

**When students are
asked to write about
their thinking, we
are telling them we
value what they
have to say.**

Writing...

- Provides opportunities to...
- Allows students to...
- Helps students to ...
- Encourages students to ...

For students to construct their own knowledge and understanding of mathematics and its applications

Allows students to clarify, record, and demonstrate their learning processes and outcomes

Helps students to formulate, organize, internalize, and evaluate concepts

Encourages students to examine their ideas and reflect on what they have

There are three types

Expository
Expressive
Creative

Expository: which includes journals, is to record and/or explain content in mathematics

Expressive: encourages playing around with ideas; students engage in free writing or respond to prompts

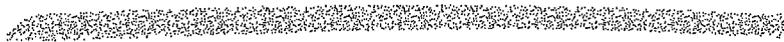
Creative: original work

**Why write
in
Mathematics?**

The Math Standards

The National and DoDEA standards include problem solving, communication, reasoning, connections

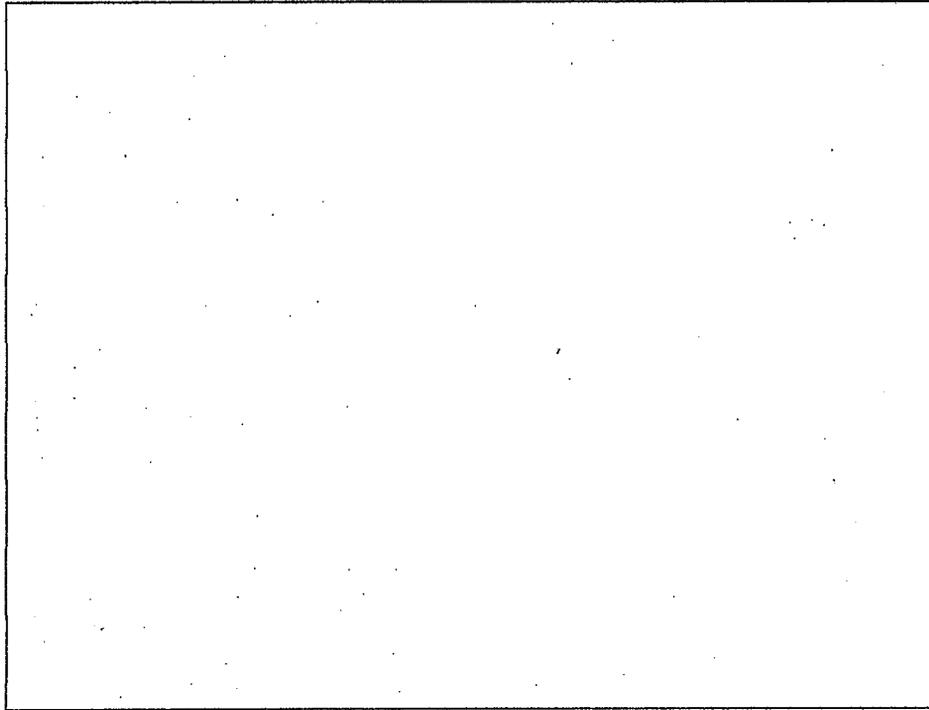
Students



- Develops skills
- Promotes higher level thinking
- Emphasizes the process/product
- Organizes
- Clarifies

Develops students' skills in communicating in a variety of venues

Promotes higher level thinking skills:
Structuring, organizing, and relating: Classify, group, sequence, compare and contrast, visualize relationships, cause and effect; **convergent generalizing:** draw conclusions, generalize, main idea, converge on an answer, understand the problem; **Divergent:** apply, infer, predict, hypothesize, devise a plan;



Evaluation: value new learning, evaluate, judge

Emphasizes the process and the product

Helps students to develop organizational skills

Clarifies students thoughts about mathematics

- Engages
- Provides one-on-one
- Monitors success
- Provides a resource
- Is a thinking tool

Engages all students in the learning process

Provides one on one opportunities without taking away class time

Allows students to monitor success through use of their journal, which is also their portfolio

Provides a resource for learning

The teacher's responsibility

- Provide experiences for gathering information such as: hands-on activities, field trips
- Provide writing models (anchors)

Example, homework model of explaining their thinking.

**Expository writing
&
Journals**

Journals are...

• An ongoing record

• Provide reflections

Journals are a way for students to keep ongoing records about what they are doing and learning

They are a way for students to reflect on their learning and communicate their ideas

Purpose of journals in my classes:
create a “math resource”, a portfolio of the students’ progress, a key communication tool between home and school

Components of a Journal

- **Table of Contents**
- **Pages numbered**
- **Entries dated and labeled**

Optional

Key Mathematical Ideas

Chapter summaries

Weekly notes to parents

Expository Writing

- Involves the students thinking and helps them make knowledge in mathematics the students' own
- Students write to make sense of and give shape to what they have learned, "Knowledge is constructed when one thinks and reflects on the thinking"

This may include:

- Describing
- Recording
- Writing instructions
- Rewrite a story problem

Involves the students thinking and helps them make knowledge in mathematics the students' own

Students write to make sense of and give shape to what they have learned

Describe how a problem is solved

Record predictions

Write instructions about how to make materials. play games. etc.

- Thinking
- Recording
- Writing and publishing
- "Self-help"

Describe the thought process used to arrive at a solution (example)

Recording questions, observations, lists, how to's, or summaries of what has happened in class

Writing and publishing newspaper articles (example)

A self-help sheet that explains the process, concept, etc so that a peer or parent can read it and understand it

Expressive Writing

Have students write their own story problems, exchange, edit and rewrite (share samples of pumpkin and shopping problems)

When writing students are able to clarify their ideas, it personalizes math

Creative Writing

Includes original stories and poems

Responses to literature (example)

**“Writing is an
important and
valuable tool that
~~can support~~
students’ learning.”**

Marilyn Burns

COMMUNICATING IN THE LANGUAGE OF MATHEMATICS

As the classroom mathematics curriculum expands to encompass the entire range of skills included in the NCTM's *Curriculum and Evaluation Standards for School Mathematics* (1989), the process by which a student arrives at the answer to a problem becomes as important as the answer itself. Answers alone often fail to reveal the nature of a student's thinking, the strategies used in the problem-solving process, or the level of understanding. Additionally, the standards document includes the expectation that students will be able to "relate their everyday language to mathematical language and symbols" (NCTM 1989, 26).

Using oral or written communication as a tool with which students can reflect their understanding of mathematics helps them make connections and personalize mathematical concepts. When students communicate mathematical information, they remember it, understand it, and use it to uncover and find even more information (Perkins 1992).

Teachers need to know how to help students grow into accomplished communicators of mathematics who can describe their thinking processes clearly. Teachers must help students make their thinking visible to others by encouraging them to talk and write about the process they use to solve problems.

The author's past efforts to encourage students to discuss and explain their problem-solving process have focused on (1) journal writing, (2) student-authored story problems, (3) the mathematician's chair, (4) cooperative-learning activities, and (5) parent newsletters. However, two articles in the May 1992 issue of *Educational Leadership*—"Cre-

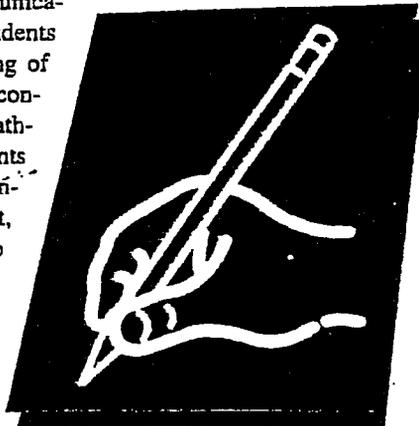
ating Tests Worth Taking" by Grant Wiggins and "Evaluating Problem Solving in Mathematics" by Walter Szetela and Cynthia Nicol—present more ideas to add to the existing student-communication activities occurring in a second-grade classroom. The goal of embedding speaking and writing into the daily mathematical activities of students is being met through the following activities.

Mathematics Journal

Ask students to keep a mathematics journal, which not only can constitute a major part of the daily curriculum but, when added to a student's portfolio, can furnish an ongoing record of the student's mathematical growth.

In our classroom, students begin each day by recording statistical data related to the date, weather, and various problem-solving activities (fig. 1): (1) day, date, number of school days attended in the current school year, and number of school days remaining; (2) at least five number sentences that equal the date; (3) the weather report—temperature, precipitation, wind speed, wind direction, and cloud type; (4) predictions for the next day's weather and the color, size, and shape of the next day's calendar piece; (5) answers to various measurement activities, such as the time shown on a Judy clock, the amount of money in a container, the weight of an object or group of objects, or an estimation of the quantity, weight, or length of an object using a standard for comparison; and (6) the solution to an open-ended mathematics problem.

At the end of each day, students use their journals to reflect on the day's mathematics activities. Students are asked to think about how they would answer such questions as "How did you help another person?" and "What did you learn that you did not know before?"



Larry Buschman teaches a blended first-, second-, and third-grade classroom at Jefferson Elementary School, Jefferson, OR 97352. He is exploring the use of portfolios and rubrics to assess students' communication skills and mathematical understandings.

Student-Authorred Story Problems

Ask students to create original story problems for someone else—a classmate, a teacher, a student in another classroom, or a family member—to solve.

The directions to the student include the following:

- Write a story problem using your imagination or the information in a picture, newspaper advertisement, poster, or short story.
- Have other people solve your problem.
- After seeing the solutions to your problem, lead a class discussion about your problem and the solutions.

Mathematician's Chair

Ask students to sit in a chair that has been designated the "mathematician's chair" and to share original problems that they have authored or solutions to a problem written by someone else.

A mathematician's chair is very similar to an author's chair, except that students share with their classmates mathematics problems and solutions rather than stories or books. Expect students, while

in the mathematician's chair, to use effective speaking skills and to communicate their thoughts clearly and completely. Also, expect classmates to use effective listening skills and to give the author useful and usable feedback:

- What did you like about the problem?
- Do you agree or disagree with the solution?
- How could the author improve the problem or solution?
- How could the author change the problem to create a new problem or change the solution to arrive at a new way to solve the problem?

Cooperative Learning

Have students engage in cooperative problem solving by asking them to describe the process that they will use to solve a problem, to work collaboratively on the problem, and to reflect on the effectiveness of the group and the contributions of individual members.

Talking with peers in cooperative-learning groups is especially important for young children. Students become comfortable with new words when they are free to experiment with language in a nonthreatening environment. To communicate their thinking to

A "mathematician's chair" is similar to an "author's chair"

FIGURE 1

Mathematics journal

DAY _____ DATE _____ How many school days? How many school days are left?		DATE EQUATIONS ?	
WEATHER WATCHER Temperature _____ Precipitation _____ Wind Speed _____ Wind Direction _____ Cloud Type _____		PREDICTIONS WEATHER CALENDAR	
TIME		MONEY	
ESTIMATION		WEIGHT	

PROBLEM-A-DAY

REFLECTIONS

others more effectively, students must have frequent opportunities to hear and speak mathematics with peers, teachers, and parents.

Family Newsletter

Ask students to write weekly or monthly "Family Newsletters."

Give the following directions to the students:

- Pretend you are a reporter for a newspaper. Write a story about something that occurred in mathematics class since the last "Family Newsletter." Use your journal and portfolio to help write the story.
- Ask at least two other students to listen to the story so that they can offer ideas for improvement.

Mathematics Communication Structures

"Mathematics communication structures" were created to add variety to students' communication tasks. Each structure listed subsequently was designed to give students a framework that supports and enhances the process of mathematical communication.

Structure 1

Present a problem and the answer arrived at by an imaginary person. Have the student write a letter to this person, explaining agreement or disagreement with the answer.

- Directions to the student: (1) Write a letter to the person who solved this problem. (2) Explain why you agree or disagree with the answer.
- Sample problem: Which number does not belong? Kristina thinks the answer is 6.

6	12
10	13

Structure 2

Present an already solved problem with a significant error. Have the student comment on the error by reacting to a series of questions about the solution.

- Directions to the student: (1) Read the problem and look at how this person solved the problem. (2) Answer each question that follows the problem.
- Sample problem: Chris and Bob have to be home by 9:00 P.M. It is now 7:00 P.M. How many hours

may they play before they have to go home? Travis solved the problem this way.

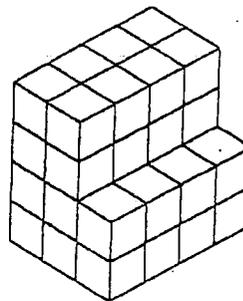
$$\begin{array}{r} 9 \\ +7 \\ \hline 16 \end{array} \quad \text{I say 16 hours.}$$

Explain whether Travis's reasoning was correct or incorrect.

Structure 3

Present a problem with all the facts and conditions, but have students write a different question for the problem. Have the students solve the new problem and tell why their new question made the problem more or less difficult to solve.

- Directions to the student: (1) Solve the problem as stated. (2) Write a different question but do not change any other part of the problem situation. (3) Solve the new problem and explain why this problem was easier or harder to solve than the original.
- Sample problem: This shape is made by stacking cubes on top of one another. How many cubes are in the bottom layer?

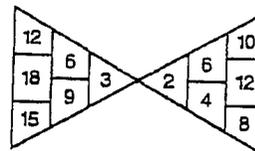


Structure 4

Present a problem and a partial solution. Have the students complete the solution.

- Directions to the student: (1) Finish the solution to this problem. (2) Describe another way to solve the problem.
- Sample problem: List all the ways that you could score 18 points by throwing two darts. Here is Aaron's partial solution:

One dart hit the 3 and the other dart hit the 15.



Structure 5

Present a problem with facts unrelated to the question. Have the students identify these facts and rewrite the problem, leaving out any irrelevant information.

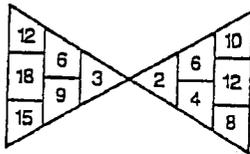
Students
can write a
different
question
for the
problem

- Directions to the student: (1) Which facts are not needed to solve the problem? (2) Rewrite the problem, leaving out any unneeded information. (3) Solve the problem.
- Sample problem: Farmer Brown has 10 cows and 23 horses. Farmer Smith has 16 cows and 17 horses. If Farmer Brown and Farmer Smith put all their cows in the same barn, how many cows would be in the barn? (Written by Melissa Santoyo, Jefferson Elementary School)

Structure 6

Present a problem and have the students explain how to solve the problem using only words. Have the students construct and solve a similar problem.

- Directions to the student: (1) Using only words, tell how you would solve this problem. (2) Write a similar problem and describe all the ways that the two problems are alike and different. (3) Solve the problem you wrote.
- Sample problem: Jill threw three darts at the target shown. What is the largest score she could make?



Structure 7

After the students have solved a problem, have them create a new problem with a different context, preserving the original problem structure.

- Directions to the student: (1) Solve the problem. (2) Tell how you solved the problem. (3) Write a new problem that can be solved in the same way. Give your problem to another person and check the solution.
- Sample problem: Tim and Bill are going camping for three days. The guidebook says that four campers need six liters of water for each day. How much water do you think that Tim and Bill should take on their camping trip? Explain your answer.

Structure 8

Present a problem without numerals. Have the students estimate the missing numbers, research appropriate numerals, and solve the problem. The problem should be based on a real-world situation—the missing information should be available to the student by gathering these data.

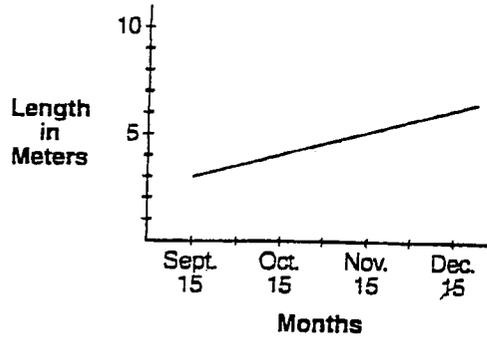
- Directions to the student: (1) Estimate the answer. (2) Complete the problem using the data you have gathered. (3) Solve the problem and tell how you found the answer.

- Sample problem: Mr. Buschman drives _____ miles to work each day. How many miles does he drive to work during October?

Structure 9

Present the students with a graph or table and have them write a story that represents the data on the graph or table.

- Directions to the student: Write a story about the data in this graph or table.
- Sample problem: Ben's shadow at the same time each day



Structure 10

Present the students with trends or sample data. Ask them to make predictions to complete the table and write a story that includes the data in the table.

- Directions to the student: (1) Look carefully at the data. (2) Make predictions using the data and fill in the missing information in the table. (3) Explain why you think your predictions are accurate. (4) Write a story that includes the data in the table.
- Sample problem: Rainfall amounts measured in inches

	Jan.	Feb.	March	April	May	June
Portland	6.4	6.8		3.4		1.0
Jefferson	5.9	6.2	4.4	3.1		
Baker	4.3		1.7	0.5		0.0
Astoria	10.6	11.3			7.5	4.3

Structure 11

Present the student with a real classroom problem that requires a group of students to share actual objects in the classroom or on the playground. Have the student develop and test a plan for sharing the objects.

- Directions to the student: (1) Make a plan for sharing the objects in the problem. (2) Test your plan to see how it works. (3) Have another student tell why he or she thinks your plan is fair or unfair. (4) Write your teacher a letter in which you de-

Have the students develop a plan for sharing objects in class

Students
come to
understand
words by
using them
in many
situations

scribe your plan and tell how well your plan worked.

- Sample problem: You have ten students in your group, but your group only has two bags of pattern blocks. You will get to use the pattern blocks for twenty minutes each day this week. Only one student can use a bag of pattern blocks at a time. Develop a plan for how your group can share the two bags of pattern blocks.

Structure 12

Ask the students to write and publish an original story problem in the form of a "letter problem" (Fig. 2). Once completed, letter problems are placed in classrooms throughout the school for other students to solve. Solutions are mailed to the problem's author through the in-school mail-delivery system.

- Directions to the student authoring a letter problem: (1) Write five original story problems. Meet with two other students and use consensus building to choose the best problem. (2) Edit and publish your problem. (3) Place several copies of your problem in chosen classrooms. (4) Read all solutions and reply to each person, telling why you agree or disagree with the solution.

- Directions to the student solving a letter problem: (1) Take one letter problem from the display. Solve the problem, write in detail how you found the answer, and tell why you think your answer is both correct and complete. (2) Mail your solution to the author of the problem through the in-school mail-delivery system. You will receive a reply in a few days.

Structure 13

Present the students with a very open-ended problem and have them request the information needed to solve the problem.

- Directions to the student: (1) Request any information you need to answer the question. (2) When you think you have enough information, solve the problem. (3) If you find that you need more information, request help from your teacher.
- Sample problem: How much will it cost for the second-grade field trip? When introducing this type of problem to students, begin with a whole-class activity using oral requests and responses, which are recorded and displayed on the overhead projector. As students become comfortable with making requests, ask them to work problems indi-

FIGURE 2

Letter problem

Name _____

Address _____

Date _____

I have 38 heifers and half of them calved. How many cows do I have?

Tell how you solved this problem. What did you do? What tools or resources did you use (rulers, calculators, etc.)? What problem solving strategy did you use? (Use the back of the paper if you need more room.)

Write the name of the person who checked your paper. _____

Please rate how you feel about this problem. Check one of the boxes.

A	B	C	D
---	---	---	---

Very Easy Easy Hard Very Hard

Mail your answer to:
Jefferson Elementary School
Lafayette, Penn 7

Place
Stamp
Here

vidually or in small groups and to make their requests in writing. By varying the type of information given to students, teachers can control the level of difficulty of the problem. For example, if a student asked, "How much does the bus for the field trip cost?" one of the following replies could be given: \$150.00; each bus costs \$75.00; each bus costs \$55.00 for the driver and \$20.00 for gasoline; or each bus costs \$8.35 an hour for the driver and \$0.05 a mile for the gasoline.

Structure 14

Ask the students to revise a fairy tale or folk tale to include numerical information. This new version of the tale can then be used as a source for generating story problems.

- Directions to the student: (1) Pick a favorite fairy tale or folk tale. Read the tale you have chosen to an adult. (2) Rewrite the tale by adding numerical information. (3) Write five story questions that someone else could answer using the added information.
- Sample tale: "The Five Bears" by Andrea Kachel, Grade 2, Jefferson Elementary School

Once upon a time there were five bears. The Papa bear was the oldest. He was 39 years old. Next came the Mama bear. She was 35 years old. Next came their son Andrew. He was 18 years old. Next came Andrea. She was 9 years old. Last came Jessica. She was 3 years old and a real brat. Every day Mama bear would leave for work at 7:00 in the morning and she would get home at 5:00 in the afternoon. The children left for school at 8:00 in the morning and came home on the hot, noisy, bumpy bus at 3:30. Papa bear took baby Jessica to the day care at 9:00 in the morning on his way to work in the honey factory.

Conclusion

Students need time to observe, to work together, and to construct an understanding of the language of mathematics and to make it their own. Personal knowledge becomes useful and usable in social situations when combined with the knowledge of others. Thoughts, ideas, and the meanings of words are focused and clarified when individuals engage in conversation.

As soon as students use words, they make their understanding of mathematics more precise and more general at the same time. Only by using words in many situations and contexts do students come to understand the full meaning of each word. When students write or talk about mathematics problems, they test, expand, and extend their understanding of mathematics. When students write or speak, they do

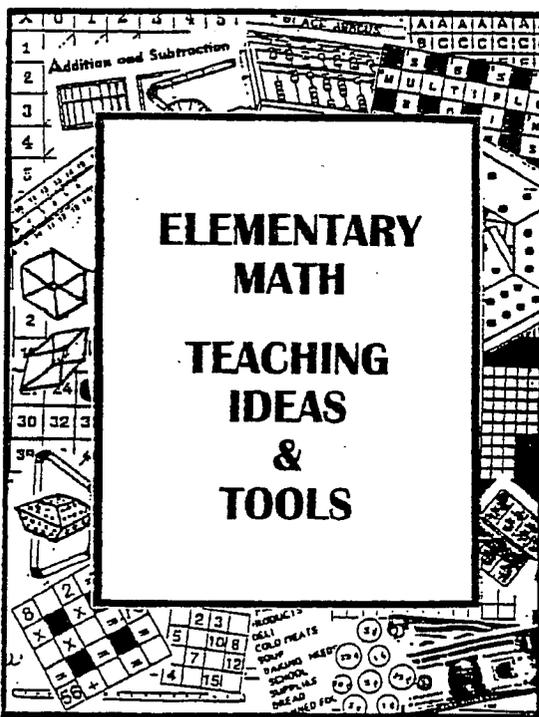
not use language just to express their thoughts; they use the process of communicating with others to engage in a conversation with their own mind.

References

- National Council of Teachers of Mathematics. *Curriculum and Evaluation Standards for School Mathematics*. Reston, Va.: The Council, 1989.
- Perkins, David. *Smart Schools: From Training Memories to Educating Minds*. New York: The Free Press, 1992.
- Szetela, Walter, and Cynthia Nicol. "Evaluating Problem Solving in Mathematics." *Educational Leadership* 49 (May 1992):42-45.
- Wiggins, Grant. "Creating Tests Worth Taking." *Educational Leadership* 49 (May 1992):26-33.

Bibliography

- Andrini, Beth, and Spencer Kagan. *Cooperative Learning and Mathematics*. San Juan Capistrano, Calif.: Resources for Teachers, 1989.
- Cambourne, Brian. *The Whole Story: Natural Learning and the Acquisition of Literacy in the Classroom*. New York: Ashton Scholastic, 1988.
- Goodman, Ken. *What's Whole in Whole Language?* Portsmouth, N.H.: Heinemann Educational Books, 1986.
- Johnson, Terry, and Daphne Louis. *Bringing It All Together: A Program for Literacy*. Portsmouth, N.H.: Heinemann Educational Books, 1990.
- Routman, Regie. *Invitations: Changing as Teachers and Learners K-12*. Portsmouth, N.H.: Heinemann Educational Books, 1991.



**ELEMENTARY
MATH
TEACHING
IDEAS
&
TOOLS**

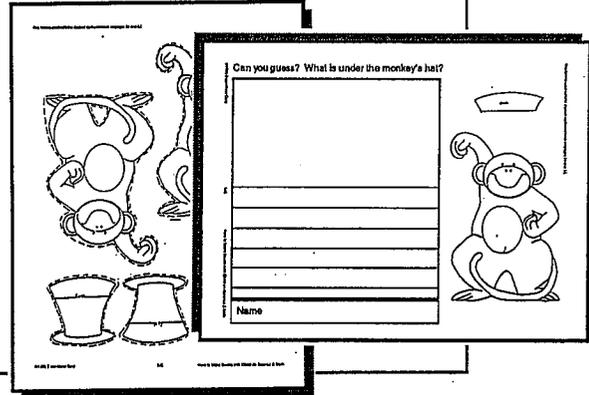
To order this 212 pg. 3-hole notebook of photocopy ready manipulatives, games demos, and K-5 Math teaching ideas, send \$15.95 check or Purchase Order (post paid)
 HAHN PRESS
 1710 NINTH STREET
 BAY CITY, MI 48708

Basic Steps to Follow

Materials:

- *Can You Guess* worksheet on page 146 for each student
- 9" x 12" (23 x 30 cm) construction paper for the back cover
- 12" x 13" (30 x 33 cm) construction paper for the front cover
- several sheets of the reproducible monkey and hat patterns on page 145
- stapler
- crayons
- paste
- scissors
- paper fasteners
- hole punch

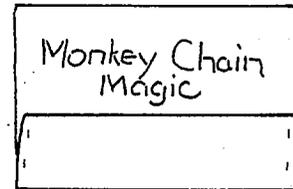
pages 145 and 146



Directions:

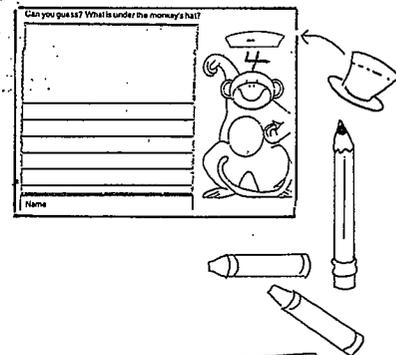
The Front Cover

1. Fold up 4" (10 cm) on the bottom of the 13" (33 cm) sheet to create a pocket.
2. Write the title *Monkey Chain Magic*.
3. Cut out the monkey patterns and slip them into the pocket.



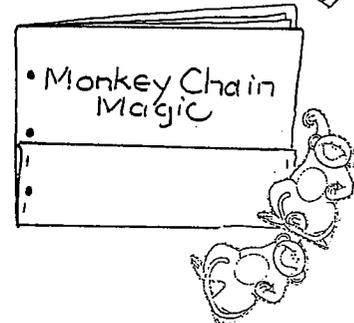
The Pages

1. Students make up their own equations.
2. They color the monkey and paste one of the hat patterns on monkey's head.
3. They write the answer to the problem in the area under the monkey's hat.



The Book

1. Place student pages inside the covers.
2. Punch holes and insert paper fasteners in the left margin.
3. Put the monkeys in the pocket.

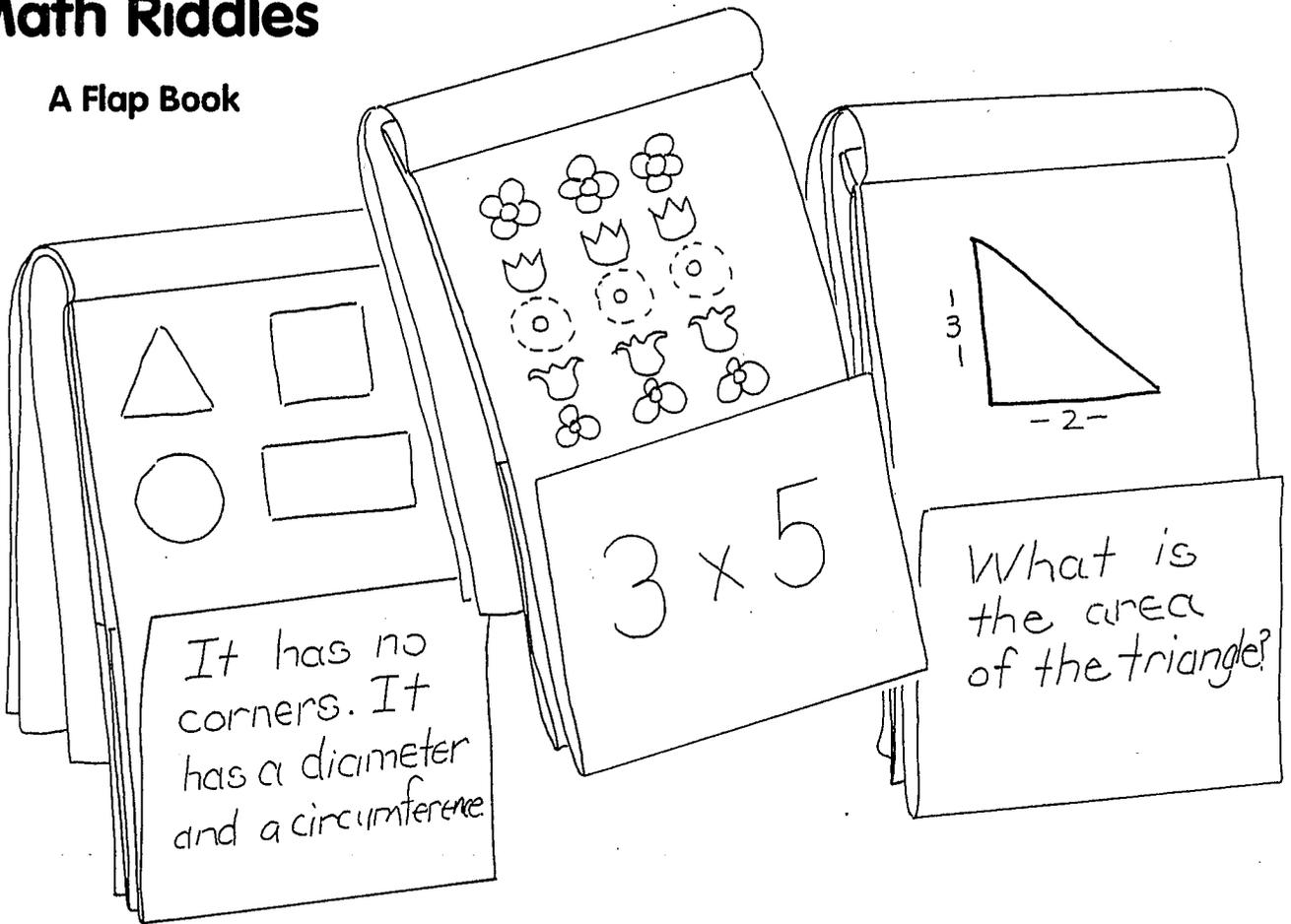


How to Use:

The students read the problems. They hook the monkeys together to make a chain to represent the numbers in that equation. They check under the monkey's hat to see if they are right. This book is a wonderful learning center all by itself.

Math Riddles

A Flap Book

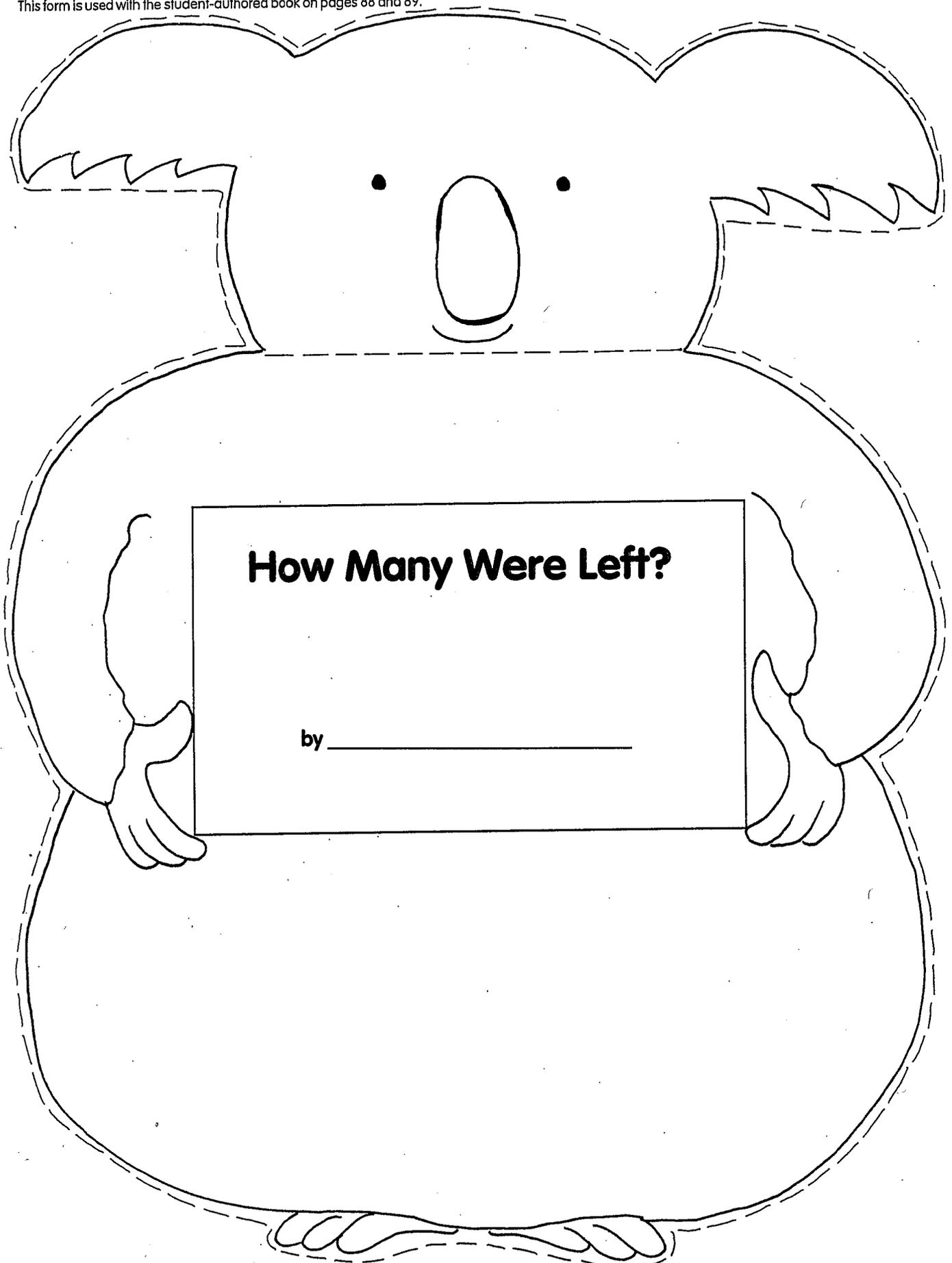


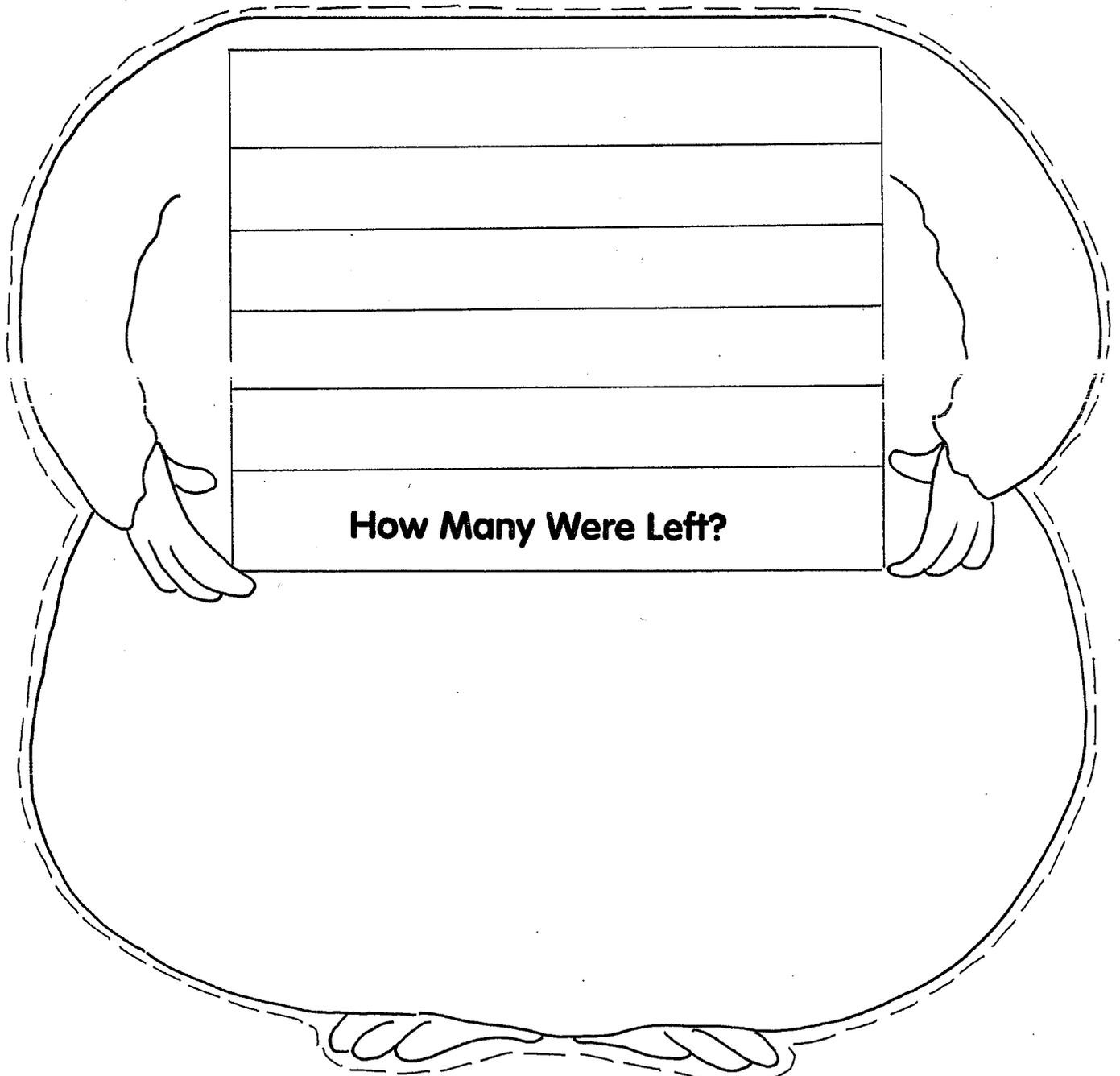
Project:

This easy-to-make book reinforces several math concepts children need to know. The level of the material is adaptable. What do your students need to practice?

Topics:

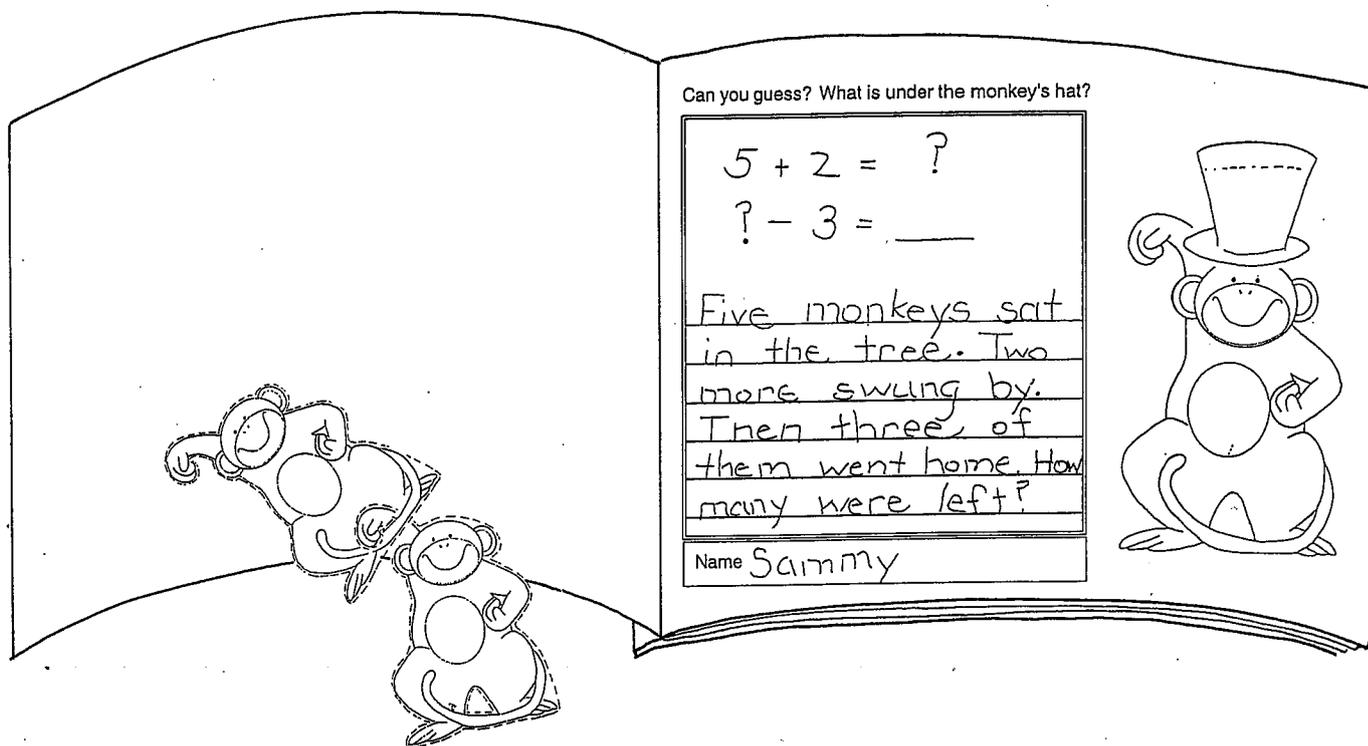
1. Number Words - one, two, three, four, five, six, seven, eight, nine, ten, etc.
2. Sets - 0-10 or 2, 4, 6, 8, etc.
3. Addition Equations - $1+1$, $2+1$, $3+1$, etc.
4. Multiplication Equations - 3×1 , 4×1 , 5×1 , etc.
5. Ordinal Numbers - first, second, third, fourth, fifth, sixth, etc.
6. Shapes - square, oval, circle, hexagon, triangle, rectangle, etc.
7. Algebraic Equations
8. Solid Geometry





Monkey Chain Magic

A Do and Learn Book



Project:

Students will set up the problems and use the monkeys that hook together to check their answers. This book will be shared again and again because they will love to participate in the solutions.

Topics:

1. Basic Addition and Subtraction Practice
2. Multi-stepped Story Problems
3. Ordinal Number Practice

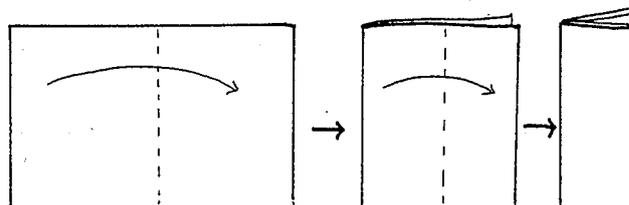
Basic Steps to Follow

Materials:

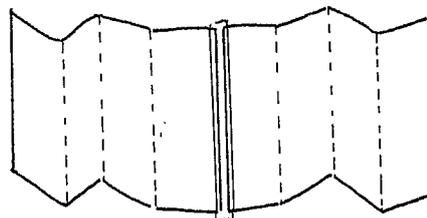
- 2 sheets of 12" x 18" (30 x 46 cm) colored construction paper
- tape
- hole punch
- ribbon
- 8 pieces of 2" x 10" (5 x 25 cm) writing paper
- pencil
- crayons or felt pens
- paste

Directions:

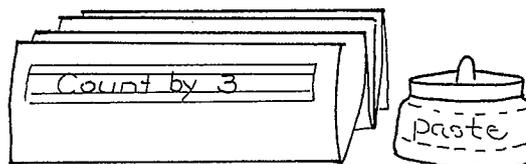
1. Fold the construction paper sheets into quarters.



2. Tape the two pieces of construction paper end-to-end. Refold the folds so they are accordion folded.



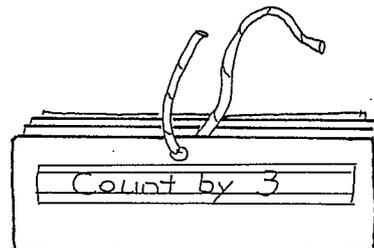
3. Glue a piece of writing paper in each segment.



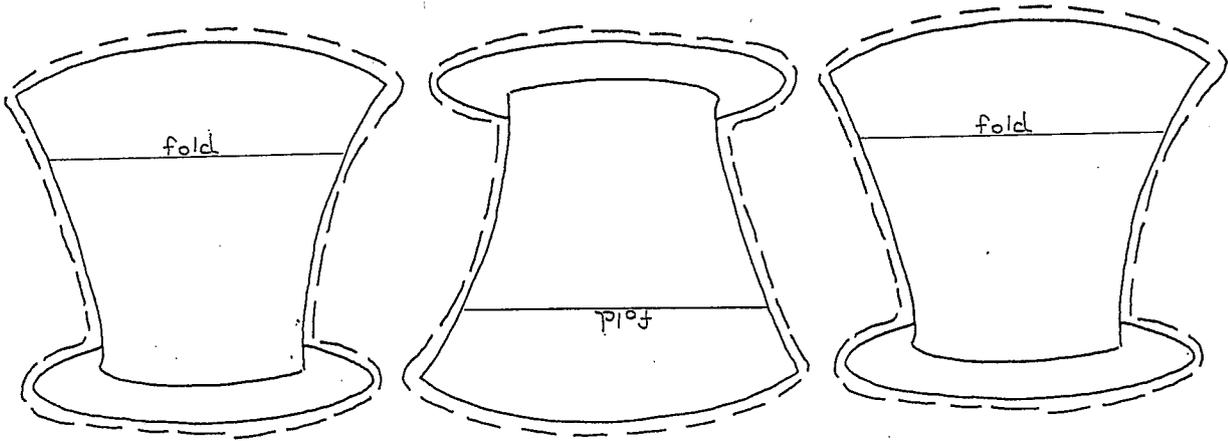
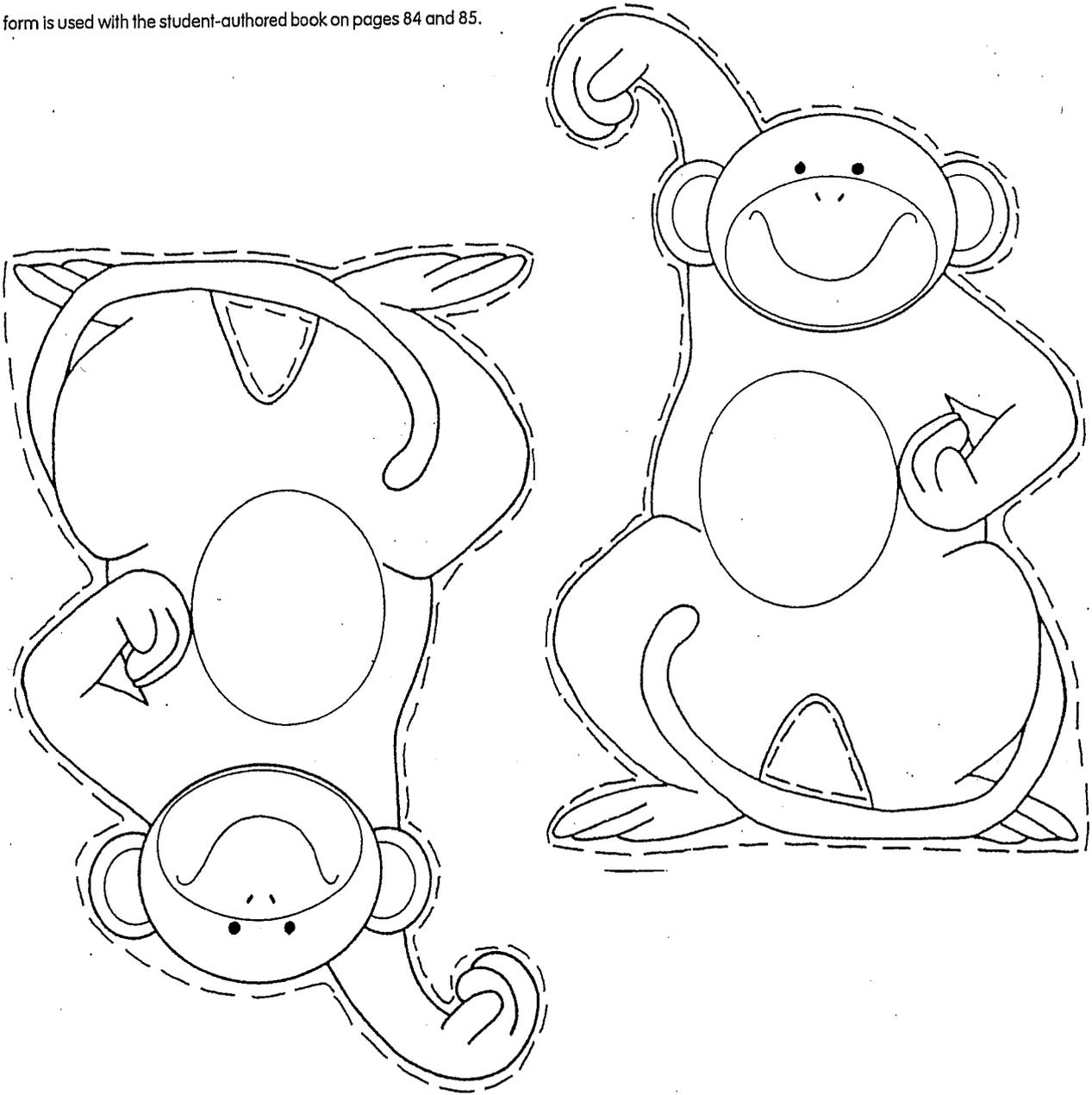
4. Draw and color as many items as necessary to illustrate that section.



5. Punch a hole at the top of the first section. Slip the ribbon through it. It may either be used to hold the accordion-pleated book closed or it may be used to hang it up for display.

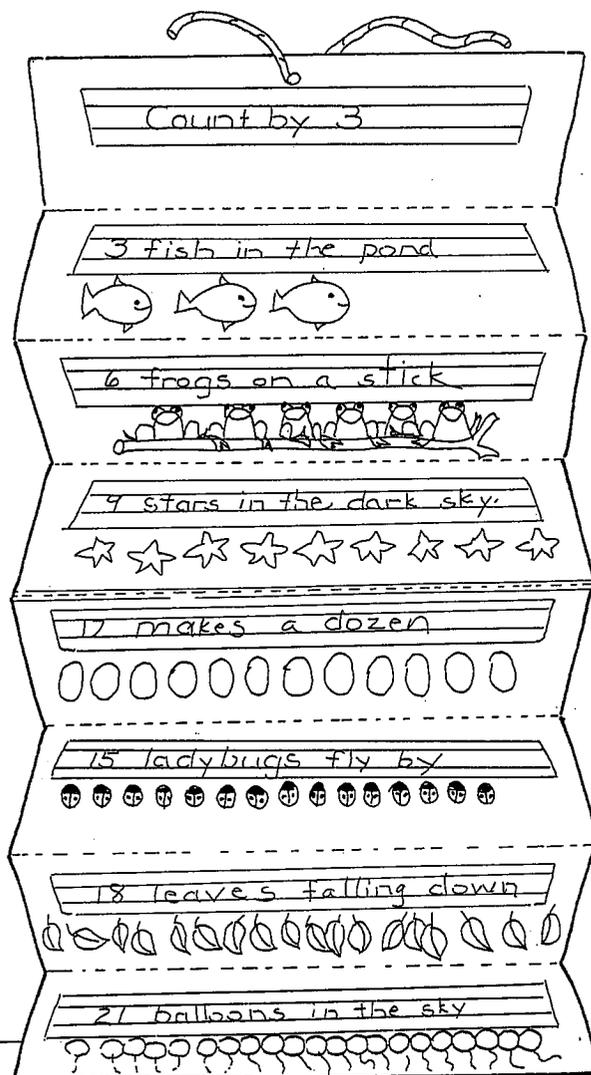


This form is used with the student-authored book on pages 84 and 85.



Skip-Counting Fun

A Drop-Down Pleated Book



Project:

Give students the opportunity to practice skip-counting and writing skills in the same project. This type of project is good to use with a cooperative group. Each student can easily make a contribution and not feel overwhelmed by the project.

Topics:

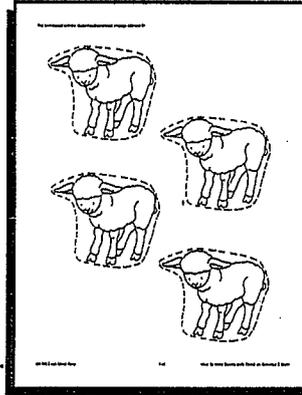
1. Learn the jingle:
2, 4, 6, 8
Who do we appreciate?
2. Practice skip counting with any pattern:
2, 4, 6, 8, 10, 12, 14, 16, 18, etc.
3, 6, 9, 12, 15, 18, 21, etc.
5, 10, 15, 20, 25, 30, 35, etc.
10, 20, 30, 40, 50, 60, etc.

The illustrations may be of different objects (somehow related) or all the same object. You may require a rhyming pattern or leave the writing style up to the student.

Basic Steps to Follow

Materials:

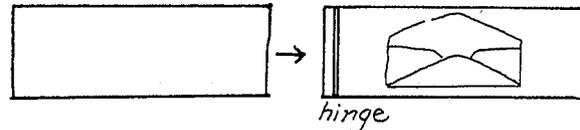
- green tagboard for the cover:
11" x 12" (28 x 30.5 cm) and 6 1/2" x 12" (16 x 30.5 cm)
- a sheet of 6" x 11" (15 x 28 cm) writing paper for each student
- construction paper scraps
- an envelope
- several copies of the reproducible sheep patterns on page 144
- felt pens
- 2 paper fasteners
- pencils
- scissors
- glue
- hole punch



Directions:

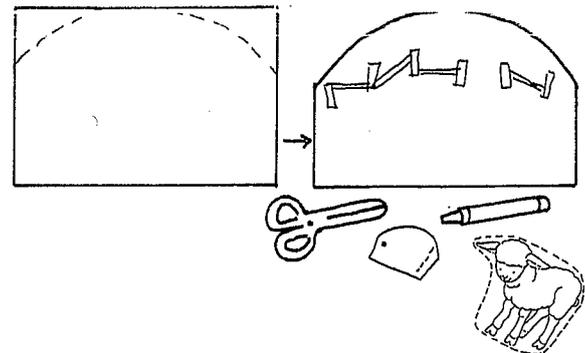
The Cover

1. Cut the front and back cover from the green tagboard. Add the fence and other details with paper scraps and felt pens.



2. Hinge the front cover. See the directions on page 3.

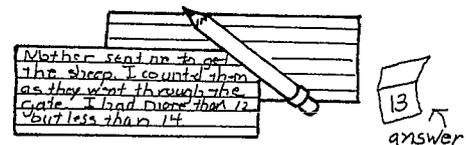
3. Adhere the envelope to the front cover. Write the title on the envelope.



4. Cut out the sheep and put them in the envelope. Make as many as are needed to solve the story problems.

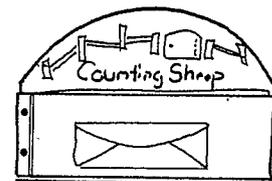
The Pages

1. Each student writes a story problem about sheep.
2. They may use a folded piece of construction paper scrap to hide the answer to the problem. Paste the answer to the back of each sheet.



The Book

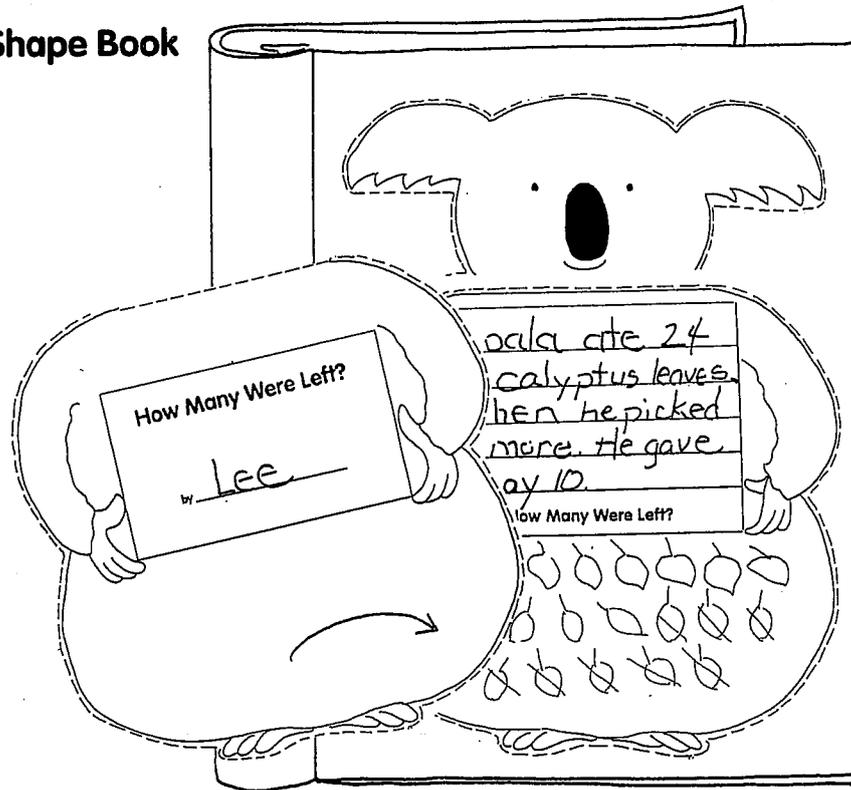
1. Collect all the pages. Bind them inside the cover using paper fasteners.
2. Make the book available for students to share. They can take out the sheep and place them on the green construction paper hill to help them answer each question. The answer should be on the back of the sheet.



Subtraction Practice

How Many Were Left?

A Koala Shape Book



Project:

Students will each create their own book practicing subtraction skills. The books may be a collection of word problems or they may be a fictional story where subtraction is involved in the storyline. The koala jar may hold anything: cookies, ants, fireflies, pencils, water, etc.

Topics:

1. Each student writes a series of word problems to share with other students. The problems will involve a subtraction equation each time. The illustration area for each problem will show the solution pictorially. Students will decorate their covers and staple all the pages together.
2. It becomes a more involved process when students have to plan a story where subtraction is a theme that continues to happen. The student would begin by developing characters and a setting. Then they would plan a plot. This plot may take several pages to work to a conclusion. Each page of the story should involve some item in the story being diminished.

Koala had six eucalyptus leaves in his lunch. But when it was time to eat, there were only three in the pouch. How many were missing?

When Koala went for a walk, she counted the trees so she wouldn't get lost. She counted 9 trees in a row. But on her way home she went too far. She counted 12 trees. How far back did she have to go?

Basic Steps to Follow

Materials:

- 6" x 18" (15 x 46 cm) white construction paper for the inside pages
- 12" x 6" (30 x 15 cm) colored construction paper for the cover
- scratch paper for a rough plan sheet
- felt pens or crayons
- pencil
- ruler
- stapler
- scissors

Directions:

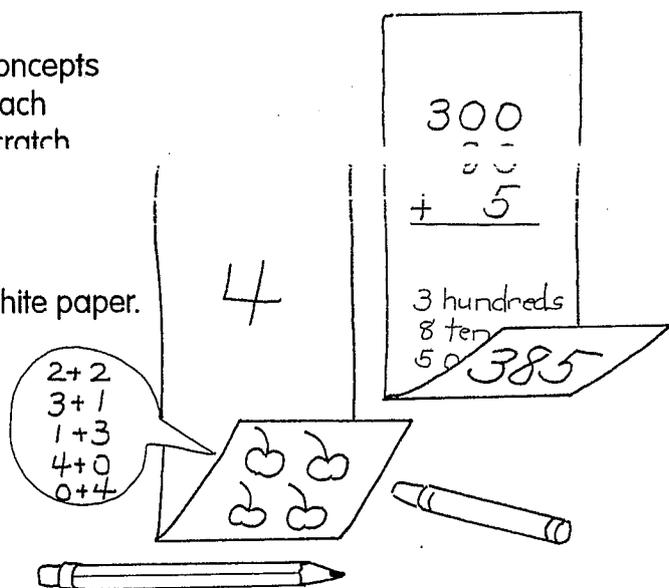
Beginning

Make a list of the numbers, number words or concepts that you want the students to practice. Assign each student one of these. They plan their work on scratch paper.

Inside Pages

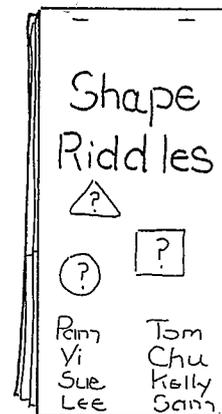
1. Fold over 6" (15 cm) on one side of the long white paper.

2. Set the paper up in the following format:
Each student must follow the general format.
Hidden under the flap is information that expands the concept.



The Cover

1. Collect papers.
2. Design a cover that lists the title and the authors.
3. Assemble the pages and the cover. Staple them together across the top.
4. Share the book with other students. Can they guess what is hidden under the flap?

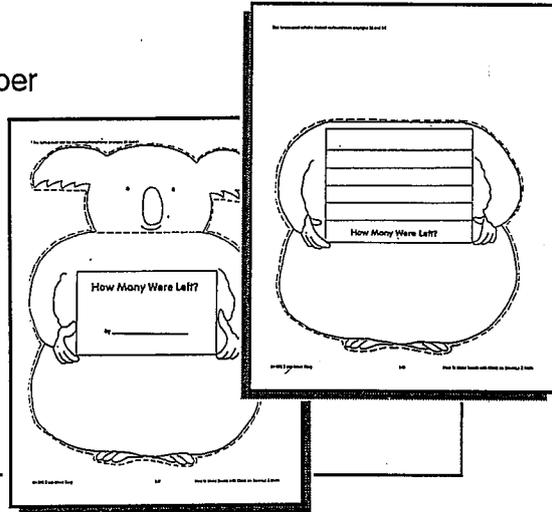


Basic Steps to Follow

Materials:

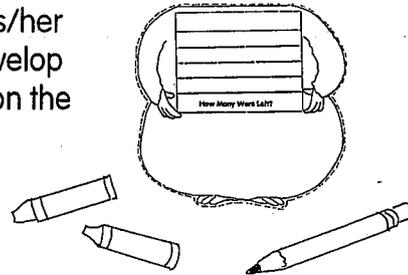
- a cover form on page 147
- the writing form on page 148
- 9" x 12" (23 x 30 cm) construction paper
- crayons or felt pens
- pencils
- stapler
- scissors
- paste

pages 147 and 148

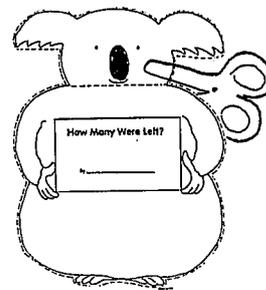


Directions:

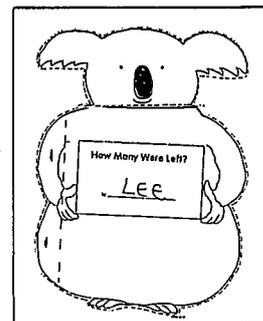
1. What is inside this koala jar? Each student formulates his/her story plan or word problems on the writing form. They develop as many of these pages as they want and then cut them on the dotted line.



2. Students color the koala cover form and cut it out. Then they cut off the koala's head on the dotted line.



3. Students paste the koala's head and the writing sheet to the construction paper. The other writing sheets and koala's body are stapled on top along the left side.



4. Student pages are put together. Add a construction paper cover and staple along the left margin.

Can You Make It? Tangram Fun

An Activity Book



Project:

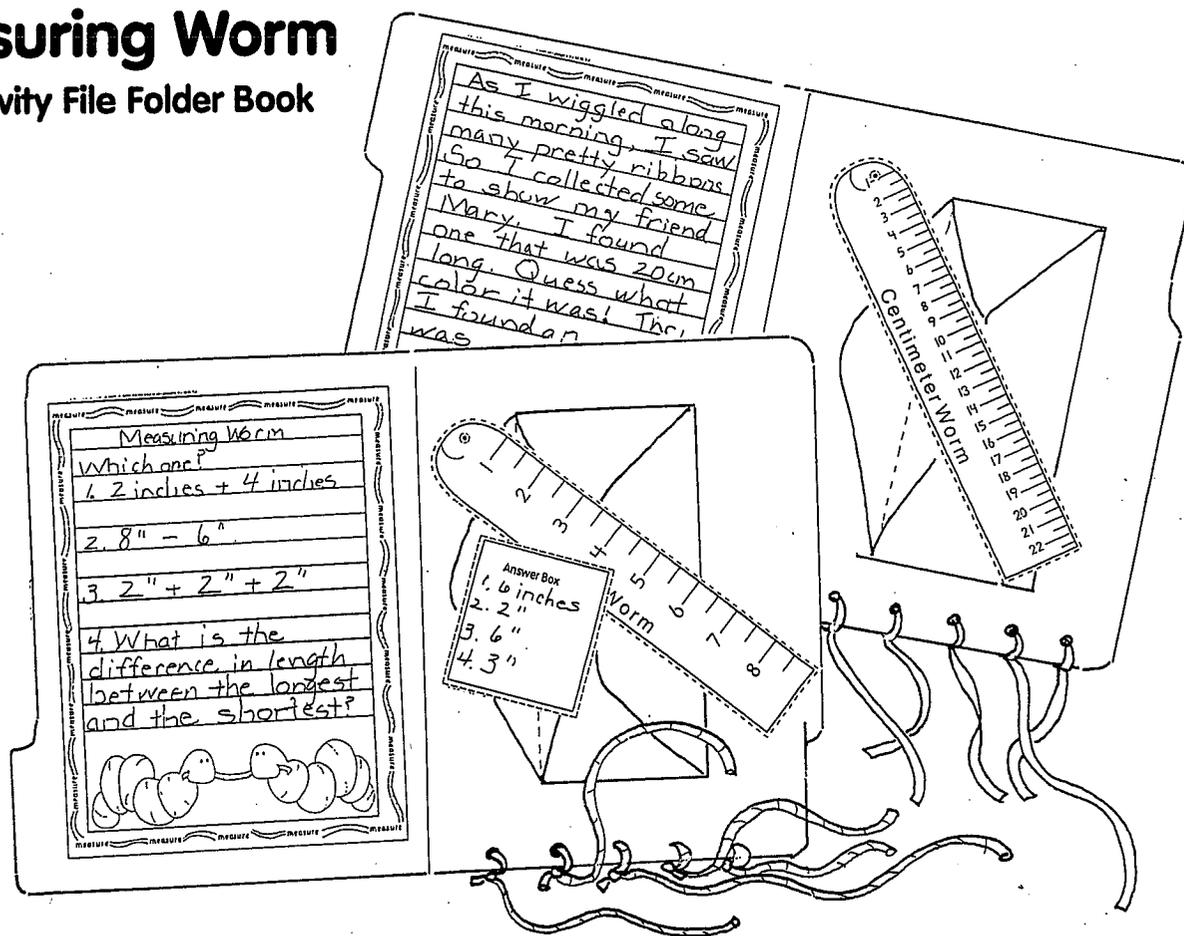
Each student contributes one page to this book with a design created from tangram patterns. The reader is provided with a set of tangrams and tries to recreate the design on each page.

Topics:

Each student has a double task. They will create the tangram pattern and a description of the design. The description may be one paragraph about the design or it may be a story created with the tangram figure as the main character.

Measuring Worm

An Activity File Folder Book



Project:

Students practice measurement skills and create an activity book for other classmates to share. The book contains forms or stories about a little worm who loves to measure. Attached to the book are yarn strips that exactly match the lengths being discussed in the stories. Readers have to find which strip of colored yarn goes with or answers each story problem.

Topics:

1. Fill in the blank.

Provide each student with the form on page 152. Let students write story problems and then cut yarn strips to match the answers.

2. Write a story.

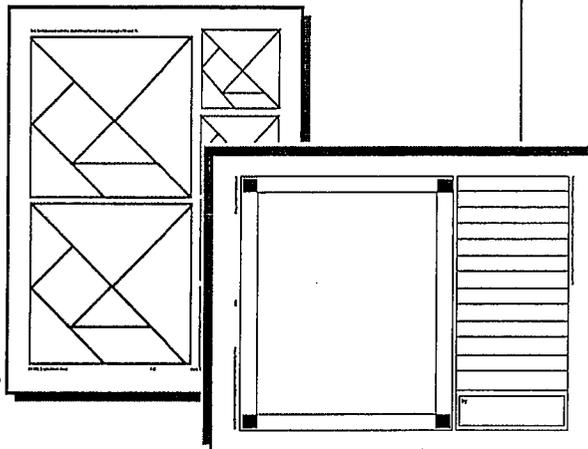
Students with more writing experience may use the same form to construct a story about this worm who loved to measure everything he saw. This could take the form of a riddle where the reader has to guess what is being measured.

Basic Steps to Follow

Materials:

- the tangram patterns on page 149
- the writing form on page 150
- 12" x 18" (30 x 46 cm) construction paper
- 9" x 12" (23 x 30 cm) construction paper
- scissors
- felt pens or crayons
- stapler

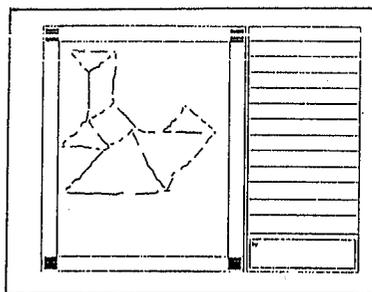
pages 149 and 150



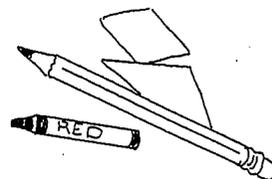
Directions:

Individual Pages

1. Students plan their tangram shape. They lightly trace around the tangram pattern pieces to create the design. They color in the entire area with a solid color (the separate tangram pieces should not be visible).



2. Students write a story or explanation of the shape on the writing form..

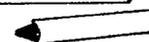
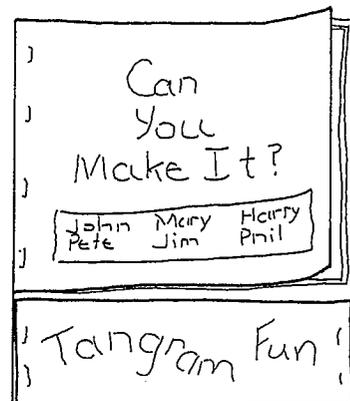


3. All student pages are collected together.

The Binding

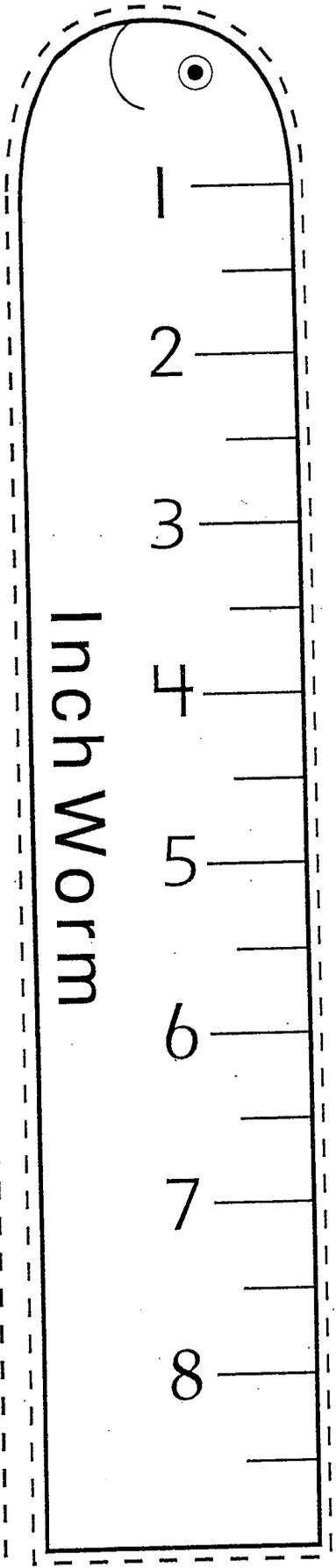
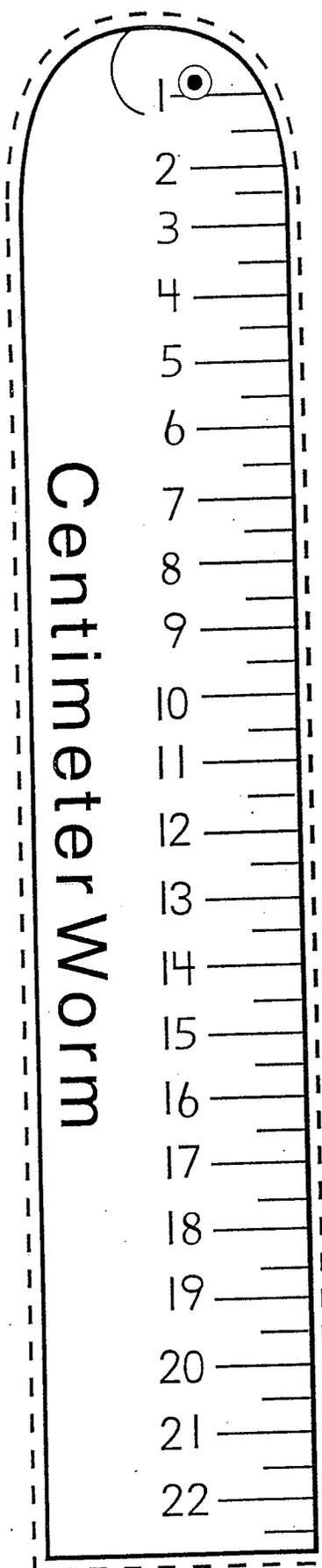
1. Fold up the bottom 4" (10 cm) of the large construction paper. Staple this flap closed on the two sides. Place a set of tangrams for students to play with in this flap.

2. Design a cover for the book on the smaller sheet of construction paper. Print the title and the name of the authors. Staple this cover and the students' papers above the flap that holds the tangram pages.

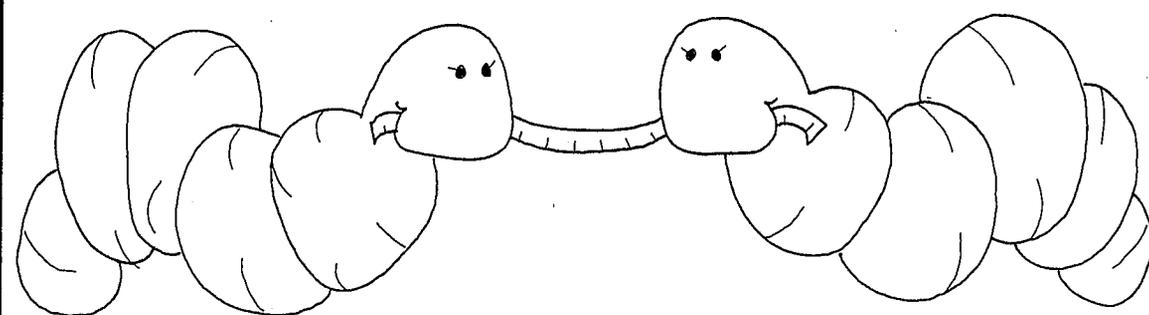


Answer Box

Answer Box



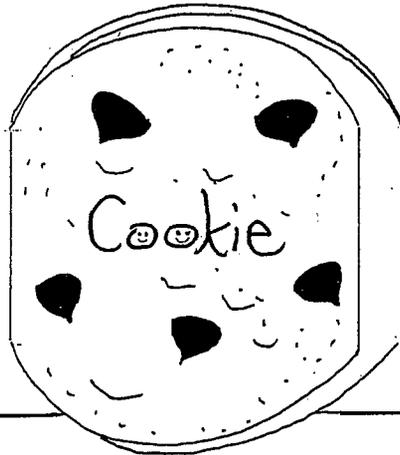
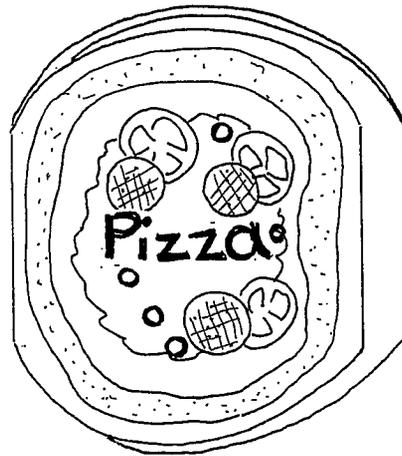
measure measure measure measure measure



measure measure measure measure measure

measure measure measure measure measure

Fraction Practice
Cut It Up
A Shape Book



Project:

Use this easily adaptable project to fit many themes: pizza, pies, cakes, cookies. Students become involved in creating stories where fractional parts of the whole turn up missing. How much is gone? How much is left? How much did each get? etc.

Topics:

1. Story Problems

- *I made a chocolate pie. I cut the pie to feed four people.
How much did each person get?*
- *My mother made pizza for dinner.
We each want two pieces.
There are four of us at home.
How many pieces did she cut?*

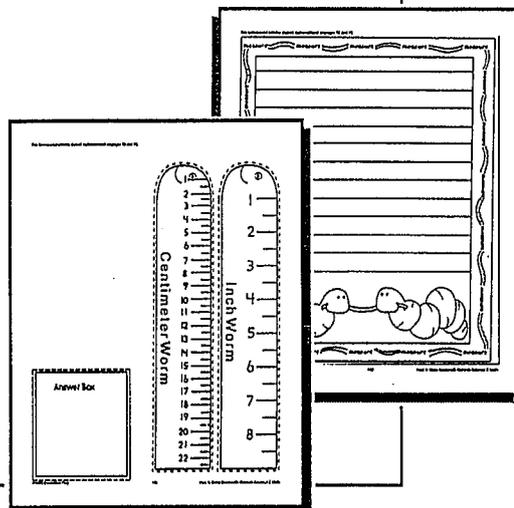
2. Write a Story

- The Day I Made a Surprise Cake
- The Magic Pizza
- Who Ate the Pie?
- The $\frac{1}{2}$ Cookie Thief

Basic Steps to Follow

Materials:

- worm form on page 151
- writing form on page 152
- yarn or ribbon in many different colors
- #10 letter envelope
- file folder
- scissors
- hole punch
- pencil
- crayons or felt pens
- tape
- stapler
- glue
- a small piece of tagboard *pages 151 and 152*



Directions:

1. Let students plan their story or word problems.
2. Provide yarn in many colors for them to cut off the length they use in their story. Have them cut the yarn longer than they need. They will cut it to exact measurements later.
3. Punch holes along the bottom of the file folder. The yarn strips are tied on. Now they are cut to match the measurements in the story problems.
4. Tape the envelope to the file folder. Make a copy of the measuring worm and glue it to tagboard. Place the worm in the envelope.
5. Staple the writing form to the left side of the folder.
6. Fill out the answer card and slip it in the envelope with the worm.
7. Design a front cover for the book. Give the title and the authors' names.

