

Table of Contents

Part I

Introduction

- Introduction 
- History of Origami
- Mathematics and Origami
- Carrers ● Opportunities ● Choices

Part II

Fundamentals

- Educational Benefits of Origami 
- Square Power 
- Folding Concepts
- Enter the Fold (Analyzing a Diagram)

Part III

Techniques

- Principles of Paper folding 
- Paper Resources (Budget Friendly) 
- Pattern Papers
- ⑩ Teaching Techniques

Part IV

Teaching Guidelines

- Lesson Plan Guide (Read First) 
- Procedure (Review before Teaching) 
- Cross-Reference Chart
- Origami isn't Just for Squares 

Part V

Paper Folding Projects

13	Symbols	41
14	Models made from Rectangles 	
15	Heart 	42
16	Sailor's Hat (Newspaper) 	44
	*Box - How to Fold a Box 	46
	Journal 	50
	*Jumping Frog – How to Fold a Frog 	52
19	How to Make a Square	56
20	Models Made from Squares 	
21	*Whales – How to Fold a Whale 	57
23	Quadrilaterals – Square Motion	57
	Wolf 	62
	Pig 	64
	Candy Cane 	66
27	Cup 	68
28	Picture Frame 	70
29		
31	How to make an Isosceles Triangle	72
	Models Made from Triangles 	
	*Dog  – How to Fold a Dog – Math	
35	Word Search – Try-Angles – Triangle Tower –	
36	How to make an Equilateral Triangle from a	
37	Rectangle	73
38	Cat 	80
	Sailboat 	82
	Sailboat  Tulip  Dog 	84

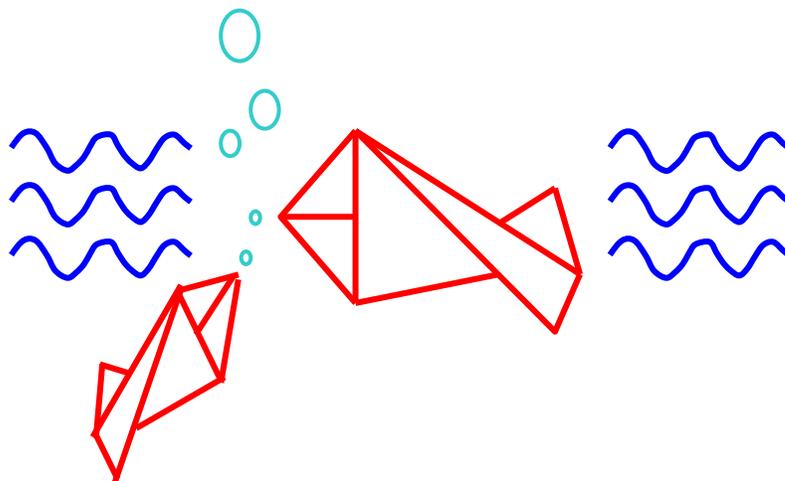
*Teacher Scripts

Part VI Cultural & Educational Enrichment

Math in Motion Poster	87
Book Marks 	88
Math Journals	89
Pearls of Wisdom	90
I'm a Japanese Fan 	91
Dot to Dot 	92
Maze Craze	93
Fun with Haiku 	94
Fish are Fascinating Animals	95
Can you Speak Japanese? 	96
Writing Japanese Numbers	97
Tangram Puzzles 	98
Fortune Cookies	99
A Thousand Cranes of Origami	100
How to make an Origami Mobile	101
Mathematics	102
Math Word Scramble 	103
Draw a Diagram 	104

Part VII Resources

What to Do with Origami 	107
Children's Origami Exhibit	108
Certificate of Accomplishment 	109
Glossary (English/Español)	110
Numbers/Números	113
Suggested Readings & Resources 	114
Notes 	117
About the Author 	118



Models Made from Squares



This fishy model is easy and good for beginners. Have a whale of a time!

FUN FACTS: The whistle of the blue whale is the loudest sound produced by any animal at 188 decibels.

Strand: Geometry • Spatial Sense • Patterns • Connections • Science

Materials: A 6-inch or larger square (15 cm), start white side up

Concepts & Vocabulary:

square
congruent
right

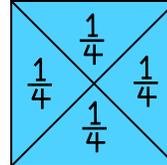
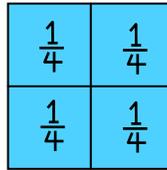
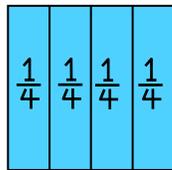
quadrilateral
vertical
left

triangle
center
point

scalene triangle
isosceles right triangle
line of symmetry

Additional Activities:

- How many ways can a square be divided into 4 equal parts?



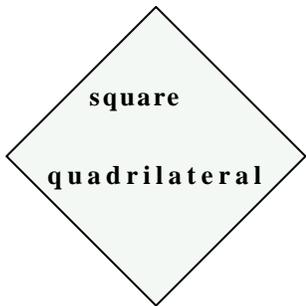
- Make a whale as a Father's Day card for a "Whale of a Dad." Use as name tags for the first day of school "a school of fish" or "Back to School" Night.
- Did you know whales sing? Nobody knows for sure, but perhaps they are singing the blues. Listen to Paul Winter's, "Lullaby from the Great Mother Whale for the Baby Seal Pups," *Concert for the Earth, Live at the United Nations*. Younger children will enjoy singing "Baby Beluga" with *Raffi in Concert*.
- Read *A Thousand Pails of Water* by R. Roy (K-2), *Whale of a Tale* by Barbara Pearl (PreK-2) includes a study guide available at: www.mathinmotion.com/studyguides, *Humphrey*, *The Wayward Whale* by E. Callenbach (K-6) and other stories about fish-like mammals (dolphins, manatees, porpoises, seals, and walrus). The *Whale's Stomach* lesson plan (Grades 4+) by the Institute for Humane Education raises awareness about ocean pollution and its effect on sea animals. See lesson plan at: www.info@mathinmotion.com/whalesstomach. To adopt a whale, contact:

Greenpeace
1436 U Street, N.W.
Washington, D.C. 20009
1-800-456-4029
www.greenpeace.org

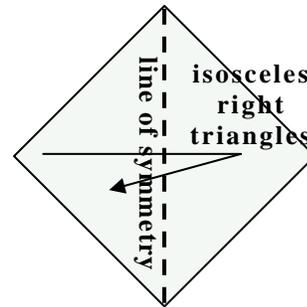
Save the Whales
1192 Waring Street
Seaside, CA 93955
1-800-942-5365
www.savethewhales.org



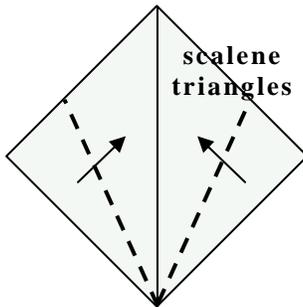
Whale



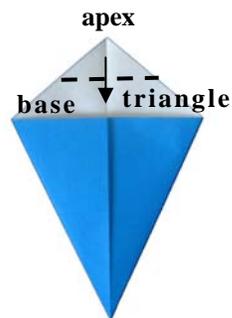
- 1 Place a 6-inch square sheet of paper on the table so it looks like a diamond.



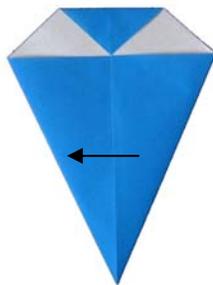
- 2 Fold the left point over to meet the right point (fold in half). Unfold.



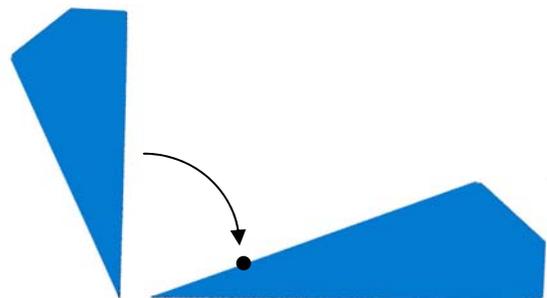
- 3 Fold the lower left and right sides to meet at the vertical line of symmetry.



- 4 It looks like a kite. Now fold the apex (top point) down to the base line to form a small triangle.



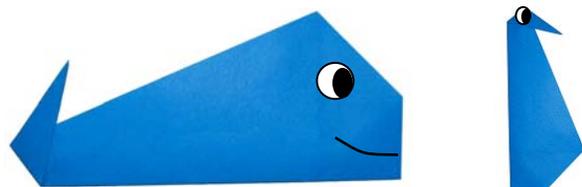
- 5 Fold the right side over to meet the left side (fold in half).



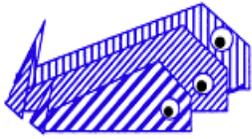
- 6 Put your finger on the bottom point as you turn the whale sideways.



- 7 Fold the end point up to make a tail.



- 8 Draw a happy face. Have a whale of a day!
For a surprise, rotate the whale—open to stand and create a penguin instead.



How to Fold a Whale

1. Place a square sheet of paper on the table so it looks like a diamond shape.

What shape is the paper?

Square.

How many sides does a square have?

4 sides.

What else can you say about the sides?

The sides are the same or **congruent**.

Another name for a four sided figure is **quadrilateral** (see *Quadrilaterals*, p. 60).

Can you think of other quadrilaterals?

Rectangle, parallelogram, rhombus, trapezoid.

Name other quadrilaterals in the room.

Book, chalkboard, desk, table, window.

2. Fold the right point over to the left point. Unfold.

*What is the **vertical** line?*

Line of Symmetry.

What is a line of symmetry?

A line of folding so that the two halves of a figure match.

What shape did it create?

Triangles.

What kind of triangles?

Isosceles right triangles.

What is an isosceles right triangle?

It has two sides that are congruent and a square corner.

3. Fold the lower left and right sides to the vertical line of symmetry. Unfold the paper and discover more triangles.

What kind of triangles?

Scalene triangles.

What are scalene triangles?

They have no congruent sides.

How many triangles are there?

Six. Refold the model.

What does it look like?

It looks like a kite or an ice cream cone.

4. Fold the apex (top point) down to the base (widest part of the kite) to form a small triangle ▲. Unfold.

How many triangles are there?

11. See triangles ABD, ABC, ADC, AEG, AEF, AGF, AEH, AGH, EFH, GFH, EHG.

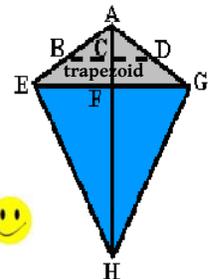
What other shapes do you see on the kite?

Trapezoid. Quadrilateral.

5. Refold the model. Fold the **right** side over to meet the **left** side.

6. Put your finger on the bottom point as you turn the whale sideways.

7. Fold the **point** up to make a tail. Draw a happy face. Have a whale of a day!



Challenge/Cooperative Activity

Quadrilateral

Quad-ri-lat-er-al is **Latin** for a figure that has four sides.

“Quad,” means **four** and “lateral,” means **side**. Find other quadrilaterals.

- 1) Look for objects in the room that are similar in shape.
- 2) Trace the geometric shapes below and draw another one.
- 3) See *Tangram Puzzles*, p. 98 and make a quadrilateral.

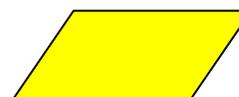
- 1. Square** - a figure that has four right angles and four sides of equal length. Every square is a rectangle.



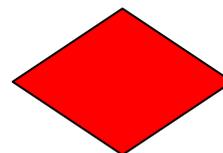
- 2. Rectangle** - a quadrilateral that has four right angles. Every rectangle is a parallelogram.



- 3. Parallelogram** - a quadrilateral that has two pairs of parallel sides and two pairs of congruent sides.



- 4. Rhombus** - a parallelogram that has four congruent sides. Every rhombus is a parallelogram.



- 5. Trapezoid** - a quadrilateral that has exactly one pair of parallel sides.

