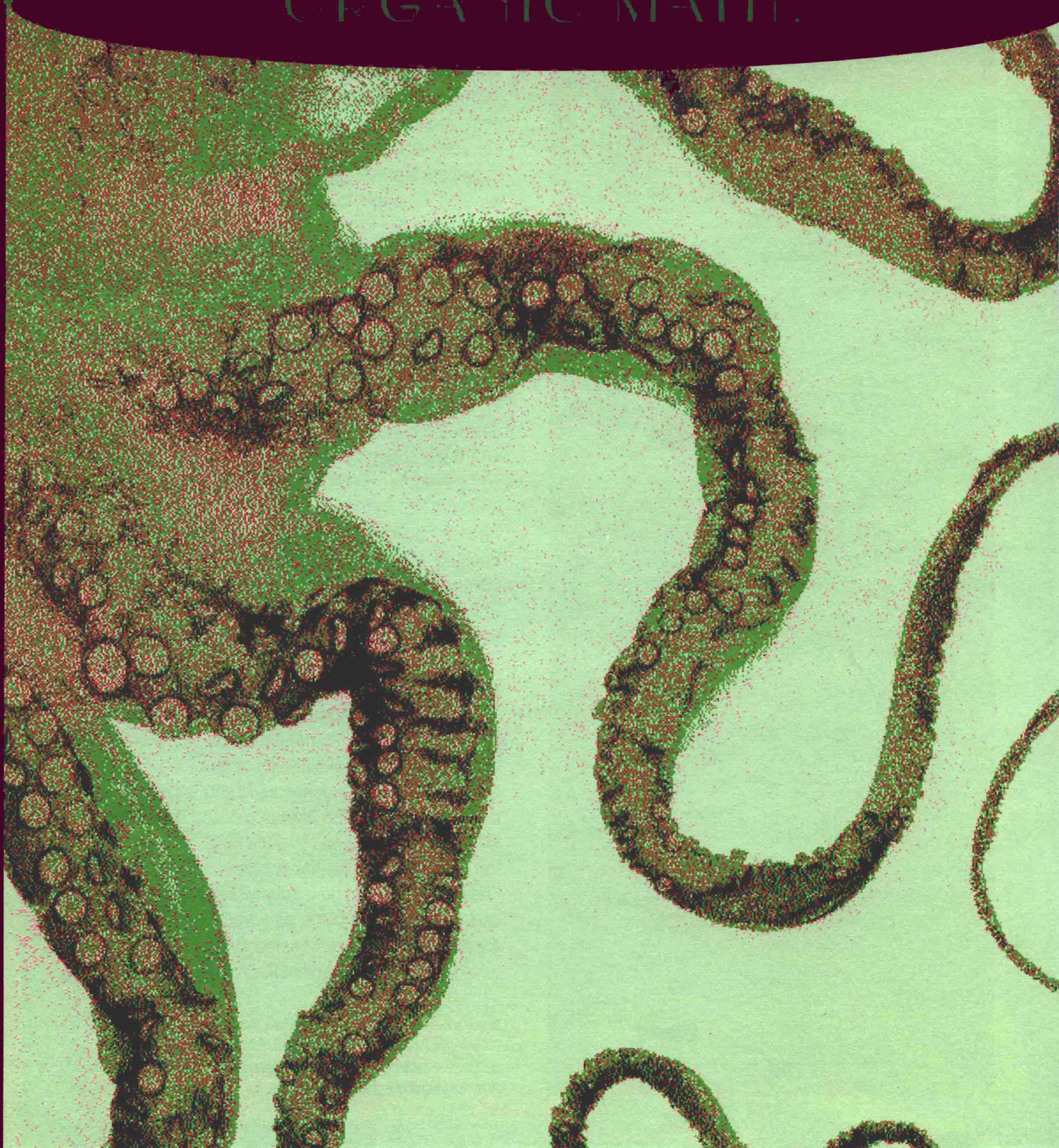
Math Reader

ORGANIC MATH!



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Math Reader

Contents

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SWT

Sir Isaac Newton

The story goes that when an apple fell from a tree and hit Sir Isaac Newton on the head, he discovered **gravity**. This is a force which pulls all objects towards one another. The heavier and closer they are, the stronger their attraction. Newton's great observation was that the force causing the apple to fall to the ground—gravity— is the same force holding the planets in orbit about the sun. What connection did Newton make between falling apples and revolving planets? He showed us how to predict their motion with a new mathematics called calculus. This form of calculation is used today in many fields, including engineering, architecture, and economics.

When Newton was in elementary school, his report cards described him as being "lazy." This does not mean that he was not a curious person: he asked many questions. By age 25, he had already made discoveries in math, optics (the study of light), physics, and astronomy. At age 27, Newton became a professor at Cambridge University in England. Here he discovered that white light is actually a mixture of many different colors of light. Prisms can split white light into its component colors, and this is what raindrops do to produce rainbows.

The most important thing to remember from Newton's story is that math can help us understand the connections between many natural phenomenon. For example, his work with gravity helped explain the tides of the sea and the motion of the moon, things which had always puzzled scientists. But Newton always realized that there was much left for others to learn. He once said: "To explain all nature is too difficult a task for any one man or even for any one age. `Tis much better to do a little with certainty, and leave the rest for others that come after you, than to explain all things." Can you think of some events in nature that you would like to explain scientifically?

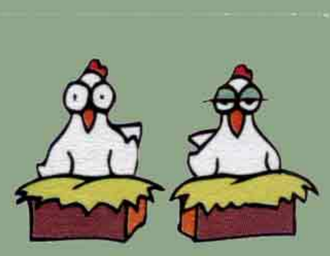
Source: www-history.mcs.st-andrews.ac.uk/history/Mathematicians/Newton

by Laura Chavkin, who is an undergraduate at Yale University. She enjoys American literature and writing.

PROBLEMS OF THE MONTH

1. A biologist knows that a lake contains about 400 turtles. One morning she travels around the lake and sees 24 turtles. Six of the turtles are spotted. Estimate how many spotted turtles are in the lake.

2. Skyscraper green beans grow 5 new branches every second and grow 25 meters upwards every 5 seconds. How many new branches does it grow while growing 100 meters upward?



3. You have 10 hens. Half lay an egg every day, and half lay an egg every other day. How many eggs will these hens lay in 10 days?

4. Suppose a fast growing vine doubles its length each night. If the vine is originally 165 feet long, how long will it take the vine to reach to a stream one mile away?

5. A family has three children. The first came home from school and found a candy bar. She ate one third of it. Her brother came home later and ate half of what was left. When the older sister came home, how much did she have left to eat? Who ate the most candy? Who ate the least?

6. Twenty-three players entered a tennis tournament. As soon as a player loses a match, he or she is out of the tournament. How many matches should the organizers schedule?

7. In an aquarium, there are exotic fish which have exactly two colors each. The only colors found on the fish are red, green, white, blue, and orange. Each pair of colors is found on exactly one fish. How many fish are in the tank?

8. Which is greater: 10! (10x9x8x7x6x5x4x3x2x1) or the number of seconds in 6 weeks?

9. INGENUITY. Draw 4 points on a circle. How many different triangles can be drawn using these points as vertices? Do the same for 5 points on a circle.

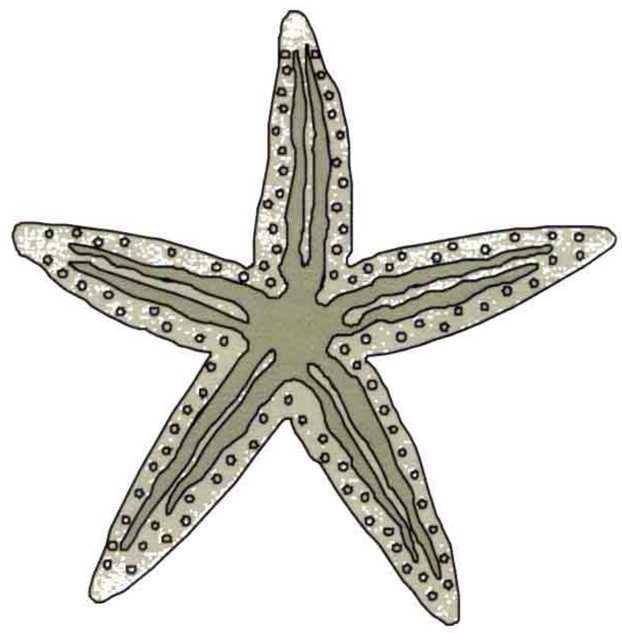
Send us your solutions! Every month, we will publish the best solutions on our website: www.mathexplorer.com. If we print your solutions, we will send you and your teacher free **Math Reader** pens!

SYMMETRY

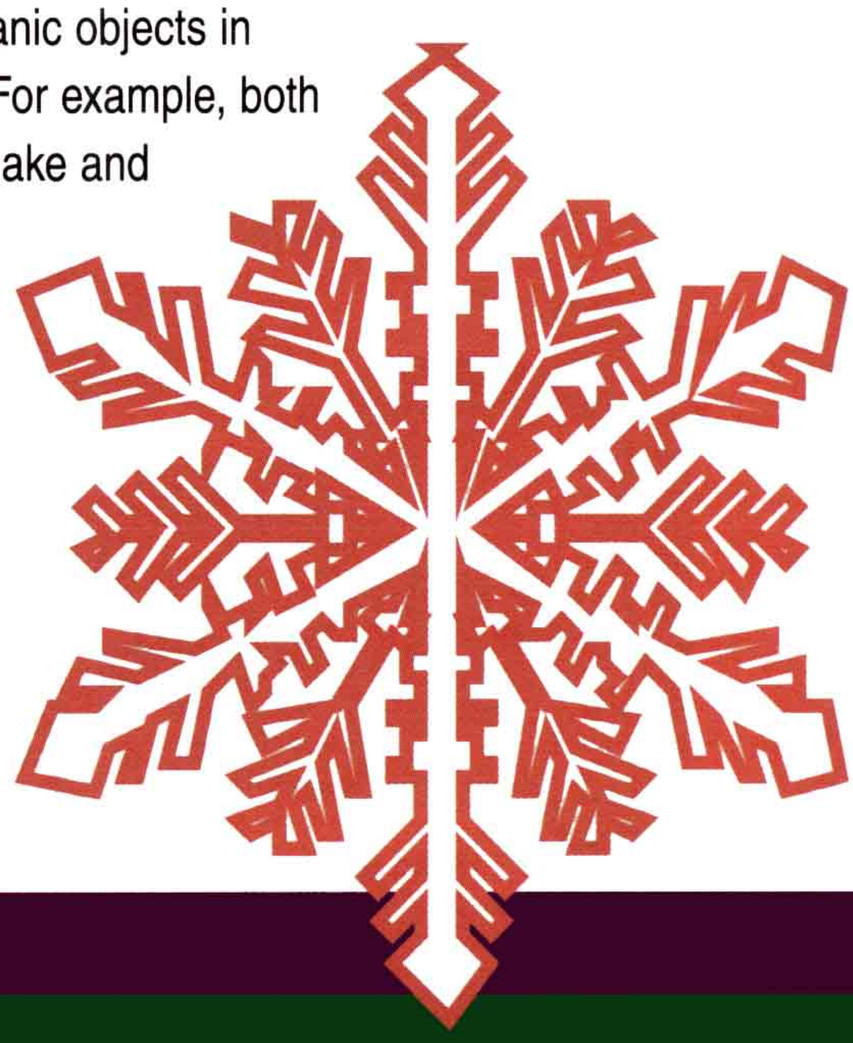
"Mathematics is the door and the key to the sciences."
Roger Bacon (1214 - 1294)

A butterfly, the cell of a beehive, a starfish, a dandelion seed head, a snowflake —these are beautiful testaments to nature's ability to engineer many very different structures. Yet these all share the mathematical characteristic of symmetry. When the word symmetry is used in a visual sense, it refers to the balance and harmony of an object's appearance. When used in a mathematical sense, symmetry refers to specific similarities among the parts of an object. In this issue of **Math Reader**, we will explore a few types of mathematical symmetry found in nature.

Imagine that a line is drawn down the middle of a butterfly's body. In almost all butterflies, the wings are mirror images of each other, so if a mirror could be inserted in this line, the image of one half of the butterfly in the mirror would look just like the other half of the butterfly. This is a kind of **reflectional** or **line symmetry**. Because there is only one line for which the two halves of a butterfly are mirror images, the line symmetry of a butterfly is called **bilateral** (two-sided) symmetry. Starfish and apple cross sections have pentagonal shapes. How many mirror-lines (lines of symmetry) can you find in these shapes?



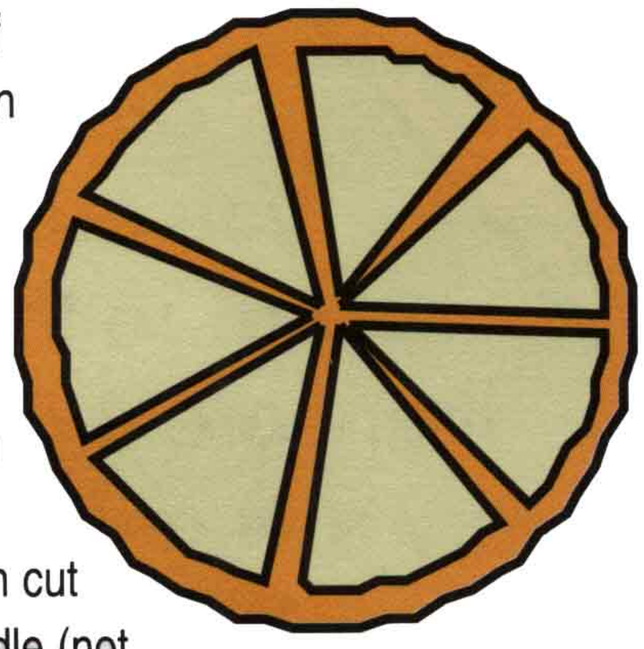
While the pentagonal shape is a very basic geometry in living organisms, inorganic (nonliving) objects rarely take this form. The hexagonal shape, however, appears frequently in inorganic objects in nature. For example, both a snowflake and the cell of a beehive have



IN NATURE

by Hiroko K. Warshauer

hexagonal shapes. How many lines of symmetry can you find in these shapes? Look at the cross section of an orange that has been cut down its middle (not end to end). Instead of imagining lines of symmetry, imagine rotating the orange slowly about a pin through its center. Even before the orange has made a full rotation, we find that there are points at which the orange looks as if it has returned to its original position, although the only part still in the same place is its center! This means that the orange has rotational symmetry. How many times does the orange seem to have returned to its original position before it actually returns to its point of origin? Do you think this is the same for all oranges? Check the next few oranges you eat!

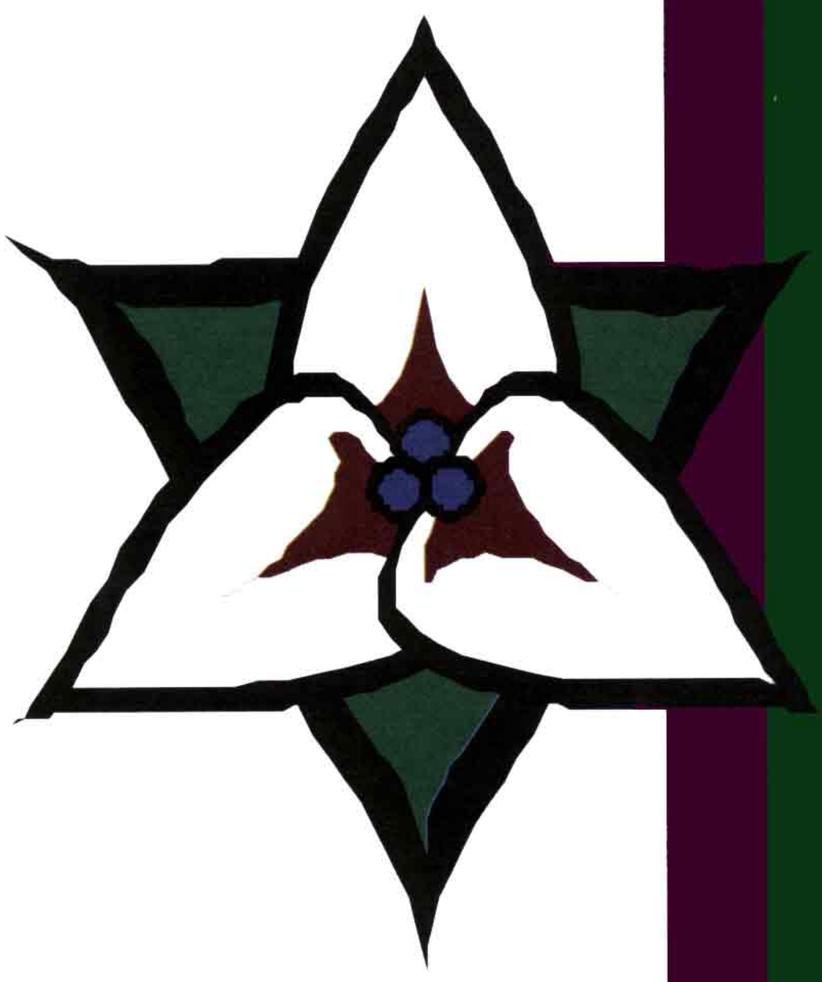


Many shapes have more than one type of symmetry. The orange and the three-petaled blossoms, for example, have not only line symmetry but also rotational symmetry. Which of our examples of line symmetry also have rotational symmetry? Do any have line symmetry but not rotational symmetry

There are flowers that have three petals, like the spiderwort blossom or the painted trillium blossom. If we look at the blossoms as equilateral triangles, we see that in a full 360 degree rotation there are three different angles at which the triangle covers itself. We say the triangle has tri-fold rotational symmetry, or rotational symmetry of order three.

Can you draw a shape which has rotational symmetry but not line symmetry? One example is a parallelogram with one pair of parallel sides longer than the other pair's. Can you think of an example of such a shape in nature?

The dandelion seed head is an example of a radial symmetry. It has rays that come out from a single point. Its shape is like a sphere with the single point as its center.



As you observe nature, see if you can spot some of the symmetries that we have discussed. Can you find other symmetries as well? Send us pictures of what you find!

Puzzle Page

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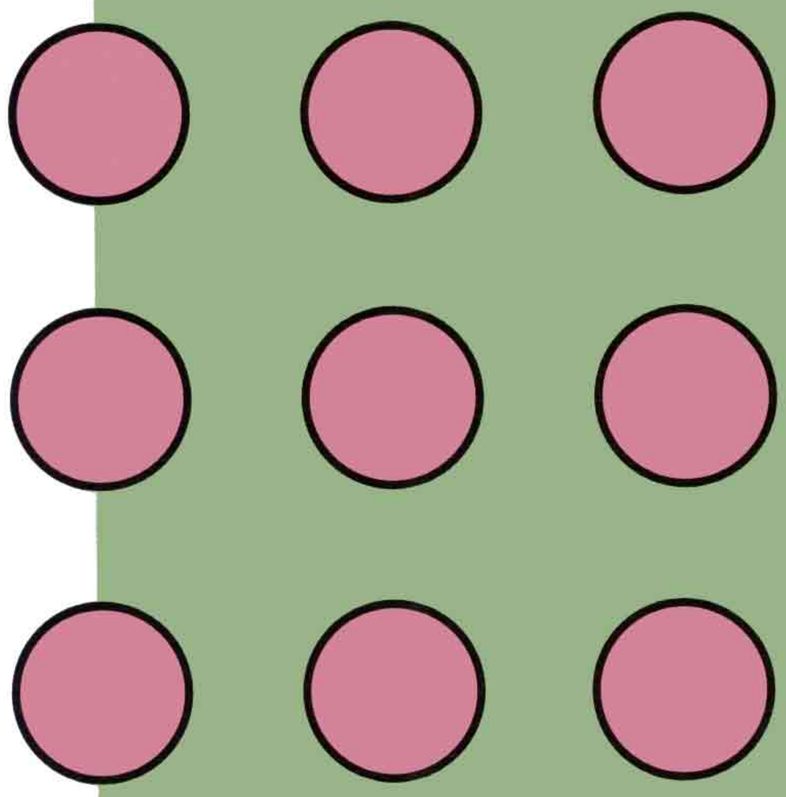

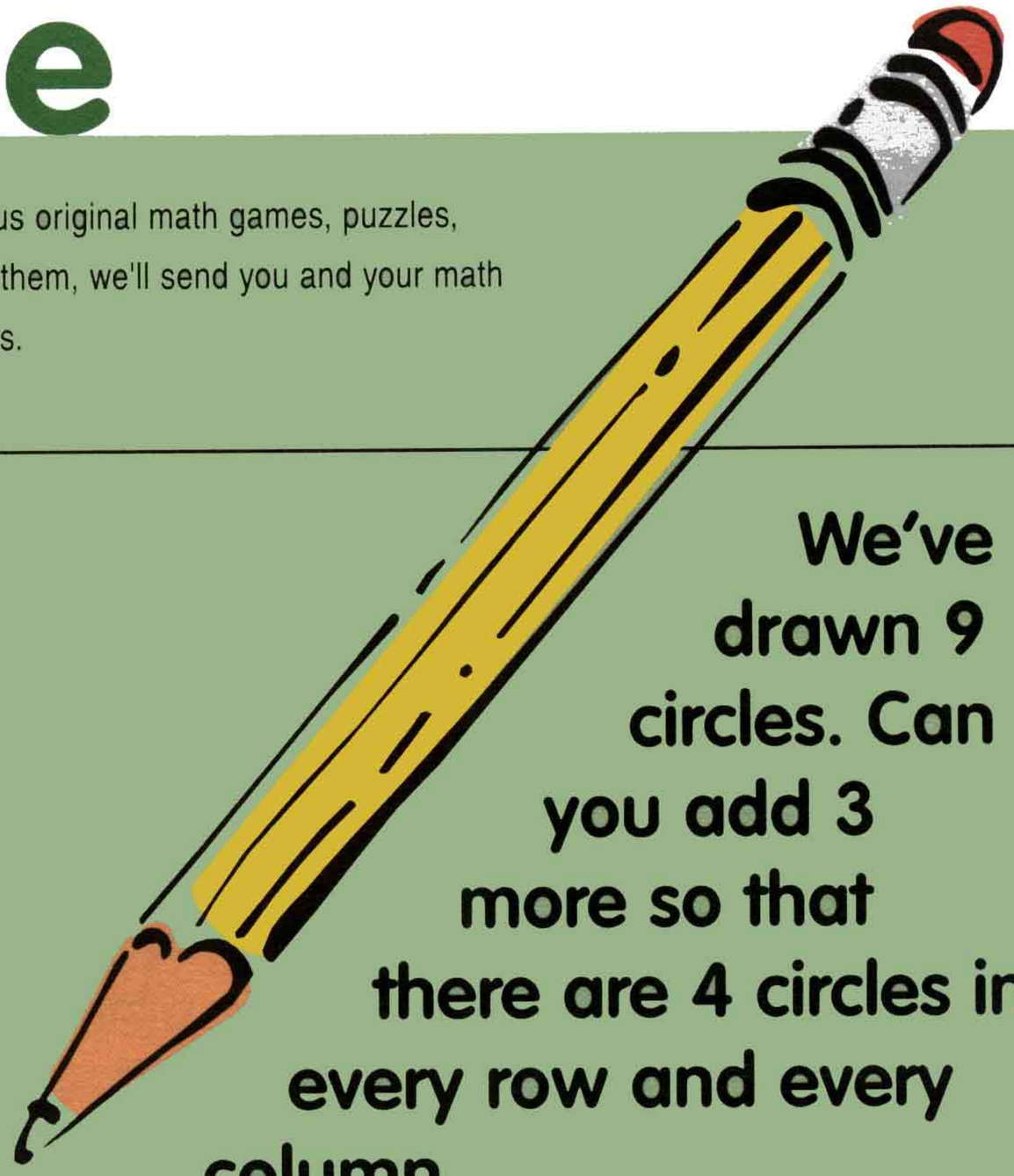

We've drawn 9 circles. Can you add 3 more so that there are 4 circles in every row and every column.

Word Search

Forwards or backwards, up, slanted, or down.

Where can the words in this puzzle be found?

LENGTH

HEIGHT

PERSPECTIVE

AREA

PERIMETER

SCALE

WIDTH

VERTEX

GRID

S	S	X	L	E	A	W	I	D	T	H	S	M	B
W	T	E	I	G	I	T	I	V	E	E	P	A	T
Z	H	T	O	S	R	I	E	N	Q	E	A	D	R
X	G	R	M	M	U	R	A	U	R	O	E	A	I
S	I	E	N	I	P	A	E	S	S	I	R	K	J
O	E	V	R	I	A	N	P	L	E	E	A	I	N
V	H	R	F	T	C	E	C	E	R	A	U	R	U
T	L	E	O	E	C	L	V	H	T	G	N	E	L
K	P	A	T	T	A	I	O	T	L	G	S	K	B
P	E	R	I	M	E	T	E	R	E	L	H	L	E
R	U	V	O	A	B	L	G	N	N	R	R	A	R
T	E	R	G	N	G	L	A	O	T	M	E	W	X
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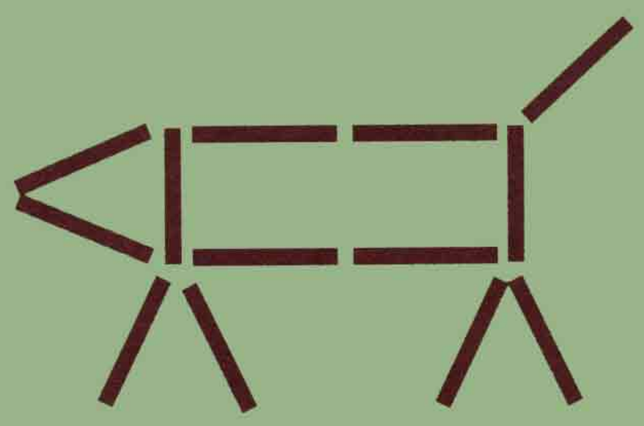


Move 2 of the 12 sticks so that the dog is looking back. The tail of the dog should still point upwards.

Bulletin Board

Math Reader joins the web!

Visit our website: www.mathexplorer.com to chat with other readers and share solutions to problems!

Thanks to our Sponsors

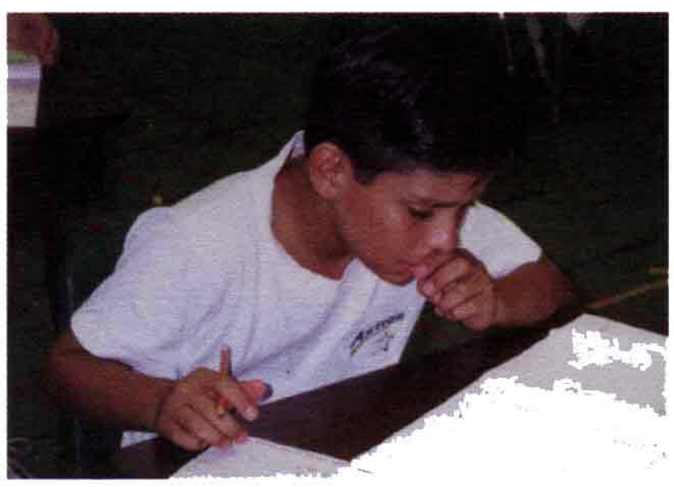
The Rockwell Fund, Inc. is helping to underwrite Math Explorer and Math Reader magazines. They also sponsor scholarships for students to attend the SWT Junior Summer Math Camp and SWT Honors Summer Math Camp! Thanks to Rockwell.

SWT Junior Summer Math Camp News

186 students and 8 teachers participated in the 1999 SWT Junior Summer Math Camp. This was sponsored by a grant from the Eisenhower program. Camps using the SWT model were held in Lockhart, Houston, Austin, Mission, Donna, Hidalgo, McAllen, Progreso and Port Lavaca.

Camp Snapshots!

Judy Carlin, camp instructor, assists Oscar Perez during the McAllen Jr. Summer Math Camp 1999.



José Zamora reflects on a problem at the McAllen Jr. Summer Math Camp, 1999.

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Welcome to **Math Reader**!

We at **Math Reader** are looking forward to sharing an exciting year with you. In this first issue we will explore mathematical ideas and connections to nature. Coming issues will examine the relationship between mathematics and other disciplines, such as architecture, astronomy, and sports. We have launched our new internet site www.mathexplorer.com. Visit us there for further discussion of articles and problems, including hints and solutions, as well as letters and solutions from fellow **Readers**.

Join us for a full year of math exploration!

Sincerely,

Hiroko K. Warshauer

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Math Reader

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