Math Reader

ORIGAMI MATH !

Vol. 3.4 Summer 2001

Math Reader

Contents

Executive Editor: Hiroko K. Warshauer
Senior Editors: Terry McCabe, Max Warshauer, Eugene Curtin
Special Writers: Deanna Badgett, Cody Patterson, Kevin Jones
Design: Jennifer LeGrévellec, Amy Warshauer
Final Editing and Proofreading: David Nelson, Michael Kellerman
Administration: Lydia Carbuccia
Circulation: Kristi Carter
Webmaster: Peng Wu

Math Reader
Southwest Texas State University
San Marcos, TX 78666
Phone: (512) 245-3439, Fax: (512) 245-1469
e-mail: mathexplorer@swt.edu.
Visit our website: www.mathexplorer.com
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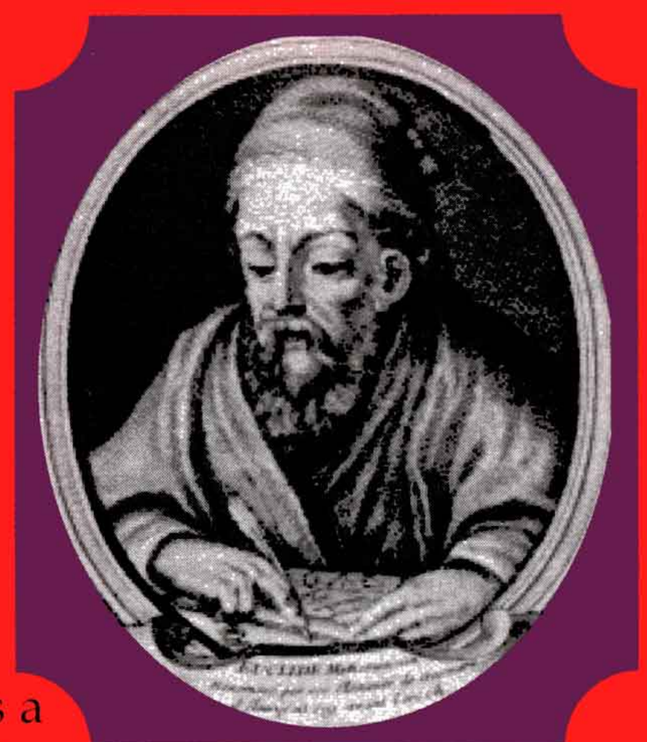
Euclid

By Hiroko K. Warshauer



Though the name Euclid is not common in the US today, back in ancient Greece it was not so uncommon. One such Euclid of Alexandria (a city in present day Egypt) was a prominent mathematician who is remembered in history for what might be the best-known textbook of geometry. Almost an encyclopedia, there are thirteen volumes that make up his work, called **The Elements**.

The enduring beauty of **The Elements** is the clear way in which the ideas are stated as well as the systematic methods that are used to develop these ideas. Euclid begins with definitions and a set of statements that are assumed to be true called **axioms**. Then, using a method called the **deductive process,** he shows that geometric discoveries follow logically from these assumptions.

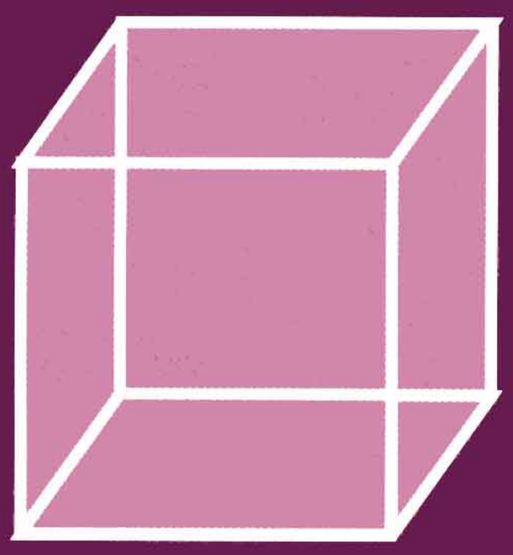
Several volumes discuss the properties of geometric shapes. Other volumes look at arithmetic and number theory, while others look at three-dimensional geometry and topics in algebra. Among the assumptions that Euclid makes is that one and only one line can be drawn through a point parallel to a given line. The inclusion of this postulate, called the **parallel postulate**, is what gives us **Euclidean geometry**. In the last one hundred years or so, mathematicians have also studied geometry where the parallel postulate is not assumed. This area of study is called **non-Euclidean geometry**.

Historians do not know a lot about the life of Euclid of Alexandria. He was born about 325 BC and died in Alexandria, about 265 BC, at 60 years of age. Alexandria was then a center of higher

(continued on p.7)

PROBLEMS OF THE MONTH

1. Kathie has 11 coins, worth $2.50 in total. All the coins are dimes and quarters. How many dimes and how many quarters does she have?



Color the edges

2. Find a way to color the edges of a cube so that every face has one red edge, one yellow edge, one blue edge, and one green edge.

3. Sarah is 4 years older than Jenni. Julie is half Jenni's age. Julie's father is 40, and is 4 times as old as Julie. How old is Sarah?

4. You are offered a choice between the following deals:

A: You can have $100 next Sunday.

B: You can have $1 on Monday, $2 on Tuesday, $4 on Wednesday and so on, getting twice as much money every new day up to and including Sunday.

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
1	2	3	4	5	6	7

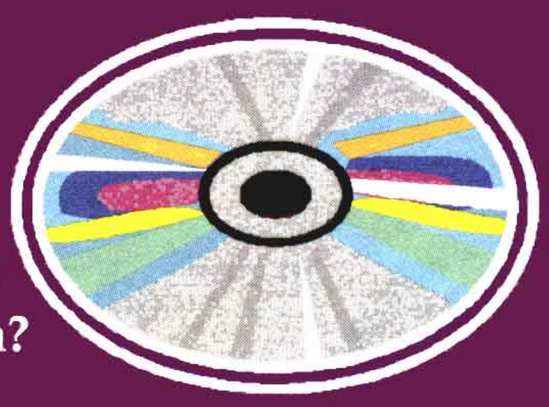
Which selection gives you more money?

5. How many ways are there to make change for a half-dollar using only quarters, nickels and dimes?

6. A drawer full of socks has white socks, red socks, blue socks, and green socks. How many socks must be in the drawer to guarantee that there are at least 4 socks of the same color?

7. In Ms. Brown's class there are 24 students. 14 have seen the first *Pokemon* movie, 12 have seen *The Emperor's New Groove*, and 8 have seen both. How many students in the class have seen neither of the movies?

8. A brand of tennis ball is sold in packages of 6 or 10 balls. How can you buy exactly 38 tennis balls? Is it possible to buy exactly 39 balls?



9. Kevin spent 1/2 of his money on a book and 1/2 of what remained on a CD. He then bought a burger and fries for 1/2 the price of the CD. He had $6 left. How much money did he start with?

10. A rectangle has area 54 square inches and perimeter 30 inches. What is the length and width of the rectangle?

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!

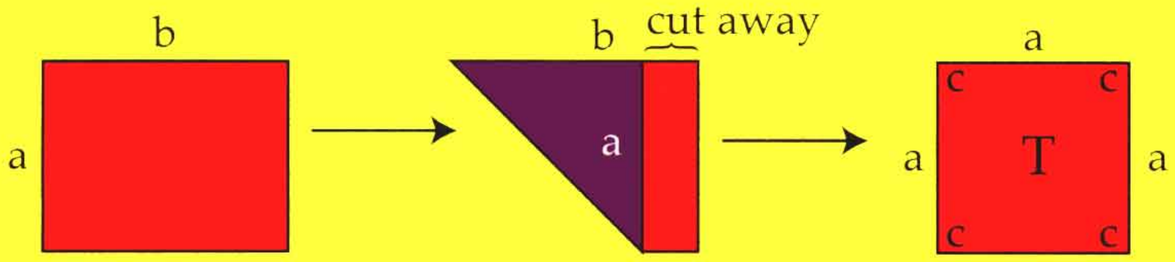
FOLDING Art UNFOLDS Mathematics

by Deanna Badgett

Origami is a fun way to use your imagination and do mathematics. The name "**origami**" means fold (ori) paper (gami) in Japanese. It is believed that origami began in Japan over a thousand years ago, shortly after paper was introduced there.

The paper could be in the shape of a rectangle, like this page, or a circle, like a flattened muffin cup. The shape used most often for origami, though, is the square.*

To make a square from a rectangle, match one short edge (a) to the long edge (b), fold, and cut off the excess small rectangle.

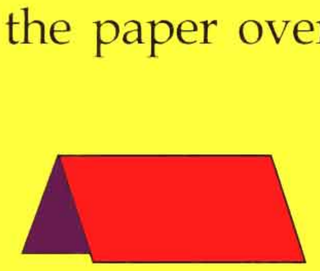


The square has four equal sides (a) and four equal angles (c). It also has a top surface (T) and a bottom surface (B), which you see when you turn the paper over.

When you fold the paper in half, the fold

on one side is a valley fold, ---------,

and if you turn the paper over, it is a mountain fold, -·-·-·-·-,



Our project today is to make a five-pointed star from a four-sided square.

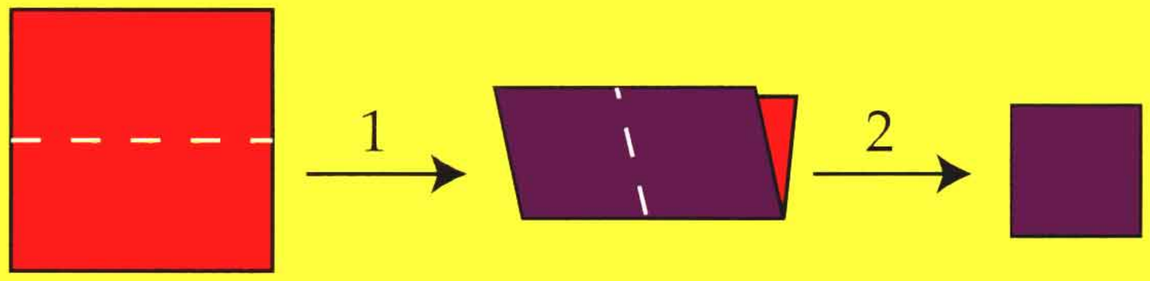
Hint: Work on a flat surface and match edges as carefully as possible. When folding, first make a light crease, check the edges, then crease sharply with a fingernail or a pen with a smooth, rounded casing .

1. Smooth out your square. Match opposite edges and fold.

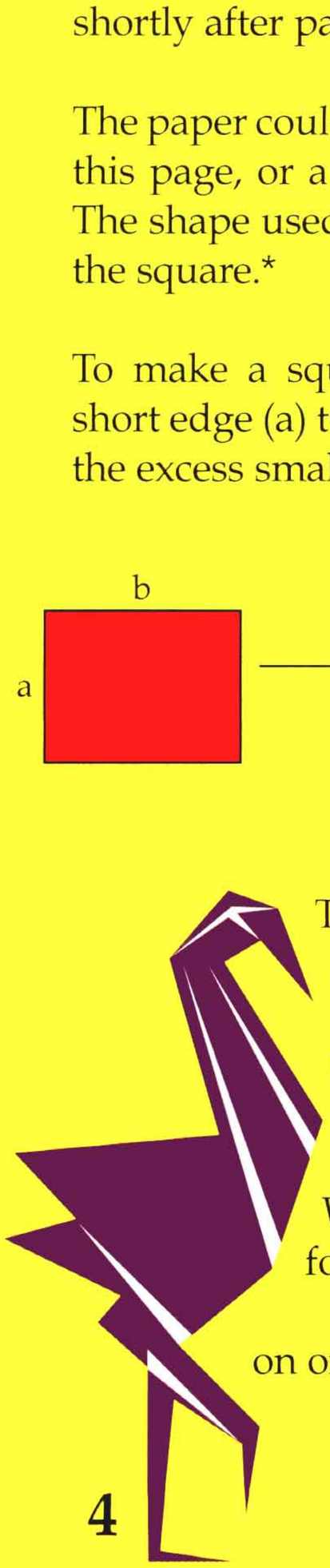
What is the resulting shape?

What is the ratio of the short side to the long side?

2. Match short edges and fold.

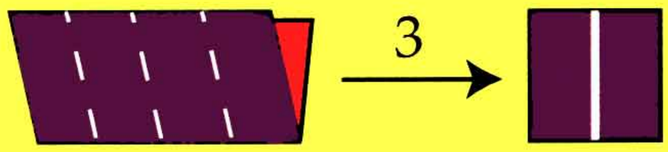


What is the resulting shape?



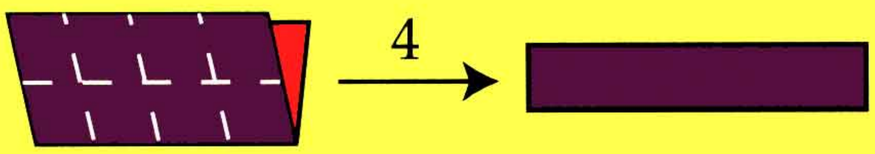
**Beautifully colored or patterned origami paper is available in arts and crafts stores.*

3. Unfold the last step and fold both short edges to the center line.



What is the resulting shape?

4. Unfold the previous step and fold both long edges to the center line.

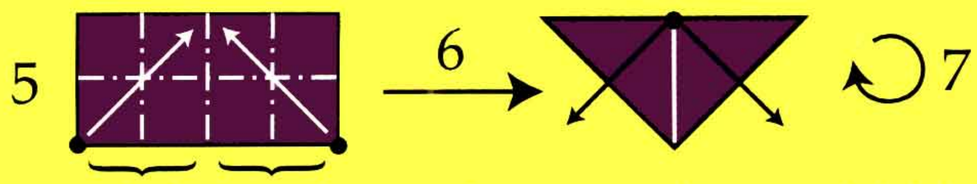


What is the ratio of the short side to the long side?

5. Unfold the previous step and turn the figure over.

How many small square units are in the rectangle?

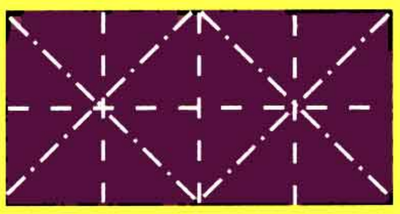
6. On the bottom long edge of the rectangle, match



each half of the edge to the center line and fold.

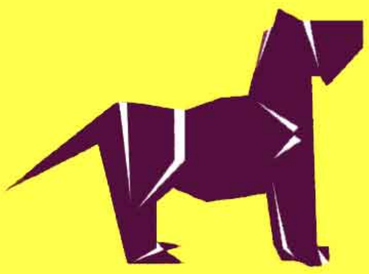
What is the resulting figure?

7. Unfold the previous step. Rotate your figure top to bottom (180 degrees). Repeat step 6 with new



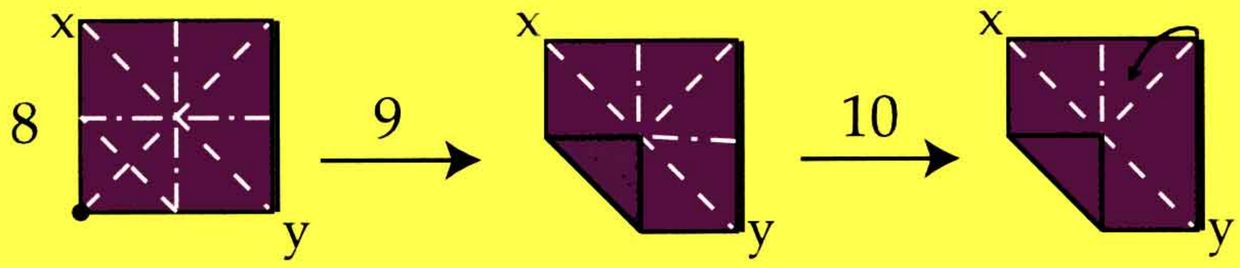
edge. Unfold.
Is each square unit now bisected into two triangles?

8. Turn the figure over. Refold the rectangle into a square by matching the short edges.



9. Fold one corner on the folded edge to the center of the square.

10. Hold the small triangle you just folded with one hand and fold down only the top layer along the diagonal (xy).



11. Sharpen your mountain folds.

Do you have a five-pointed star?

Can you count how many square units are showing in your star?

How many are hidden in the folds behind the star?
(Hint: unfold to the rectangle and count them.)

Could you have made this star by beginning with a rectangle?

What should be the ratio of the sides?

You can use this same beginning fold to make a jumping tree frog. There are many books on origami in the public library and in book stores. It is also fun just to get some paper, begin folding, and use your imagination.

Until next time, happy folding!

Deanna Badgett is a Suzuki violin teacher in San Marcos, Texas.
She also teaches origami at various workshops throughout Texas.

Puzzle Page

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Word Search

Forwards or backwards, up, slanted, or down.

Where can the words in this puzzle be found?

Euclid
Axiom
Elements
Origami
Ratio
Symmetry
Deductive
Geometric
Perfect
Fold

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

Of seven coins, which all look alike, five have the same weight, while two are slightly heavier. Using a balance of two pans, without weights, how many operations are necessary to tell which are the two heavy coins?

```
  A B C D
    A B C
      A B
+       A
---------
  4 3 2 1
```

In this addition, the same letters mean the same digits, and different letters mean different digits. What number is (ABCD) on top?

Bulletin Board

Math Camps Everywhere!

SWT Math Camps are opening all over: Austin, Port Lavaca, McAllen, Mission, Rio Grande City, Edinburg, Progreso, Donna, Hidalgo, Zapata, Mercedes, La Joya and even in California! For more information about attending or beginning a new program, call or contact Max Warshauer at 512-245-3439 or e-mail max@swt.edu

Check it Out!

For fun math prboblems, puzzles, and calculation tips check out http://forum.swarthmore.edu/k12/mathtips/

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Did you know?

Origami is in"creasing"!

Euclid (cont'd)

learning. Euclid lived at the same time as the philosopher Plato, scientist Archimedes, and the mathematician Eratosthenes. It was a golden time of great thinking and discovery.

Reference:
http://www-history.mcs.st-and.ac.uk/history/Mathematicians/Euclid.html

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MATH ODYSSEY

by **Hiroko Warshauer**

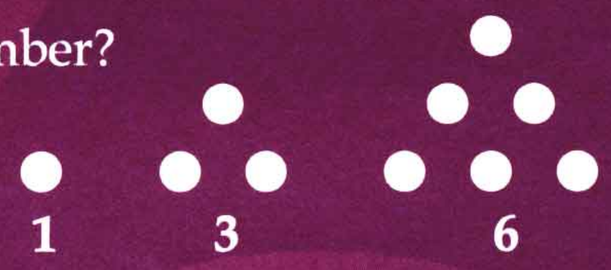
Six is Perfect!

Let's look at the divisors of 6. 2 and 3 are divisors of 6 since 6 = 2 x 3. 1 and 6 are also divisors of 6 since 6 = 1 x 6. We say that 6 is a **perfect** number since all the divisors less than the number add up to the number.

$$6 = 1 + 2 + 3$$

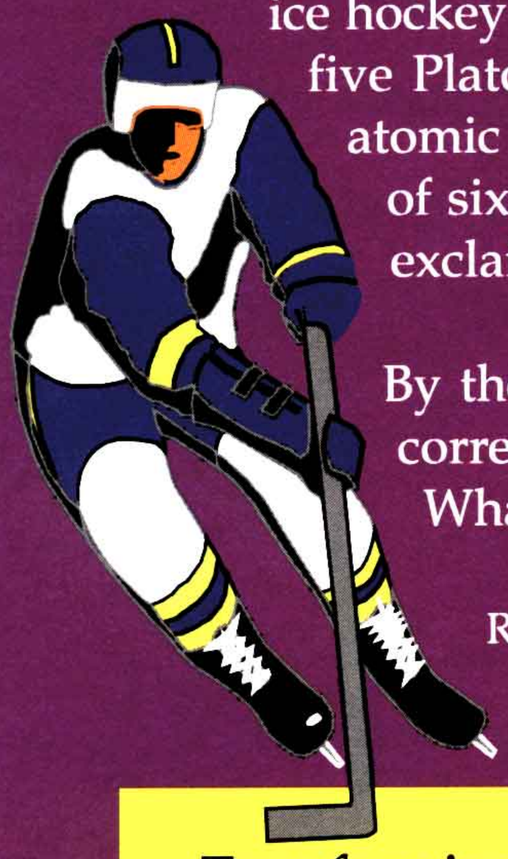
Can you find the next largest perfect number?

We also call 6 a **triangular number** since



Notice also that 6 = 1 x 2 x 3 = 3! The **!** is read as **factorial**.

The number six is both perfect and triangular and occurs naturally in many places. The cells of honeycombs are six sided polygons, or hexagons. In fact, insects like flies, bees, and butterflies have six legs. There are six feet in a fathom, a unit used by sailors to measure ocean depths. Volleyball and ice hockey teams play with six players on each team. There are six faces on a cube, one of the five Platonic Solids. Carbon, the element that is a basic building block of living things has atomic number 6. Many composers like Haydn and J. S. Bach wrote their works in groups of six. "Why, sometimes I've believed as many as six impossible things before breakfast" exclaimed the White Queen in Lewis Carroll's ***Alice Through the Looking Glass***.



By the way, did you find the next perfect number after 6? If you said 28, you would be correct. List all the divisors of 28. The sum should equal 28. Is 28 a triangular number? What is the next triangular number after 6?

Reference: http://www.nottingham.ac.uk/education/number/Num6.htm

Transforming a square piece of paper into a bird is like art magic. Origami, the art of paper folding, takes us through folds, angles and geometric shapes to arrive at a three dimensional result. In this issue of Math Reader, you can see that mathematics is an important part of this art form.

The summer is a great time to go to the library and check out books about origami and the various shapes you can learn to fold. Have a great summer, subscribe early and join us in the fall as we continue our math explorations.

Have a great summer!

Sincerely,

Hiroko K. Warshauer

Hiroko K. Warshauer, editor