ for the bottom, and two for each side for a total of $6n + 8$ square units.

Another approach, which may not be appropriate for all classes is the following: For Sequence 1, the surface areas form the sequence 6, 14, 22, 30, . . . Start with six and add eight $(n - 1)$ times. This sequence suggests the general formula $6 + (n - 1) \times 8 = 6 + 8(n - 1) = 6 + 8n - 8 = 8n - 2$.

EXTENSION
Ask students to use the cubes to build their own sequence, make a table, and find expressions to represent the perimeter of the front face, the volume, and the total surface area.

SOLUTIONS
Set 1: $4n$, $2n - 1$, $8n - 2$

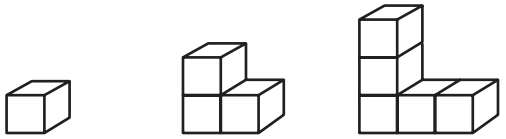
Set 2: $2n + 6$, $2n + 1$, $6n + 8$

Student Activity Sheet, page 13 . . .

Counting On Cubes

by Beth Schlesinger

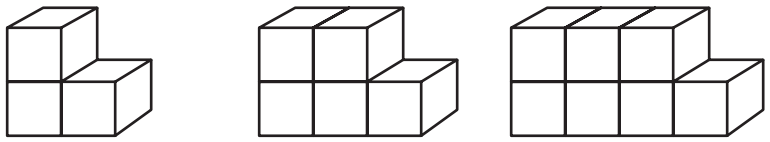
Sequence 1



1 2 3

Model Number	Perimeter of Front Face in Units	Volume in Cubic Units	Total Surface Area in Square Units
1			
2			
3			
4			
5			
6			
. . .	**. . .**	**. . .**	**. . .**
n			

Sequence 2

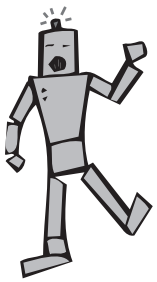


1 2 3

Model Number	Perimeter of Front Face in Units	Volume in Cubic Units	Total Surface Area in Square Units
1			
2			
3			
4			
5			
6			
. . .	**. . .**	**. . .**	**. . .**
n			

AlgeBot—A Trek Through the Hundred's Chart

by Brad Fulton and Bill Lombard



My 8th grade students enjoy discovering the algebraic patterns hidden within the hundreds chart. They are all familiar with this chart that they have seen since Kindergarten. One of our activities involves "AlgeBot." I display a transparency of the hundreds chart and a second transparency of AlgeBot on top of it as shown.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

I move the upper transparency around until a student yells, "Stop." Then the students race me to find the total of the numbers inside AlgeBot. The total for the placement shown is 580. I always win this contest and boast that it is because I am so talented at mathematics. The students insist there is a trick and demand a rematch. After a few times, some of the students see a pattern and discover the trick. (Turns out I'm not a rocket scientist after all!) Once a few discover my secret, we explore the problem using algebra.

The students notice that for any number on the chart, the number to the right is one more and the number to the left is one less. Also, the number beneath the given number is ten more and the number above it is ten less. This is always true no matter where AlgeBot runs. If we think of the number in its waist as n, then the following diagram shows the values of all ten numbers inside AlgeBot:

	$n - 20$	
$n - 11$	$n - 10$	$n - 9$
	n	
$n + 9$	$n + 10$	$n + 11$
$n + 19$		$n + 21$

If we add the terms inside him, we get $10n + 20$. It is a simple matter to look at the number in its waist (56), multiply it by ten (560), and add 20 (580). Many of my students say that they got the answer a different way. Often they simply look two spaces to the right of his waist and put a zero after the number. I express this algebraically on the board. The number two spaces to the right of his waist would be called $n + 2$. Putting a zero after it is the same as multiplying by ten. Thus their method is $10(n + 2)$. I show them that these are equivalent, being the distributed and factored forms of the same expression: $10n + 20 = 10(n + 2)$.

AlgeBot works on any hundreds chart, even one that begins with –49 and ends with 50. It also works on a calendar, but the formula for its sum is slightly different.

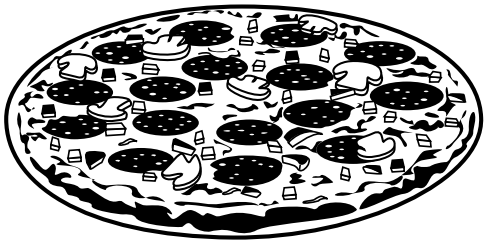
Challenge your students to find the formula when AlgeBot runs around on a calendar. This is just one of many algebraic explorations that can be made on the hundreds chart. If your students are like mine, they will want to explore all the "what ifs" they suggest. One time my students wanted to find out what happens to AlgeBot's formula when it is standing on its head. Now *I* was curious.

Extension

Challenge students to invent new AlgeBots.

The Pizza Problem

by Milton Rosa, San Juan Unified School District, and Daniel Orey, Universidade Federal de Ouro Preto, Minas Gerais, Brazil



CONCEPT: Proportional Reasoning
SKILL: Using tables, graphs, and regression equations
GRADES: 9–12
MATERIALS: EXCEL or graphing calculators

BACKGROUND

Proportional reasoning is the ability to understand and compare ratios. It is also defined as the comparison between two quantities. Proportional reasoning does not depend on specific mechanical skills nor does it depend on algorithmic procedures. Proportional reasoning involves concepts of quantitative and qualitative thinking. This concept allows teachers to develop, elaborate, and present meaningful lessons that show the application of proportional reasoning to students' daily lives

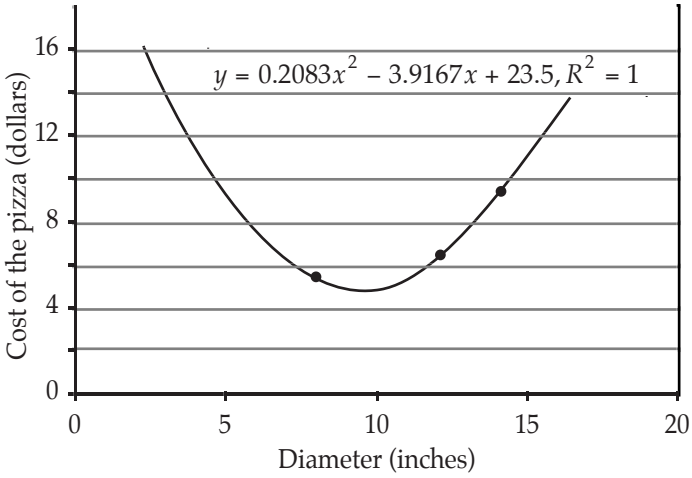
Generally, linear and quadratic equations are often used to model real-world situations that have certain features such as values that depend on surface area. For example, the area A of a circular region is a quadratic function of the radius r. The formula for a circular region is $A = \pi r^2$. In a particular case the cost of a plain pizza is a function of its area and therefore a quadratic function of its radius or diameter.

DIRECTIONS

Display the following table on a transparency on an overhead projector or on the board.

Diameter (inches)	2	4	6	8	10	12	14
Cost of Pizza				$5.50		$6.50	$9.50

Suppose that an 8-inch diameter, 12-inch diameter and 14-inch diameter pizza cost, $5.50, $6.50, and $9.50 respectively. Ask your students to use EXCEL or a graphing calculator to make a graph and find the quadratic equation that best fits the data in the table. The



students should then complete the table with the costs of the pizzas.

Discuss with the students the relationship between the diameter and the cost of the pizza. Pose the following questions:

- ✔ Which pizza has the lowest cost? Is this situation possible? Explain your answer completely.
- ✔ Which pizza has the highest cost? Are these situations possible? Explain your answer completely.

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The California Mathematics Council is committed to:

- promoting professional activities that will ensure continual improvement towards excellence in the teaching of mathematics;
- communicating with educators, parents, the public, and legislative bodies concerning issues related to teaching rigorous, challenging mathematics; and
- increasing the diversity of the membership of the California Mathematics Council and the diversity of leadership in mathematics education at the local, state, and national levels.