Dinah Zike's Teaching with FOLDABLES™ Mathematics

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Table of Contents

Dear Teacher,

In this book, you will find instructions for making Foldables as well as ideas on how to use them. They are an excellent communication tool for students and teachers.

National Math Standards and Communication Skills

The Principles and Standards for School Mathematics, published by the National Council of Teachers of Mathematics (NCTM) in 2000, stress the importance of communication skills in a strong mathematics program. Not all students will become mathematicians, engineers, or statisticians, but all students need to be able to think, analyze, and problem solve using skills acquired through the study of mathematics.

Throughout their lives, students will be called upon to be literate in mathematics—personally and professionally. They will need to have a basic understanding of numbers, operations, and quantitative reasoning; patterns, relationships, and algebraic thinking; geometry; measurement; and probability and statistics to solve real-life problems involving finances, chance, design, science, fine arts, and more.

Furthermore, students must be able to share the results of their use of mathematics using various forms of oral and written communication. Foldables are one of many techniques that can be used to integrate reading, writing, thinking, organizing data, researching, and other communication skills into an interdisciplinary mathematics curriculum.

Who, What, When, Why

You probably have seen at least one of the Foldables featured in this book used in supplemental programs or staff-deveopment workshops. Today, my Foldables are used internationally. I present workshops and keynotes to over fifty thousand teachers and parents a year, sharing the Foldables that I began inventing, designing, and adapting over thirty years ago. Around the world, students of all ages are using them for daily work, note-taking activities, student-directed projects, forms of alternative assessment, math journals, graphs, charts, tables, and more.

Foldables become a visual and kinesthetic tool to help students communicate what they learn, observe, and experience in math. I hope you enjoy making Foldables a part of your math classroom!

Why use Foldables in mathematics?

When teachers ask me why they should take time to use the Foldables featured in this book, I explain that they

. . . quickly organize, display, and arrange information, making it easier for students to grasp math concepts and master skills.

. . . result in student-made study guides that are compiled as students listen for main ideas, read for main ideas, and work their way through new concepts and procedures.

. . . provide a multitude of creative formats in which students can present projects, research, and computations instead of typical poster board or math fair formats.

. . . replace teacher-generated writing or photocopied sheets with student-generated print.

. . . incorporate the use of such skills as comparing and contrasting, recognizing cause and effect, and finding similarities and differences into daily work and long-term projects. For example, these Foldables can be used to compare and contrast student explanations and procedures for solving problems to the explanations presented by other students and teachers.

. . . continue to "immerse" students in previously learned vocabulary and concepts, providing them with a strong foundation that they can build upon with new observations, experiences, and knowledge.

. . . can be used by students or teachers to easily communicate data through graphs, tables, charts, models, and diagrams, including Venn diagrams.

. . . allow students to make their own math journals for recording main ideas, problem-solving strategies, examples, questions that arise during classwork, and personal experiences that occur during learning.

. . . can be used as alternative assessment tools by teachers to evaluate student progress or by students to evaluate their own progress.

. . . integrate language arts, the sciences, and social sciences into the study of mathematics.

. . . provide a sense of student ownership in the mathematics curriculum.

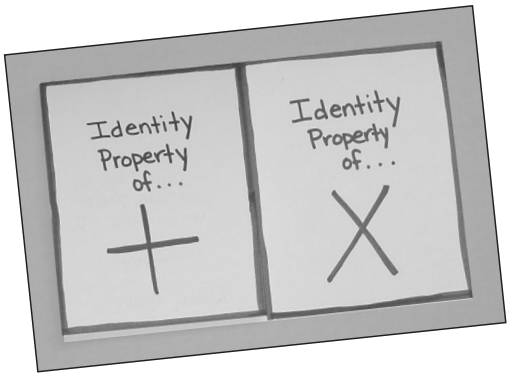
Foldable Basics

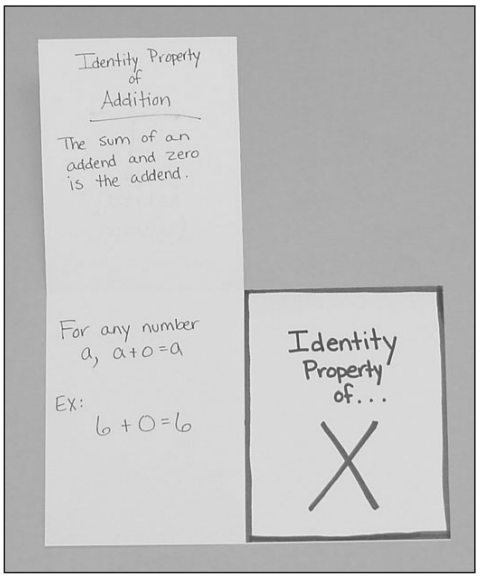
What to Write and Where

Teach students to write general information—titles, vocabulary words, concepts, questions, main ideas, and properties or theorems—on the front tabs of their Foldables. General information is viewed every time a student looks at a Foldable. Foldables help students focus on and remember key points without being distracted by other print.

Ask students to write specific information—supporting ideas, student thoughts, answers to questions, research information, computation steps, class notes, observations, and definitions—under the tabs.

As you teach, demonstrate different ways in which Foldables can be used. Soon you will find that students make their own Foldables and use them independently for study guides and projects.

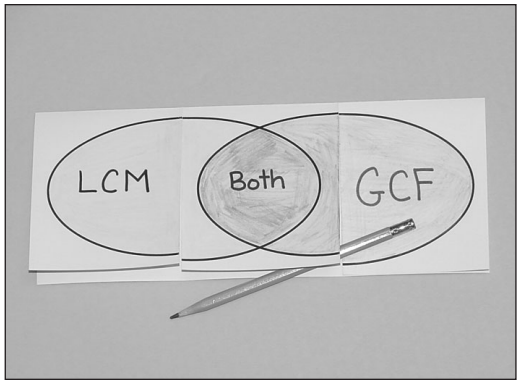




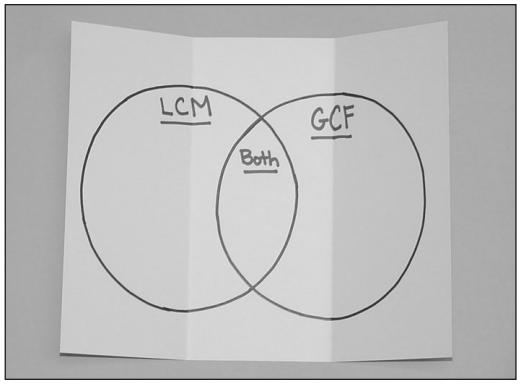
With or Without Tabs

Foldables with flaps or tabs create study guides that students can use to self check what they know about the general information on the front of the tabs. Use Foldables without tabs for assessment purposes or projects where information is presented for others to view quickly.

Venn Diagram used as a study guide



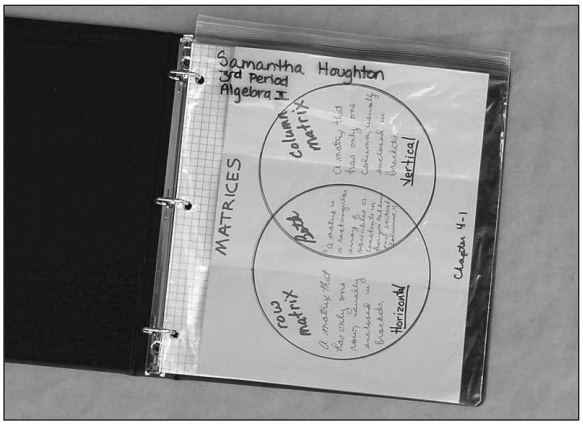
Venn Diagram used for assessment



What to Do with Scissors and Glue

I don't expect secondary students to bring glue and scissors to math class. Instead, I set up a small table in the classroom and provide several containers of glue, numerous pairs of scissors (sometimes tied to the table), containers of markers and colored pencils, a stapler, clear tape, and anything else I think students might need to make their Foldables. Don't be surprised if students donate unusual markers, decorative-edged scissors, gel pens, stencils, and other art items to your publishing table.

The more they make and use graphic organizers, the faster students become at producing them.



Storing Graphic Organizers in Student Portfolios

Turn one-gallon freezer bags into student portfolios which can be collected and stored in the classroom. Students can also carry their portfolios in their notebooks if they place strips of two-inch clear tape along one side and punch three holes through the taped edge.

Have each student write his or her name along the top of the plastic portfolio with a permanent marker and cover the writing with two-inch clear tape to keep it from wearing off.

Cut the bottom corners off the bag so it won't hold air and will stack and store easily.

> **HINT**: *I found it more convenient to keep student portfolios in my classroom so student work was always available when needed and not "left at home" or "in the car." Giant laundry-soap boxes make good storage containers for portfolios.*

Let Students Use This Book As an Idea Reference

Make this book available to students to use as an idea reference for projects, discussions, extra credit work, cooperative learning group presentations, and more.

Selecting the Appropriate Foldable

Dividing Math Concepts into Parts

Foldables divide information and make it visual. In order to select the appropriate Foldable, decide how many parts you want to divide the information into and then determine which Foldable best illustrates or fits those parts. Foldables that are three-dimensional also make the student interact with the information kinesthetically.

For example, if you are studying the Properties of Equality you could choose a Foldable that has five tabs (or sections). On the front tabs write the properties. Under the tabs, explain the properties in words on one side and in symbols on the other side.

Math Concepts Already Divided into Parts

Algebra		*Geometry*		*Statistics and Probability*	
Parts	**Concept**	**Parts**	**Concept**	**Parts**	**Concept**
5	Properties of Equality	2	collinear and noncollinear	3	mean, median, mode
3	parentheses, brackets, and braces	2	complementary and supplementary angles	1	Fundamental Counting Principle
2	equations and inequalities	2	parallel and perpendicular	4	Who, What, When, Where: Blaise Pascal
2	numeric and algebraic expressions	3	translation, rotation, reflection	2	permutations and combinations
2	domain and range	6	types of triangles	2	upper quartile and lower quartile
7	properties of addition and multiplication	4	SSS, SAS, ASA, AAS	2	dependent and independent events
2	LCM and LCD	2	two types of special right triangles	2	probability and odds
3	monomials, binomials, and trinomials	6	types of quadrilaterals	2	odds in favor and odds against
2	powers and exponents	2	x-axis and y-axis	2	mutually inclusive and exclusive events

Math Concepts That Can Be Divided into Parts

Algebra	*Geometry*	*Statistics and Probability*
write algebraic expressions	draw angles with a protractor	determine ranges of sets
evaluate expressions	classify polygons	interpret scatter plots
sequence steps	illustrate quadrilaterals	display data collected in plots
list algebraic rules	list examples of prisms	draw models of combinations
solve equations	name ordered pairs	
find values for variables	graph points	

Dividing Skills and Foldables into Parts

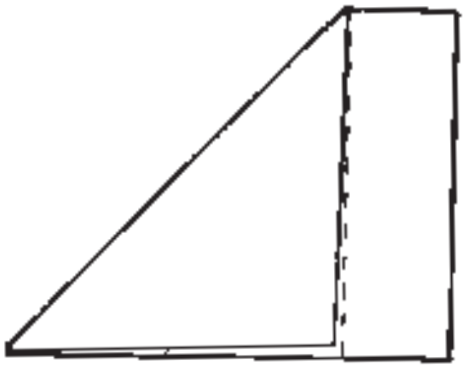
Reading, writing, and thinking skills can easily be used with Foldables. The following lists show examples of skills and activities and a selection of Foldables divided into parts.

Skills and Activities Divided into Parts	
1 Part	***2 Parts***
Find the Main Idea	Compare and Contrast
Predict an Outcome	Cause and Effect
Narrative Writing	Similarities and Differences
Descriptive Writing	Opposite Operations
Expository Writing	
Persuasive Writing	
3 Parts	***4 Parts***
Venn Diagrams	Who, What, When, Where
Know?-Like to Know?-Learned?	What, Where, When, Why/How
Beginning, Middle, End	
Any Number of Parts	
Questioning	Making and Using Tables
Flow Charts	Making and Using Graphs
Vocabulary Words	Making and Using Charts
Timelines	Sequencing Data or Events
Concept Webs or Maps	

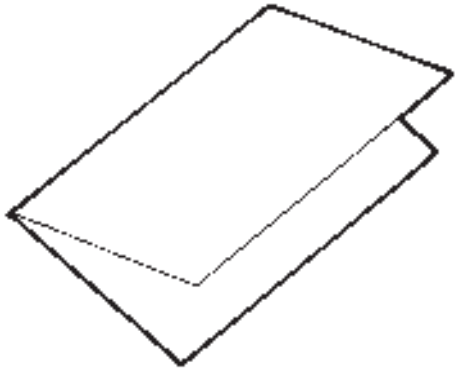
Foldables Divided into Parts	
1 Part	***2 Parts***
Half Book	Two-Tab Book
Folded Book	Pocket Book
Matchbook	Shutter Fold
Bound Book	Matchbook Cut in Half
	Concept-Map Book with Two Tabs
3 Parts	***4 Parts***
Trifold Book	Four-Tab Book
Three-Tab Book	Standing Cube
Pyramid Book	Top-Tab Book
Layered-Look Book	Four-Door Book
Concept Map with Three Tabs	
Any Number of Parts	
Accordion Book	Circle Graph
Layered-Look Book	Concept-Map Book
Sentence-Strip Holder	Vocabulary Book
Folded Table, Chart, or Graph	Bound Book
Pyramid Mobile	Pocket Books
Top-Tab Book (three or more sheets of paper)	

Basic Foldable Shapes

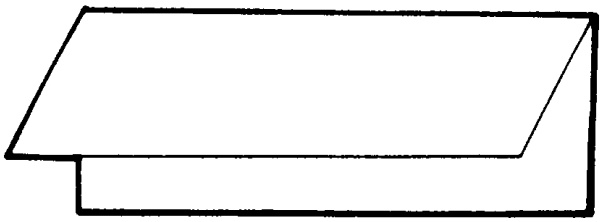
The following figures illustrate the basic folds that are referred to throughout the following section of this book.



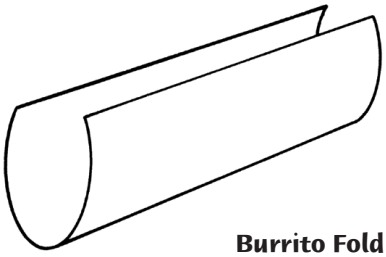
Taco Fold



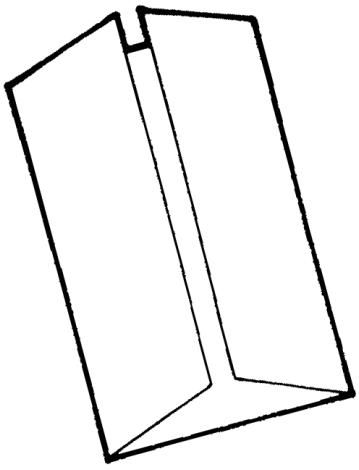
Hamburger Fold



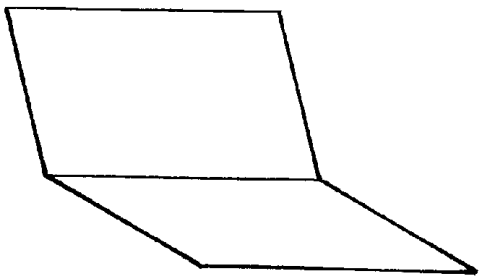
Hot Dog Fold



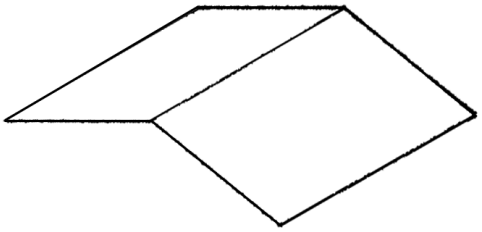
Burrito Fold



Shutter Fold

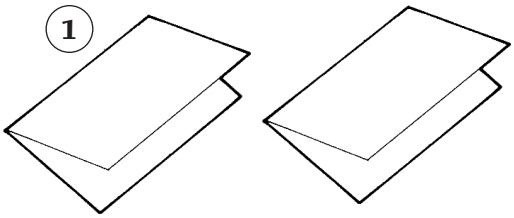


Valley Fold

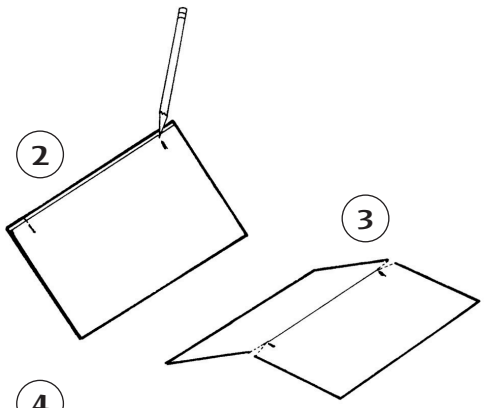


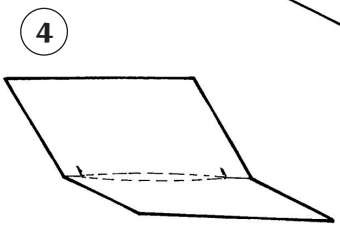
Mountain Fold

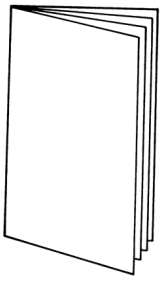
Bound Book

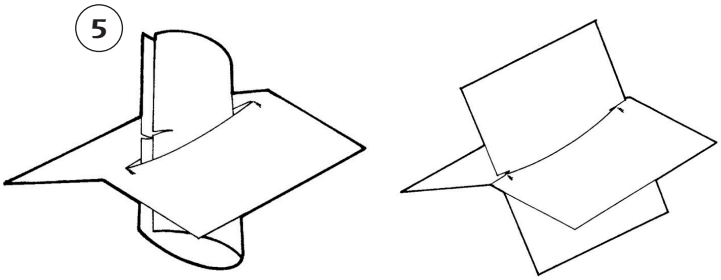


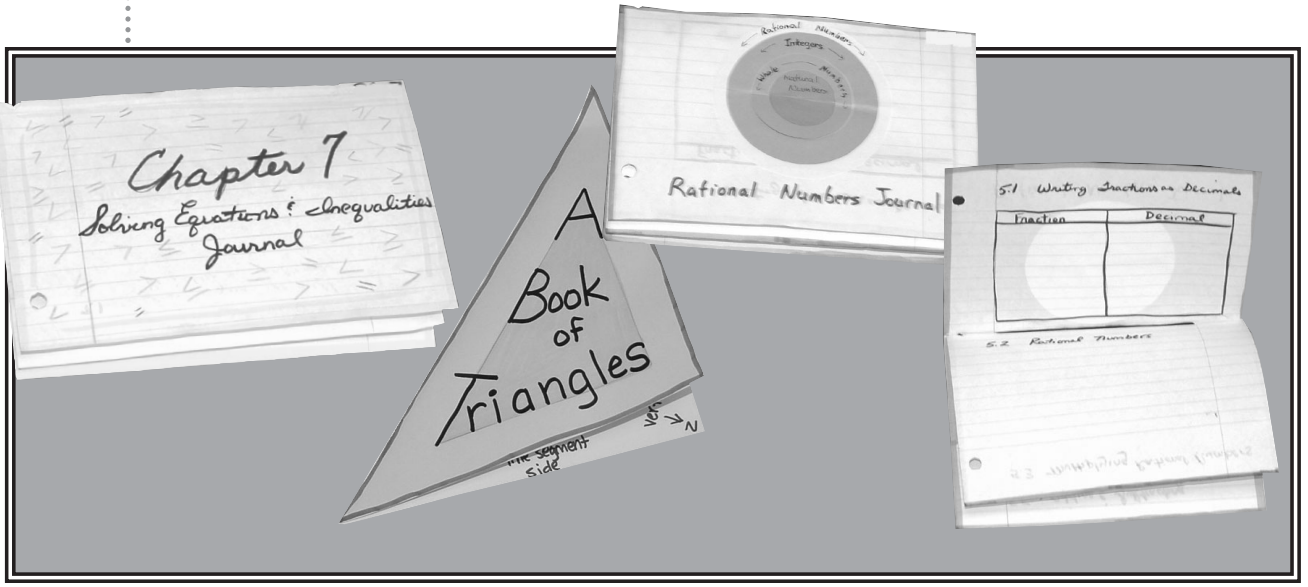
1. Take two sheets of $8\frac{1}{2}$" × 11" paper and fold each one like a *hamburger.* Place the papers on top of each other, leaving one sixteenth of an inch between the *mountain tops.*
2. Mark both folds one inch from the outer edges.
3. On one of the folded sheets, cut from the top and bottom edge to the marked spot on both sides.
4. On the second folded sheet, start at one of the marked spots and cut the fold between the two marks.
5. Take the cut sheet from step 3 and fold it like a *burrito.* Place the *burrito* through the other sheet and then open the *burrito*. Fold the bound pages in half to form an eight-page book.







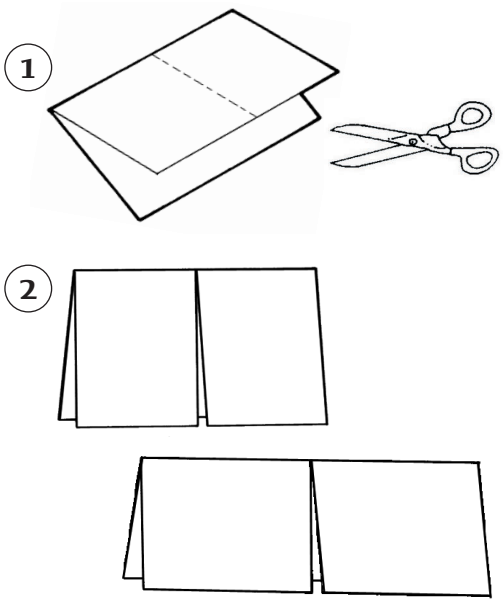




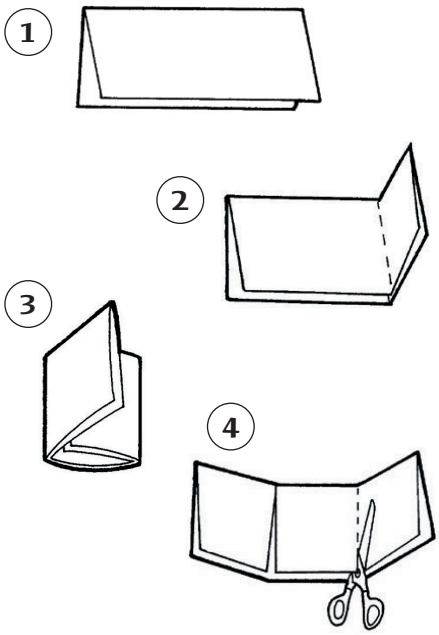
Two-Tab Book

1. Take a *folded book* and cut up the *valley* of the inside fold toward the *mountain top.* This cut forms two large tabs that can be used front and back for writing and illustrations.
2. The book can be expanded by making several of these folds and gluing them side-by-side.

Use this book for data that occurs in twos, for example opposite operations



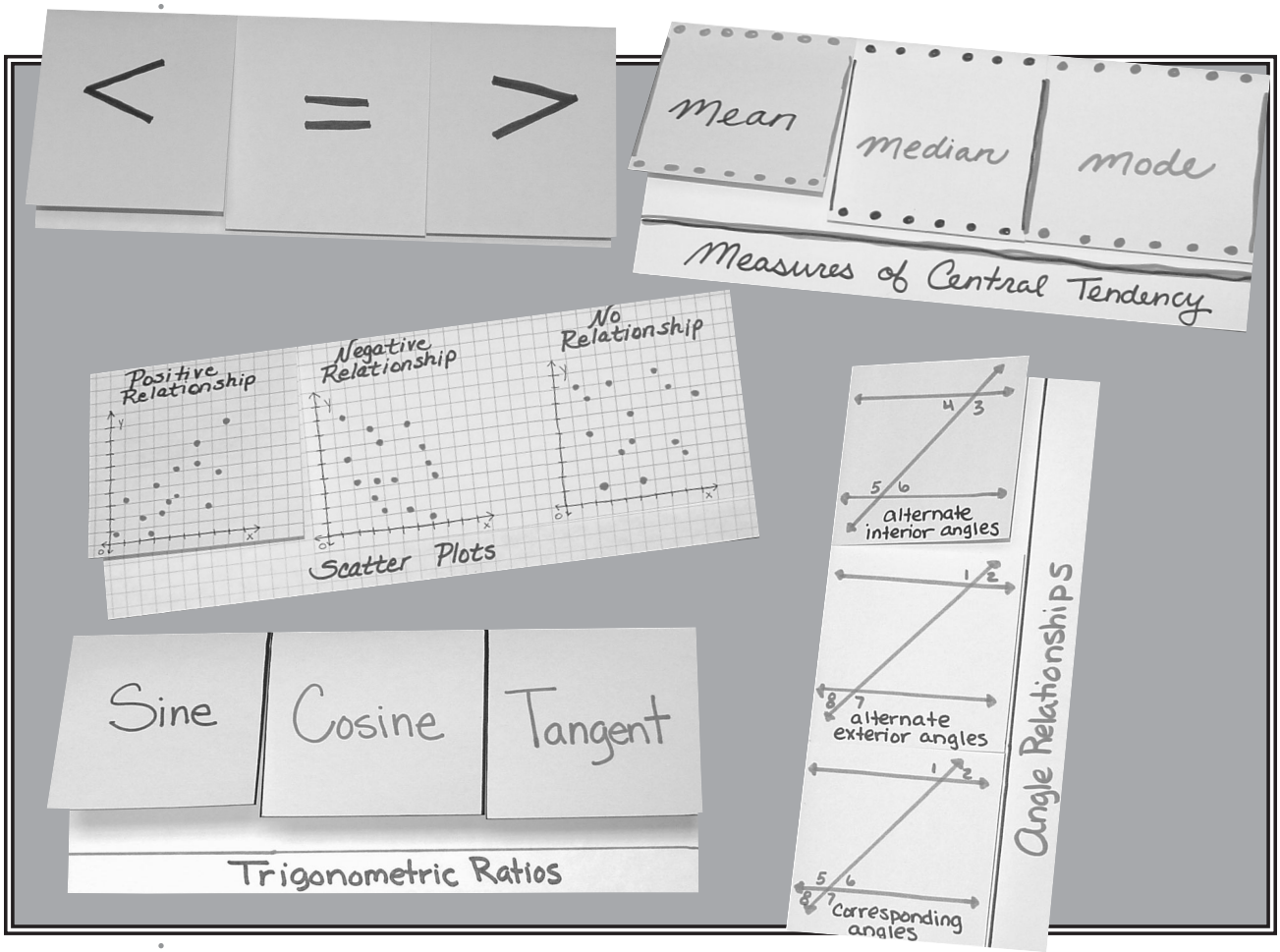
Three-Tab Book



1. Fold a sheet of paper like a *hot dog*.
2. With the paper horizontal, and the fold of the *hot dog* up, fold the right side toward the center, trying to cover one half of the paper.

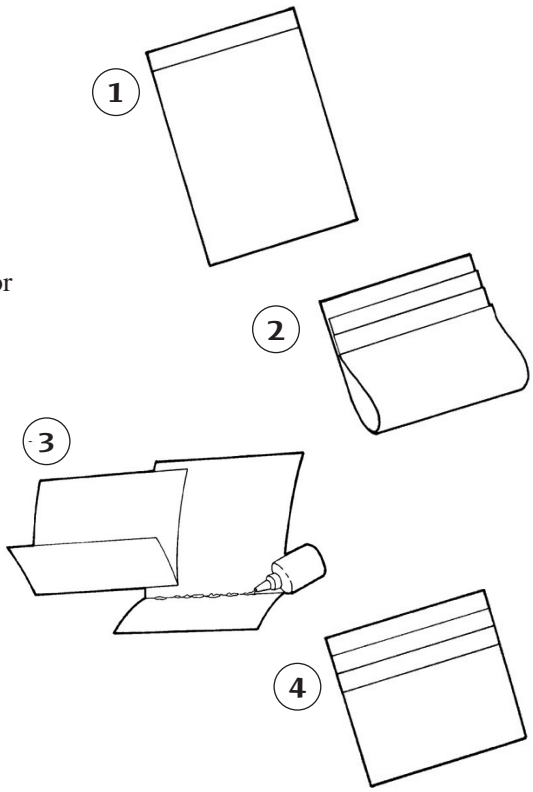
   NOTE: *If you fold the right edge over first, the final graphic organizer will open and close like a book.*
3. Fold the left side over the right side to make a book with three folds.
4. Open the folded book. Place your hands between the two thicknesses of paper and cut up the two *valleys* on one side only. This will form three tabs.

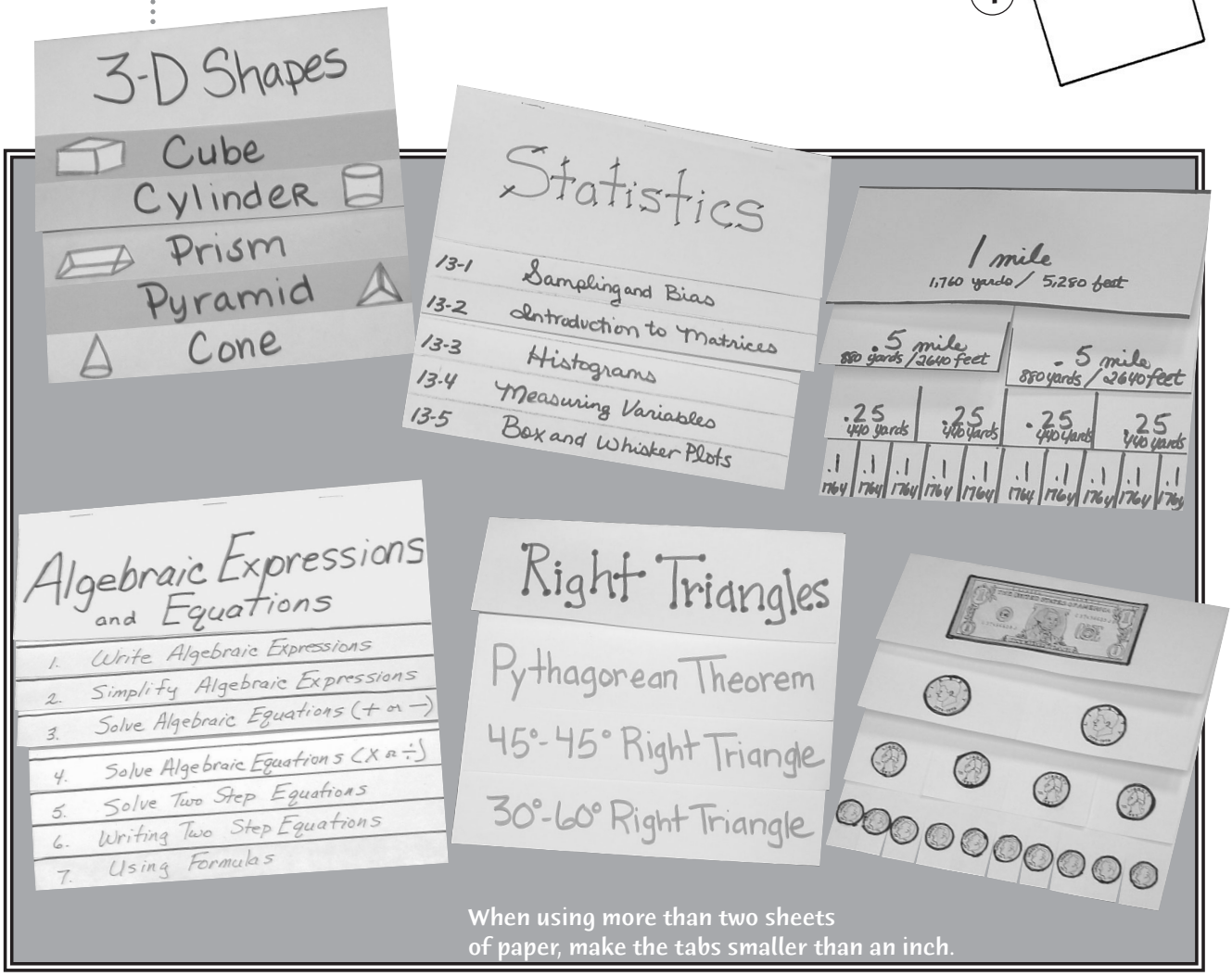
Use this book for data occurring in threes.



Layered-Look Book

1. Stack two sheets of paper $8\frac{1}{2}$" × 11" so that the back sheet is one inch higher than the front sheet.
2. Bring the bottom of both sheets upward and align the edges so that all of the layers or tabs are the same distance apart.
3. When all tabs are an equal distance apart, fold the papers and crease well.
4. Open the papers and glue them together along the *valley* or inner center fold or, staple them along the mountain.



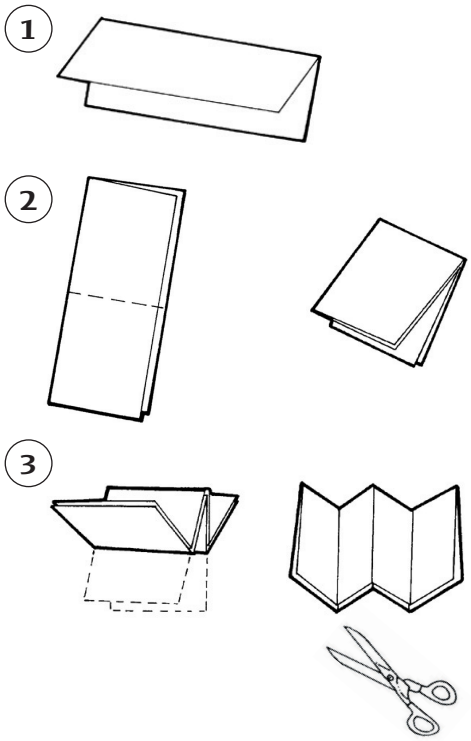


When using more than two sheets of paper, make the tabs smaller than an inch.

Four-Tab Book

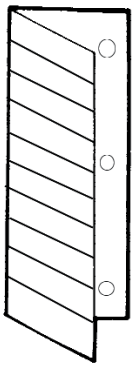
1. Fold a sheet of paper $8\frac{1}{2}$" × 11" in half like a *hot dog.*
2. Fold this long rectangle in half like a *hamburger.*
3. Fold both ends back to touch the *mountain top* or fold it like an *accordion.*
4. On the side with two *valleys* and one *mountain top,* make vertical cuts through one thickness of paper, forming four tabs.

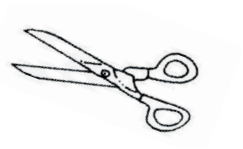
Use this book for data occurring in fours. For example: the four steps in the order of operations.

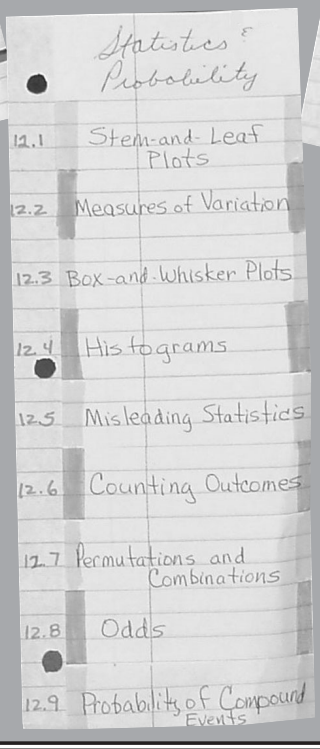


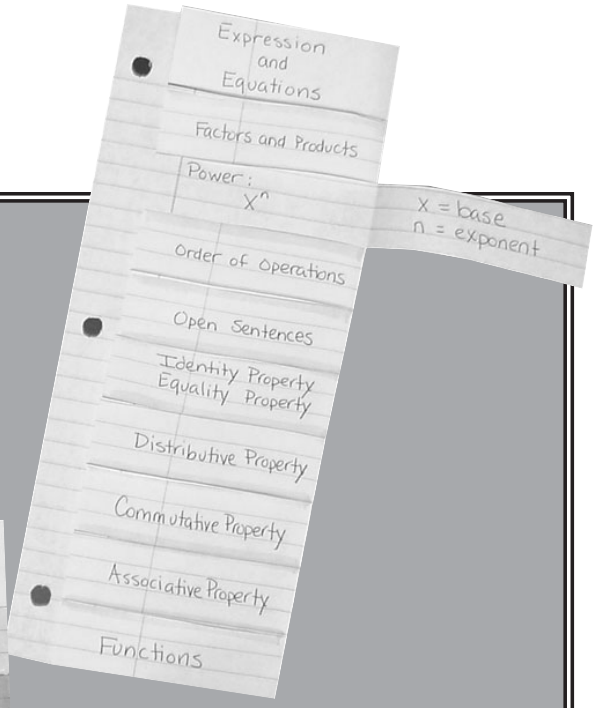
Vocabulary Book

1. Fold a sheet of notebook paper in half like a *hotdog*.
2. On one side, cut every third line. This usually results in ten tabs.
3. Label the tabs.









Use to take notes and record data.

Leave the notebook holes uncovered and the Foldable can be stored in a notebook.

Use for vocabulary books.

Use for recording student questions and answers.