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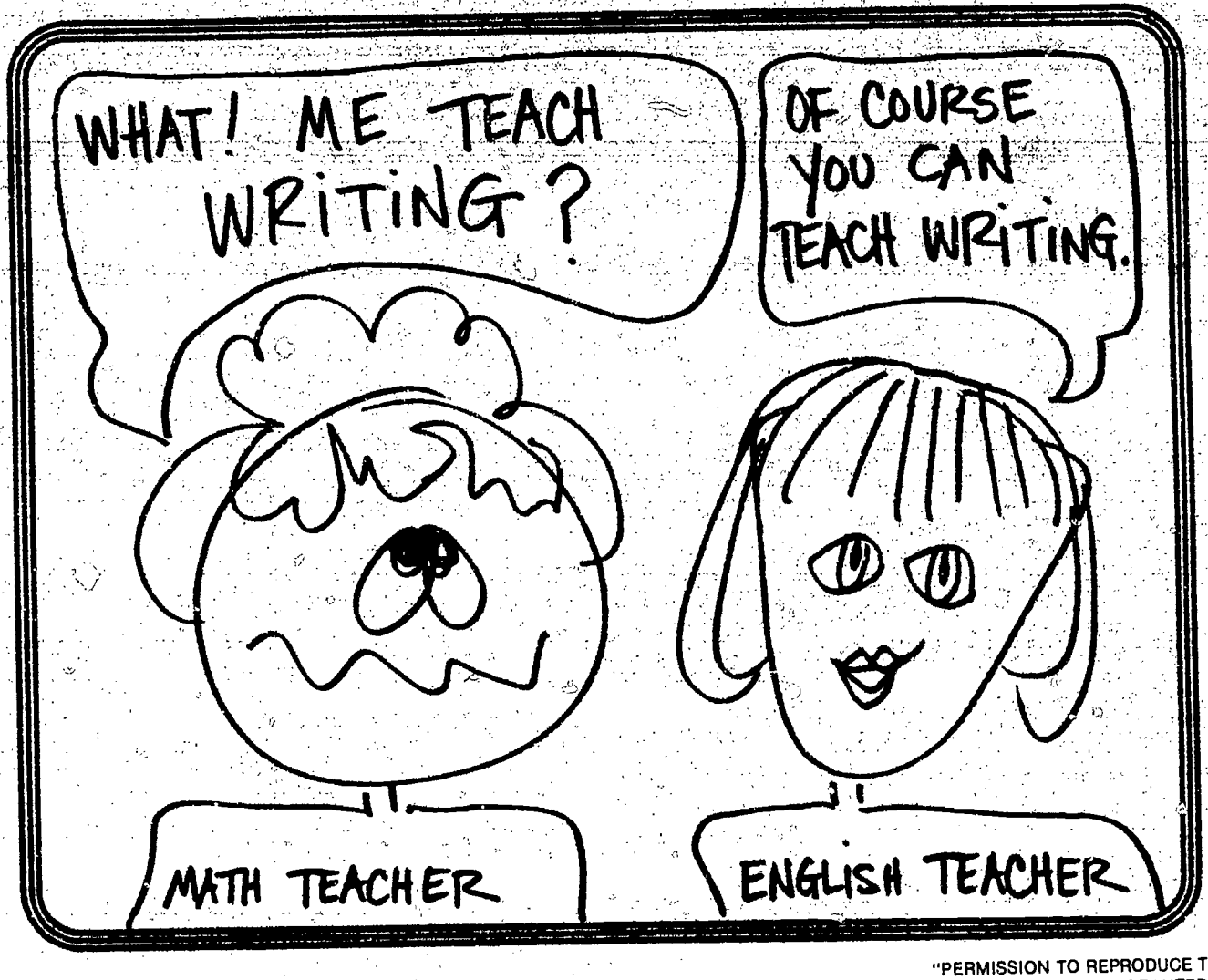
ABSTRACT

This teacher's guide was developed to help teachers improve learning by incorporating writing into mathematics instruction. The document is divided into three sections. The issue of why writing should be utilized in the mathematics classroom is addressed in the first section. The topics discussed include why students should utilize writing in mathematics class, what additional benefits students obtain from writing in class, how assessment in mathematics utilizes writing, what the National Council of Teachers of Mathematics, business and industry, and colleges and universities say about mathematics and writing. The second section discusses what teachers can do once they decide to incorporate writing in the mathematics class. The topics discussed include steps that can be taken to start using writing in the mathematics class, audiences to whom students can write, purposes for which students write, writing forms that can be employed, methods of evaluating students' writing, how to use students' writing as a diagnostic tool, and methods to improve students' writing. The final section includes examples of writing assignments for mathematics classes and samples of students' responses to the assignments. (MDH)

Writing Mathematics



Mississippi State Department of Education

Writing Mathematics

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October 1991

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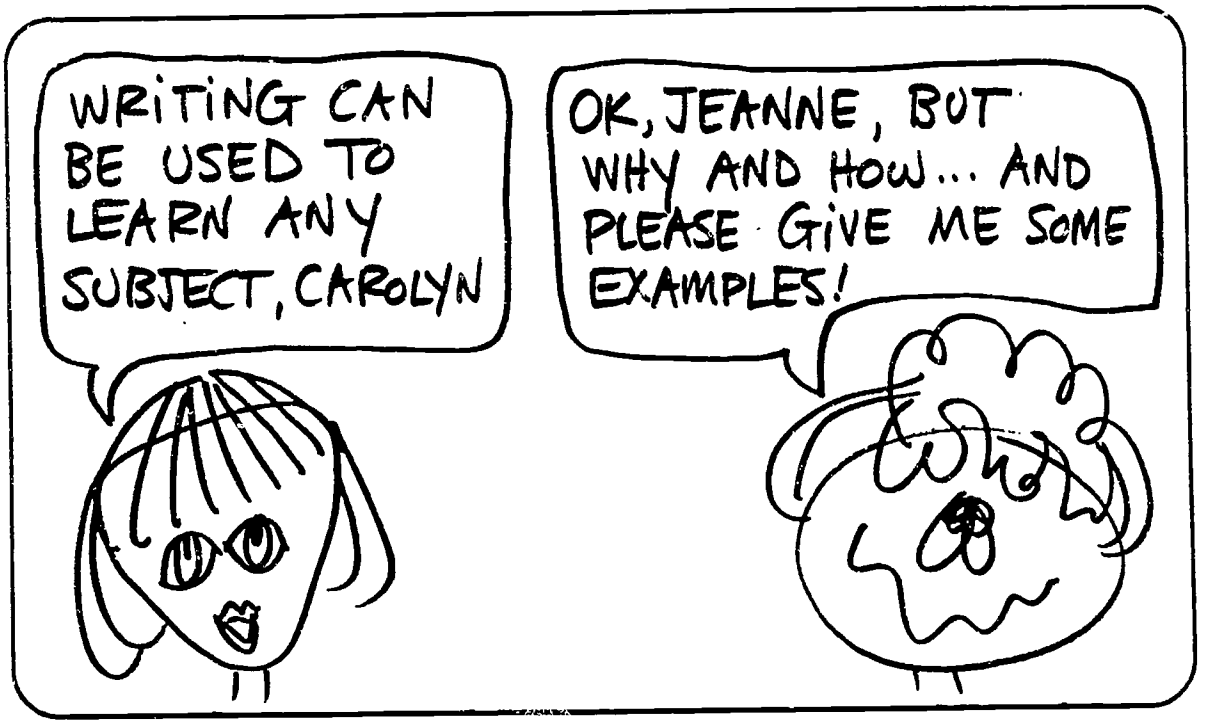
PREFACE

Together we have discussed, debated, brainstormed, written, and rewritten this book many times in hopes of making it helpful to math teachers. In the course of writing it, we have discovered that writing is a more powerful way to learn math than we had ever before realized. This discovery reinforces our belief that writing indeed promotes learning. We hope that our collaboration will model what can happen when teachers of different subjects talk to each other and work together to promote learning.



ACKNOWLEDGEMENTS

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All references to *Curriculum and Evaluation Standards for School Mathematics*, *Arithmetic Teacher*, and *Mathematics Teacher* are used with the permission of the National Council of Teachers of Mathematics. *Curriculum and Evaluation Standards for School Mathematics*, published in 1989, was prepared by the Working Groups of the Commission on Standards for School Mathematics of the National Council of Teachers of Mathematics. We would like to express appreciation to the National Council of Teachers of Mathematics for allowing the use of this material.

Many quotations are taken from the *Proceedings of the Symposium: Math Matters*, published by the Mississippi State Department of Education in 1990. The Symposium, sponsored by the Mississippi State Department of Education, was held in November 1988.

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WHY

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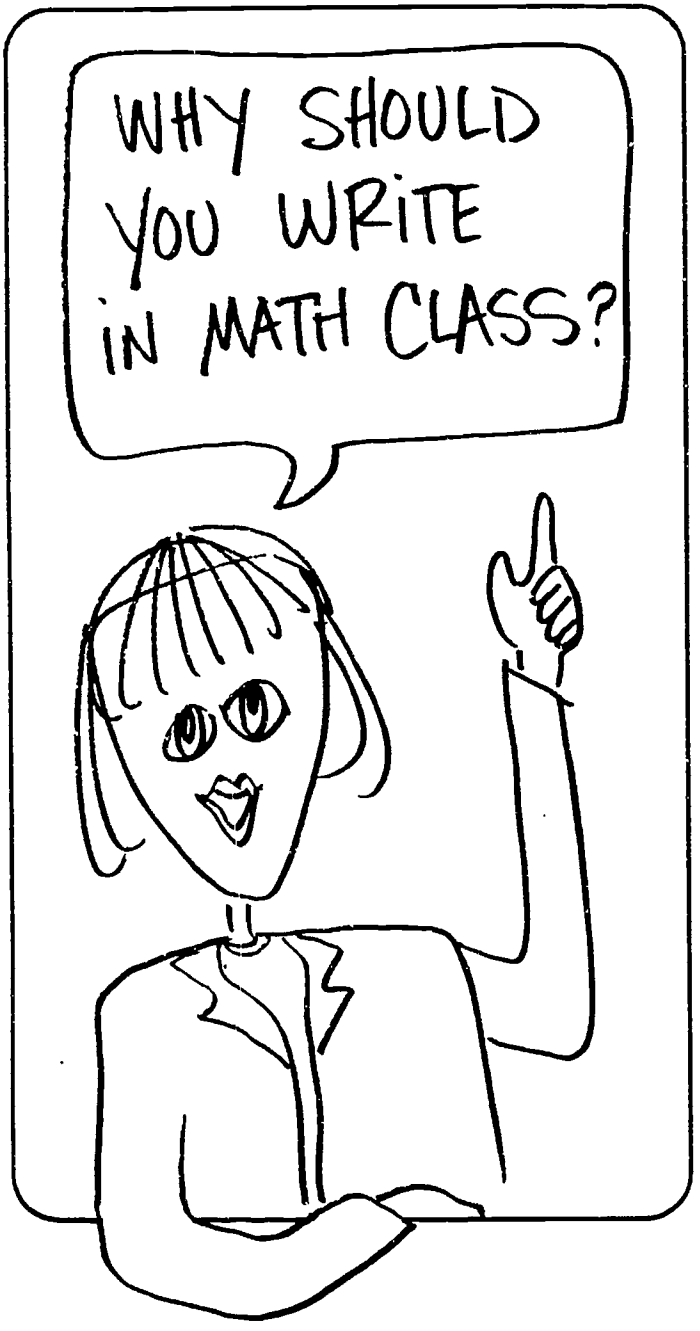
EXAMPLES



Writing is a tool for learning any subject, including math. Writing clarifies thinking, promotes critical thinking, and also gives evidence that thinking has occurred.

Writing is a way to share mathematical ideas with others. Writing develops those reading skills so necessary for solving word problems. Writing in the math class is a powerful way to connect math, reading, and language arts skills.

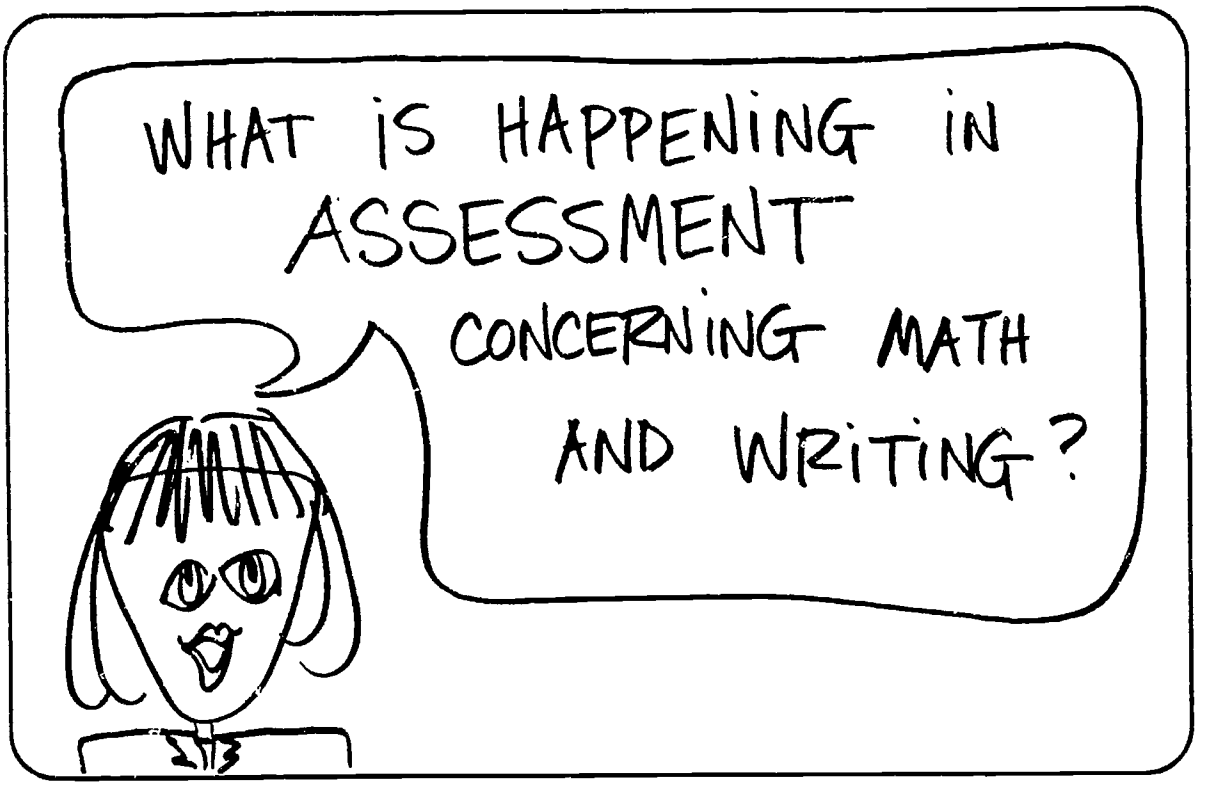
"Students need to be able to justify how they got their answer, to defend the process, and to know when the answer is unreasonable."

John Garner, Tougaloo College, 1988, *Proceedings of the Symposium: Math Matters*, p. 84.

"Writing about mathematics, such as describing how a problem was solved, also helps students clarify their thinking and develop deeper understanding."

NCTM, *Curriculum and Evaluation Standards*, p. 26.

- It reinforces and deepens learning for longer retention of concepts.
- It relates new knowledge to prior learning.
- It develops creative powers to explore and play with ideas.
- It develops thinking skills and problem-solving processes.
- It interrelates different subjects.
- It indicates what has been learned.
- It reveals where students have misunderstandings or problems.
- It is a tool for planning and problem-solving.
- It connects the symbolic language of mathematics with the language students already know.
- It strengthens reading and communication skills.
- It creates a personal connection with the subject.
- It promotes self-analysis and reflection.
- It provides an outlet for expressing attitudes and emotions.
- It develops self-confidence and a positive self-concept.
- It establishes a personal relationship between the learner and the teacher.
- It motivates students.

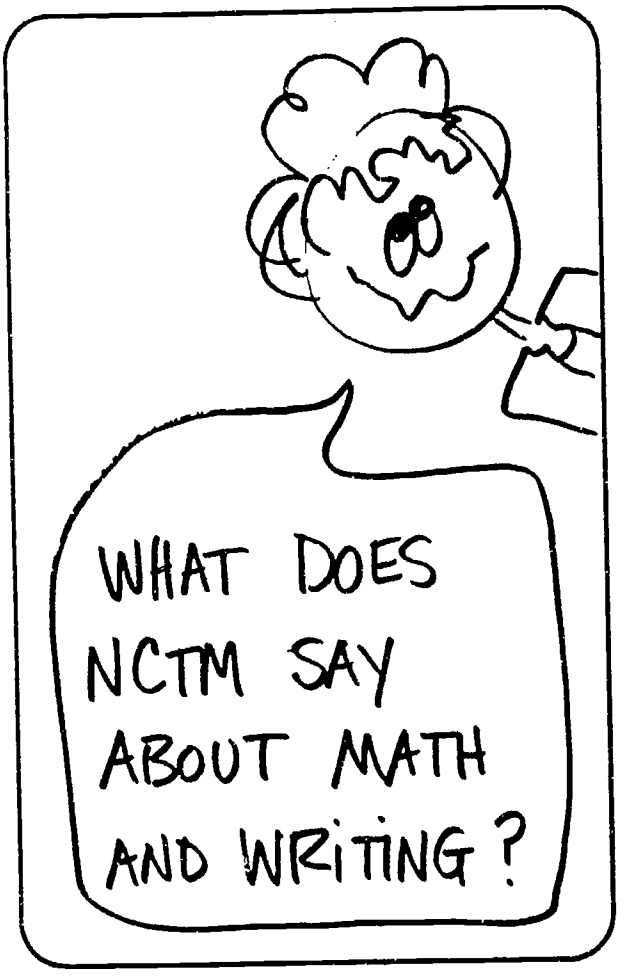


As mathematics assessment undergoes major changes at state and national levels, math tests are beginning to require students to write. Today's educators want more than multiple choice questions that require only recall of facts or basic computational skills. They want assessments that measure students' knowledge and understanding using a variety of performance tasks. Assessments are being developed using portfolios, problem-solving with calculators, and open-ended questions that call for extended written responses. Leaders in this effort are the National Assessment of Educational Progress (NAEP) and states such as California, Vermont, and Connecticut.

According to NAEP, the mathematics assessment includes tasks such as "problem-solving with scientific calculators, 'manipulative' geometric shapes that are rather like pieces to a puzzle, open-ended questions that require extended written explanations and questions designed to examine the links between the concrete and the abstract and between knowledge and its applications."

"Communication involves the ability to read and write mathematics and to interpret meanings and ideas. Writing and talking about their thinking clarifies students' ideas and gives the teacher valuable information from which to make instructional decisions."

National Council of Teachers of Mathematics, *Curriculum and Evaluation Standards*, p. 78.



The National Council of Teachers of Mathematics (NCTM) has set these five general goals for all students:

1) that they learn to value mathematics.

2) that they become confident in their ability to do mathematics.

3) that they become mathematical problem solvers.

4) that they learn to communicate mathematically.

5) that they learn to reason mathematically.

Writing can serve as a way to achieve all of the goals. Through writing, students can express how they use mathematics in their lives and how they solve problems. Students can clarify their reasoning through writing.

According to NCTM, the fourth goal, learning to communicate mathematically, is "best accomplished in problem situations in which students have an opportunity to read, write, and discuss ideas. As students communicate their ideas, they learn to clarify, refine, and consolidate their thinking." *Curriculum and Evaluation Standards*, p. 6.

"Mathematics is something that someone does. We solve problems, we communicate, and we reason. Mathematics is not a paper-pencil computation activity."
Shirley Frye, President, National Council of Teachers of Mathematics, 1988-90, *Proceedings of the Symposium: Math Matters*, p. 16.

"Writing–what does it have to do with mathematics? It is central. It helps us to learn."
John Garner, Tougaloo College, 1988, *Proceedings of the Symposium: Math Matters*, p. 85.

WHAT DO BUSINESS and INDUSTRY SAY ABOUT MATH and WRITING?

For the U.S. to stay economically competitive in an international marketplace, employees need to know and apply mathematics, solve problems, communicate clearly, and work together. Business, science, and technology leaders tell us they will need people who not only can do math but can communicate about math:

> An employee or high school graduate must be able to read, write, and compute. We need employees who can learn new skills, who can generate change through effective reasoning, utilizing analytical, creative, and problem-solving skills to produce a world-class quality product at a reduced cost. Should future job applicants coming into our business or industry be prepared to satisfy that industry's basic requirements of the ability to read, write, and compute? The answer is yes.
> **Thomas R. Smith**, General Supervisor, Organizational Training and Development, Packard Electric, Division of General Motors, 1988; *Proceedings of the Symposium: Math Matters*, p. 40.

> What do you think industry expects of the high school graduate? Reading, writing, and arithmetic. By the year 2000, to succeed in the job market, workers will need to possess good reading and verbal skills, problem-solving abilities, and inter-personal skills. Simply put, workers who do not have these skills will be left behind.
> **Betty Posey**, Director of Employment/Employee Benefits Administrator, Jitney Jungle Stores of America, Inc., 1988; *Proceedings of the Symposium: Math Matters*, pp. 37-38.

> All industrialized countries have experienced a shift from an industrial to an information society. Information is the new capital and the new material, and communication is the new means of production. **NCTM**, *Curriculum and Evaluation Standards*, p. 3.

> The U.S. Congressional Office of Technology Assessment (1988) claims that employees must be prepared to understand the complexities and technologies of communication, to ask questions, to assimilate unfamiliar information, and to work cooperatively in teams. **NCTM**, *Curriculum and Evaluation Standards*, p. 3.

WHAT DO COLLEGES and UNIVERSITIES SAY ABOUT MATH and WRITING?

"They want students with good attitudes about mathematics – to value it and have knowledge of its use. They want students who can create and imagine. They want them to know how to justify solutions, to be capable of analytical thinking, to be able to solve work problems, to manipulate formulas, to decide what data is relevant, to have good oral and written communication skills, to be able to work in groups, to be able to use appropriate technology, and to have a working knowledge of the metric system." *Proceedings of the Symposium: Math Matters*, p. 3.

"Reading, writing, and mathematics should be the cornerstones of all educational pursuits."
Dr. Sam Cobbins, Associate Professor of Technology, Jackson State University, 1988, *Proceedings of the Symposium: Math Matters*, p. 90.

"The ability to read, listen, think creatively, and communicate about problem situations, mathematical representations, and the validation of solutions will help students to develop and deepen their understanding of mathematics."
NCTM, *Curriculum and Evaluation Standards*, p. 80.

Start by understanding the writing process. That's the process writers usually go through as they struggle to put ideas on paper. The process is neither neat nor orderly. Although it can be described as consisting of a series of actions listed below, the process should not be followed in a lockstep manner.

- Brainstorm ideas: think, list, draw, gather information, and organize.
- Write a first draft.
- Revise the ideas.
- Write a second draft.
- Edit spelling, capitalization, punctuation and other problems.
- Write a final draft.

The National Council of Teachers of Mathematics says that the process of writing is similar to the process of solving a math problem:

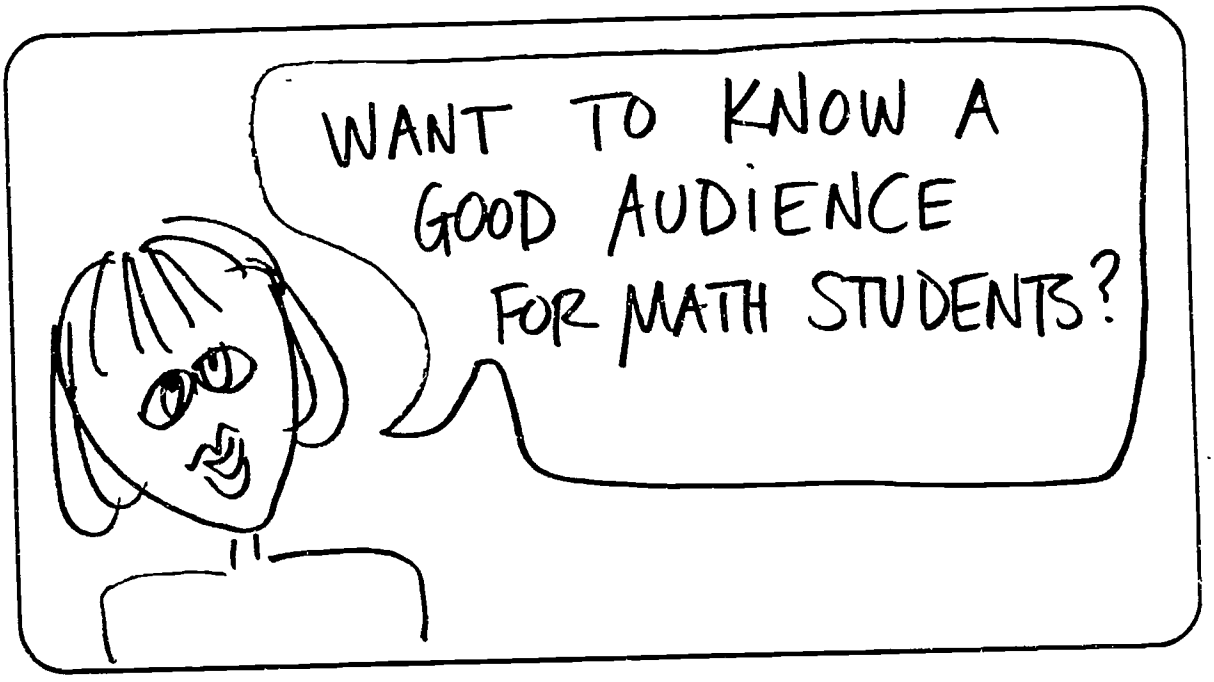
> Techniques used to teach writing can be useful in teaching mathematical communication. The view of writing as a process emphasizes brainstorming, clarifying, and revising; this view can readily be applied to solving a mathematical problem. *Curriculum and Evaluation Standards*, p. 142.

As writers begin writing, they should consider to whom they are writing and what they want to achieve through their words. In short, writers need to know their audience and purpose.

A good audience for math students is the students themselves. They need to write for themselves to promote learning and discovery.

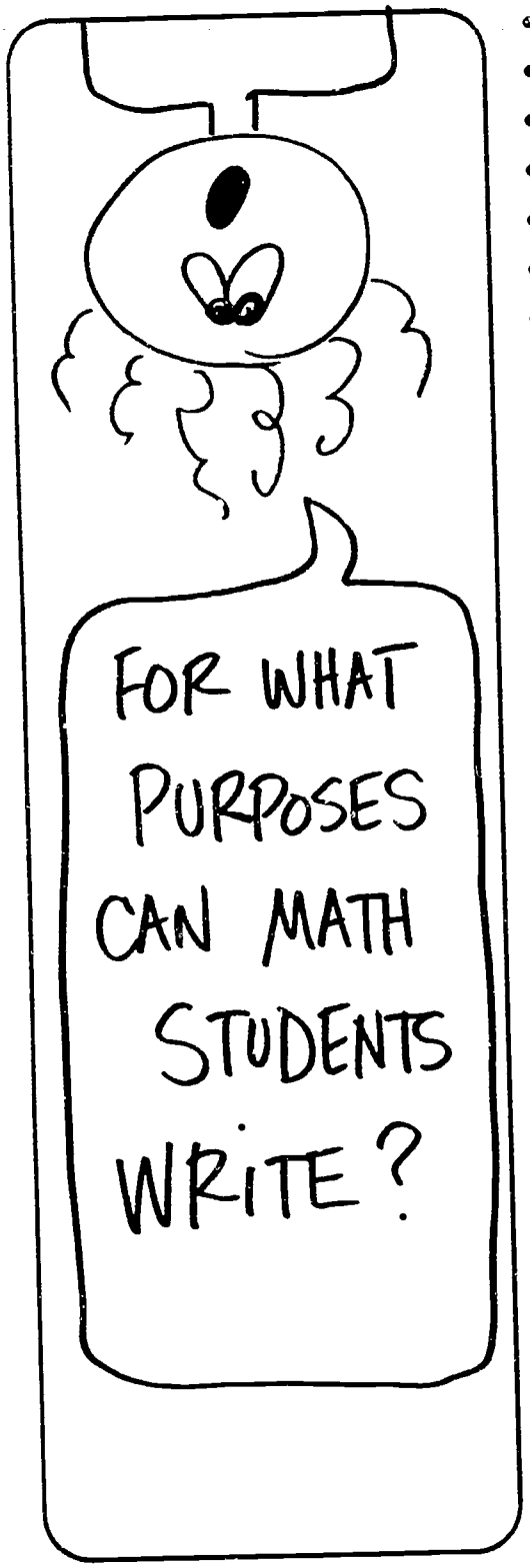
They can also write others to explain what they know or to help them understand math better. These other people could be:

- friends
- classmates
- parents
- grandparents
- siblings
- younger children
- teachers
- community leaders
- fictional characters.



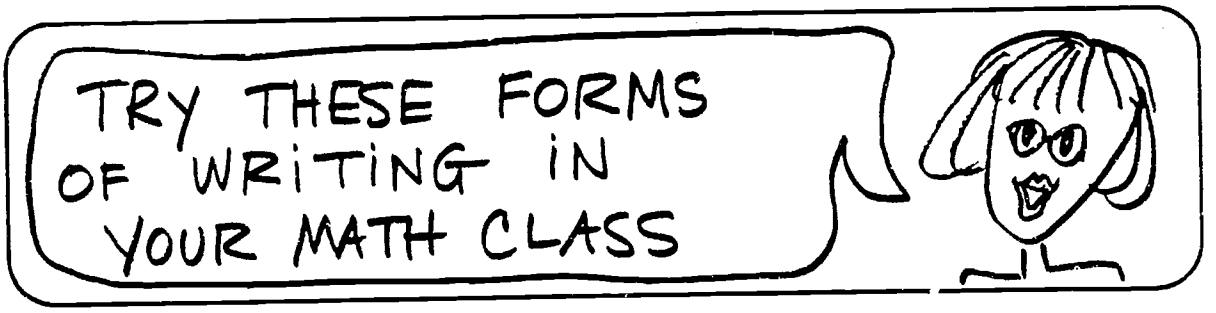
"Students must be able to discuss mathematics, to conjecture, to test and debate the validity of conjectures, for without communication, we are lost. In oral and written communications, a student should be able to discuss alternatives for solutions and strategies. They should be able to formulate problems, relate math to other subjects, for mathematics is not the only subject being pursued."

Bettye Allen, Chairperson, Department of Mathematical Science, Alcorn State University, 1988
Proceedings of the Symposium: Math Matters, p. 55.



- To explain how they solved a problem
- To record information or observations
- To predict solutions or events
- To inform others
- To persuade others
- To review what they have learned or done
- To create something new
- To analyze data or shapes
- To imagine possibilities
- To describe shapes, sizes, events, processes, solutions, or difficulties
- To express personal feelings
- To entertain others
- To solve problems
- To predict outcomes or unknowns
- To estimate cost, size, processes, or solutions
- To evaluate alternatives
- To compare sizes, shapes, weight, alternatives, or predictions
- To interpret visual material
- To give directions
- To summarize what they have learned or done
- To plan how to solve a problem
- To clarify thinking or feelings
- To draw upon memory
- To explore possibilities
- To discover information, processes, or alternatives
- To ask questions
- To pose problems
- To reflect on problem-solving processes

"All students need extensive experience listening to, reading about, writing about, speaking about, reflecting on, and demonstrating mathematical ideas."
NCTM, *Curriculum and Evaluation Standards*, p. 140.



Advertisements
Advice
Brainstorming
Bumper sticker
Captions for illustrations
Charts
Decisions
Descriptions
Dialogues
Diaries
Directions
Expense itemization defense
Freewriting
Impromptu writing
Interviews
Jokes
Journals
Labels
Learning logs
Letters
Lists
Newspaper article
Newscast
Notes
Observations
Personal experiences
Poems
Poster
Public notice
Projects
Questions
Reports
Research project
Rhymes
Riddle
Self evaluations
Ship's log
Songs
Specifications
Stories
Summaries
Surveys
Word maps, webs, or charts
Word problems

"Representing, talking, listening, writing, and reading are key communication skills and should be viewed as integral parts of the mathematics curriculum."
NCTM, *Curriculum and Evaluation Standards*, p. 27.

WHAT DO I DO WITH STUDENTS' WRITING?

Display students' writing on the bulletin board and in hallways and libraries. Ask students to read their writing aloud to other students. Their writing may help others, especially students who have been absent or who are having trouble understanding a particular concept. Have students keep a collection of their writing in a notebook, scrapbook, or folder. Students can use the collection to reflect on what they have learned and to set new goals for learning. Parents will also enjoy seeing a showcase of their children's work.

Invite school personnel to visit the classrooms to listen to students read what they have written. Encourage students to read their works to their parents or siblings. Read students' writing at parents' meetings. Talk with community leaders about posting students' writing in offices, libraries, or store windows. Show students that writing counts!

HOW DO I GRADE STUDENTS' WRITING?

You do not have to grade everything your students write. Students should write much more than you grade. Use writing as a tool for learning and discovery as well as for evaluation. You can still hold students accountable for writing without grading every single piece.

Talk with students about what makes for good writing. Let them help develop criteria for evaluating writing. As you discuss what makes for clear communication, consider the quality of the ideas expressed, their detail and organization. You can talk about some things that interfere with clear communication, such as problems with punctuation, spelling, grammar usage, or information missing or out of order.

Give them time to read other students' work. Have them read their writing aloud to help them find communication problems. Let them help each other proofread and edit their papers before handing them in to you for a grade. You will get better papers and they will be improving their writing skills.

When you do want to use writing for evaluation purposes, give students time to revise their work before you grade it so it reflects their best efforts. Have students collect their writing in folders, and let them select their best work to revise and turn in for a grade.

Students' writing reveals their understanding as well as their misunderstanding. Their writing indicates what they need to spend more time on or what they are confused about.

Students' writing also shows how well you, the teacher, have communicated mathematical concepts. If several students express a similar misunderstanding, you will have a better idea of what they don't understand, why they are confused, and what you can do to clarify their thinking.

By reading students' writing, you can also discover attitudes toward math that help or hinder their success. If attitude is a problem, provide extra attention and activities that will help the student grow to view math more positively.

"Students could be encouraged to keep journals describing their mathematical experiences, including reflections on their problem-solving thought processes. Journal writing also can help students clarify feelings about mathematics or about a particular experience or activity in a mathematics classroom. These activities can foster students' positive attitudes about mathematics, particularly if the journal entries are accompanied by discussions about any negative feelings and ways to deal with unpleasant experiences." NCTM, *Curriculum and Evaluation Standards*, p. 142.

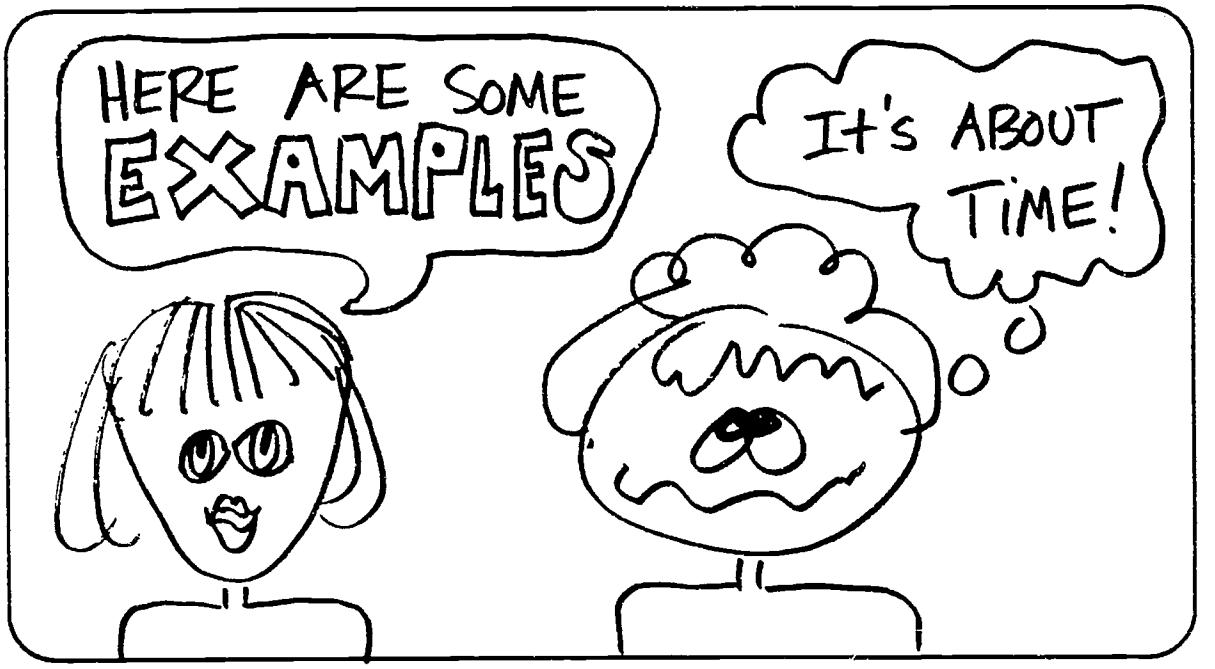
Be positive and encouraging. Nothing discourages writers any faster than too much criticism. Give honest praise as well as suggestions for improvement.

Give students an opportunity to handle mathematical objects, such as counters and other manipulatives as part of brainstorming and prewriting. Let them draw. Encourage them to anticipate questions a reader would ask. Help them consider questions of who, what, when, where, why, and how. Lead them into writing by making lists of key words and phrases. Give plenty of time for brainstorming and prewriting.

While students are writing, move around the room talking briefly with students about their writing and any problems they are having expressing their ideas. Ask them how their work is going or what their main idea is. Brief conversation with the student about a piece often has a more powerful effect on improving writing than does marking errors.

On first drafts, respond to their ideas. Limit your comments to issues of content. On later drafts, nudge them to proofread and edit their work. Have students read their writing aloud to other students in small groups. Oftentimes, when they hear the sound of their own words, they recognize problems that interfere with clear communication.

"Writing is an active, messy process. That's true even of good writers. One becomes a better writer by being active, by outlining, by prewriting, by summarizing, by struggling, by rewriting."
John Garner, Tougaloo College, 1988, *Proceedings of the Symposium: Math Matters*, p. 85.



Assignment: Explain how to find the difference in 3/4 and 1/6.

Sample responses:

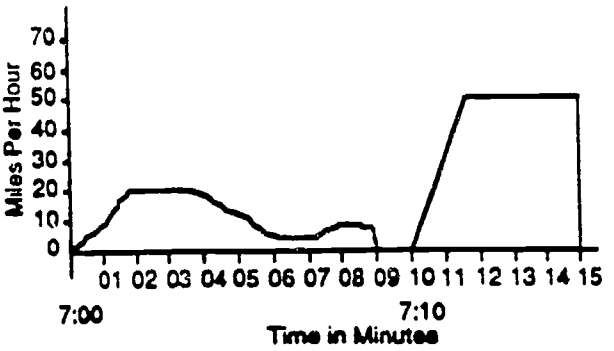
Response 1: First you have to have common denominators. To do this you have to change each fraction so that they both have twelve as their denominator. Three-fourths is the same as nine-twelfths (multiply the numerator and the denominator by three since four times three is twelve.) One-sixth is the same as two-twelfths (multiply the numerator and the denominator by two since six times two is twelve.) The problem is now nine-twelfths minus two-twelfths (difference means to subtract). Nine minus two is seven. So the answer is seven-twelfths. When adding and subtracting fractions, you should not change the denominator.

Response 2: I don't like fractions! They confuse me. You said to get the same number on the bottom of each fraction first. I choose 24 as my common denominator. I'm gonna multiply the top of the first fraction by the bottom of the second one and I get 18 over 24. I'm gonna multiply the top of the second fraction by the bottom of the first one and I get 4 over 24. I thought this was a subtraction problem and all we've done so far is multiply. Now I subtract. 18-4 is 14. So my answer is 14 over 24.

Response 3: Subtract the top numbers and get 2. Subtract the bottom numbers and get 2. The answer is 2/2 = 1.

Response 4: I know that you have to multiply and subtract. I don't know what to do first. HELP!!!!!

Assignment: Write a story to interpret the following graph.



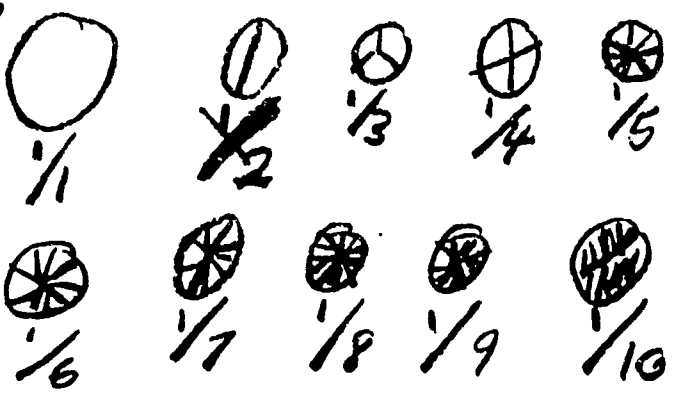
Sample response:

It was right before the road race was going to start. It was 7:00 p.m. when the gun went off. I took off doing 10 m.p.h. and then I sped up to 20 for two minutes. After the two minutes passed a guy pulled in front of me and I slowed down to 10 m.p.h. Then he slowed down to 5 m.p.h. and he stayed that way for two minutes. After that he got up to 10 m.p.h., and then he stoped. I didn't know what was going on until I heard sireans. I saw that it was my friends car. I looked at my watch it was 7:09. At 7:10 the ambulance took off doing 60 m.p.h. I followed him for 5 minutes then the ambulance turned and hit another car head on. Luckily my friend didn't die, but he did brake both arms and 1 leg.
By Jon, fifth grade student of Peggy Morgan in Martin, Tennessee
Used with permission by Mike Taylor, University of Tennessee Martin

Assignment: Explain what you learned today.

Sample response: Casey Manda

Fractions are very importer d, use them a lot. I lernd about fractions and how they woork I know all about then I know wich is biger and/or orsmller One half is bige then One forth

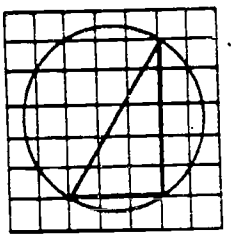


From "Learning to Write about Mathematics," by Sandra Wilde, *Arithmetic Teacher*, Feb. 1991, p. 38.

Assignment: Write your strategy for determining how many Kit-kat wrappers would be needed to cover a particular wall at home.

Assignment: Explain why you do or don't like math.

Assignment: Imagine you are talking to a student in your class on the telephone and want the student to draw some figures. The other student cannot see the figures. Write a set of directions so that the other student can draw the figure and graph exactly as shown in the figure.



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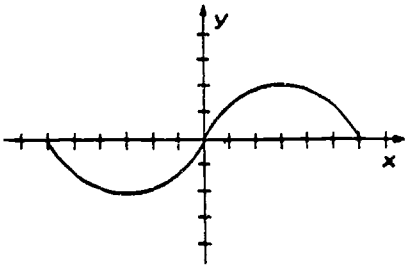


(b)

NCTM, *Curriculum & Evaluation Standards*, p. 217.

Assignment: You are considering purchasing one of two cars, both four years old. One car costs $3000 and gets 20 miles a gallon. The other costs $4500 and gets 35 miles a gallon. Which car is the best buy if you plan to keep it two years? What additional information do you need to answer these questions?

NCTM, *Curriculum & Evaluation Standards*, p. 212.

Assignment: Write a letter to a friend about something you learned in math class.

Sample response:

Dear Jane,
Guess what I did in school this week? We made a model of our room. It was in math class. Our group was Harry, George, and Maria and me. We decided to make a real model. Mrs. Little showed us how to make things out of paper--desks, tables, and stuff. I made teacher's desk. I had to measure it with a ruler. I used centimeters.

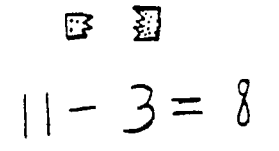
NCTM, *Curriculum & Evaluation Standards*, p. 28.

Assignment: Write a story or word problem to go along with this equation:
20% of 80 = $16.

Assignment: Draw a plan of your classroom. Measure the dimensions. What is the area? What is the perimeter? Did you make any surprising discoveries by doing this? What if our room was half its present size? What would it look like?

Assignment: Write a story or word problem to go along with this equation:
11 - 3 = 8.

Sample response:



R.C. had 11. chickenpox. He picked 3 off. How many more are Left?

From "Learning to Write about Mathematics," by Sandra Wilde, *Arithmetic Teacher*, Feb. 1991, p. 41.

Assignment: Explain the process you used to work this problem:

$$\begin{array}{r} .7 \\ .8 \\ \hline 1.5 \end{array}$$

Assignment: Explain why .8 + .4 is 1.2 and not .12.

Assignment: Explain what you had trouble with in working your homework.

Assignment: Explain what is wrong with this problem:
.9 + .2 = .11

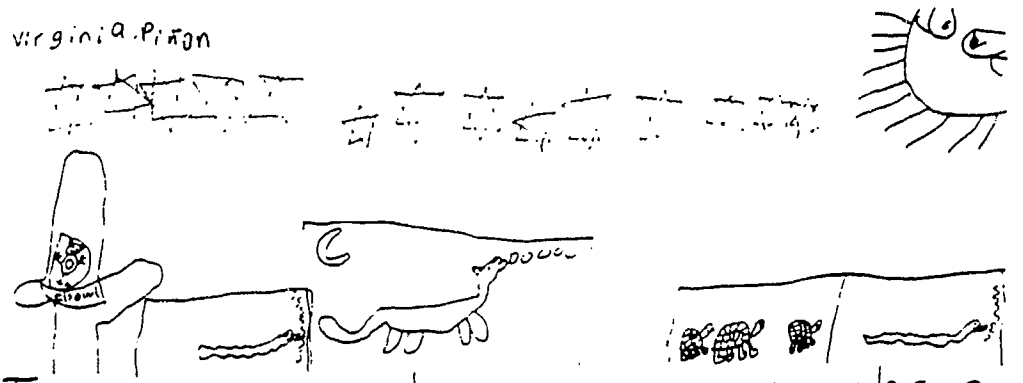
Assignment: Write down what you don't understand about our lesson today.

Sample response:

What are Venn diagrams for? I don't understand what they could be used for.

Assignment: Tell an oral story about what you've seen or done recently. Write the story in mathematical terms. Then write your story and illustrate it.

Sample response:



From "Learning to Write about Mathematics," by Sandra Wilde, *Arithmetic Teacher*, Feb. 1991, p. 42.

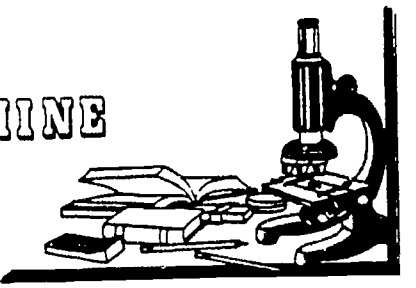
Assignment: Use this information to make up a problem. You have this amount of change: 8 pennies, 5 nickels, 11 dimes, and 5 quarters. These items are for sale: a box of cereal for $1.60, a glass of milk for 40¢, a poster for 90¢, and one ball for $1.20.

NCTM, *Curriculum & Evalution Standards*, p. 210.

Assignment: Explain how to divide fractions.

Sample response:

I'D LIKE TO EXAMINE YOUR THINKING



Explain how to divide fractions:

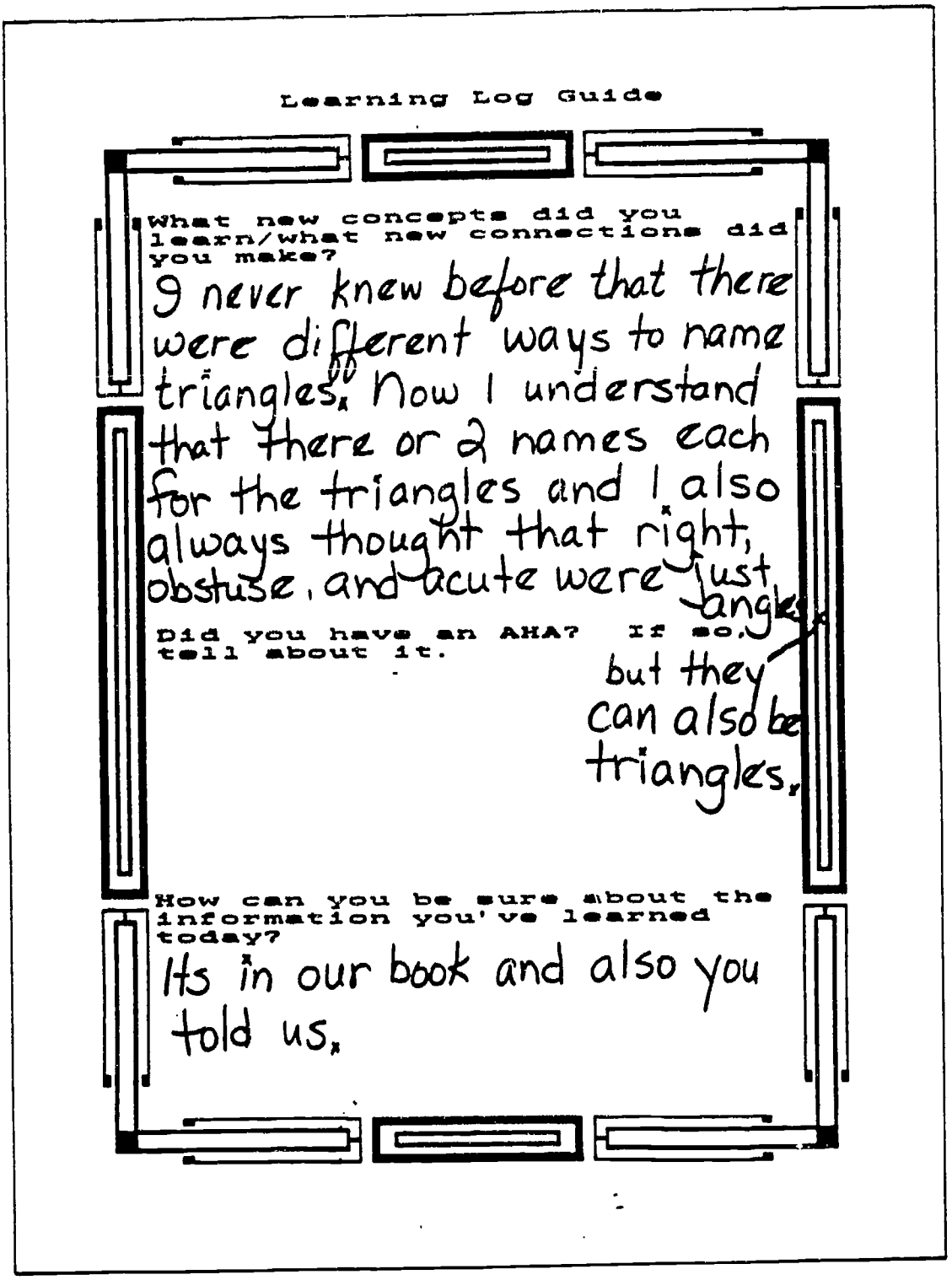
First you write it down. Next you flip the second fractions, ($\frac{2}{7}$ would become $\frac{7}{2}$) then you cross-cancel if you can, then if it's a number that can be reduced ($\frac{2}{20}=\frac{1}{5}$) reduce it. You reduce it by finding a number that goes into both ($\frac{2}{8}=\frac{1}{4}$ because 2 goes into 2 and 8). Then you write your answer.

($\frac{1}{4}\times\frac{1}{2}=\frac{1}{4}$)

From "No Time for Writing in Your Class?" by Margaret E. McIntosh, *Mathematics Teacher*, Sept. 1991, p. 429.

Assignment: Write what new concept you have learned today, or what you have come to understand.

Sample response:



Learning Log Guide

What new concepts did you learn/what new connections did you make?

I never knew before that there were different ways to name triangles. Now I understand that there or 2 names each for the triangles and I also always thought that right, obstuse, and acute were just angles but they can also be triangles.

Did you have an AHA? If so, tell about it.

How can you be sure about the information you've learned today?

Its in our book and also you told us.

From "No Time for Writing in Your Class?" by Margaret E. McIntosh, *Mathematics Teacher*, Sept. 1991, p. 427.

Sample response:

Now I understand how you measure how big a triangle is. I also understand how if you have three sides with the same length is an equilateral. And if something measures less than 90° it's acute. & if it's more than 90° it's obtuse! I also learned that you can give two names for a triangle! If at least two sides have the same length it's isosceles. It's a scalene triangle if all three sides are different. I had also learned many other things too!

Becky H.

From "No Time for Writing in Your Class?" by Margaret E. McIntosh, *Mathematics Teacher*, Sept. 1991, p. 425.

Assignment: Write how you think you did on the test.

Sample response:

How do you think you did?

I think I missed about 8 or 9 questions be cause I was really tired and did not feel like taking a test. So I think I missed them because I was aggravated! The reason why I think I missed that many is because I got like 6 NON given ones in a row.

John S.

From "No Time for Writing in Your Class?" by Margaret E. McIntosh, *Mathematics Teacher*, Sept. 1991, p. 426.

Assignment: Explain how you study for tests.

Explain how you study for tests.

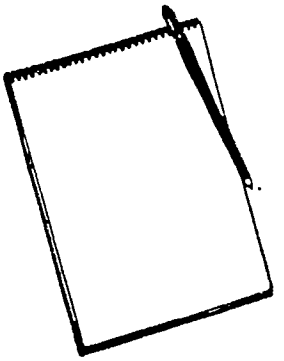
For math Tests you can't study for them like other subjects. Because in other subjects you can just memorize the questions. I usually don't study for math tests but if I did I'd just do a few pages of work thats going to be on the test.

John S.

From "No Time for Writing in Your Class?" by Margaret E. McIntosh, *Mathematics Teacher*, Sept. 1991, p. 426.

Assignment: Explain to students who are absent what we studied in class today.

Sample response:



EXPLAIN IT TO ME

Polygons are named on how many sides they have the names came from latin words. thats how polygons are named.

One sided and 2 sided fgures are not polygons because they dont conect.

(1) triangle has 3 sides
(2) qua means 4 so its quadrilateral
(3) penta means 5 so its pentagon
(4) hexa means 6 so its hexagon
(5) hepta means 7 so its heptagon
(6) octa means 8 so its octagon
(7) nona means 9 so it is nonagon
(8) deca mean 10 so its decagon
(9) gon means sides

From "No Time for Writing in Your Class?" by Margaret E. McIntosh, *Mathematics Teacher*, Sept. 1991, p. 428.

Assignment: Use this information to make up a problem: monthly salary $900, rent $200, food $180, car payment $150, gasoline $50, car insurance $40, telephone $40, and utilities $140 Explain what is done with the money left over from monthly expenses. As part of this activity, write a check to pay one of the expenses.

Assignment: This is the beginning of a new school year (or unit or semester). Write what your goals are for this class, what you expect to learn, and what grade you predict you'll earn.

Assignment: For each problem you missed on a test, explain why you missed it.

Assignment: Write a poem using as many mathematical terms as possible.

Sample responses:

A Mathematical Valentine

You distintegrate my differential,
You dislocate my focus
My pulse goes up like an exponential
Whenever you cross my locus
Without you, sets are null and void --
So won't you be my cardioid?

anonymous

A Rap

I made Algebra my course
It was my choice
I always listen
To the teacher's voice

Once I was toss and loss
The teacher gave me aid
And when I tried real hard
I made an A for a grade

So it can be done
You just got to do it
Open up a math book
And put your mind to it

I'm saying this rhyme
So you can have hope
So in any situation
You will try to cope.

By Patrick Gladney
Clinton High School, 1987

Assignment: Think of as many ways as you can to solve this problem: $3(x + 5) = 36$. Write your explanations and suggest the best way for you.

Assignment: Draw a vertical line down one-half of your writing paper. On the right side, write how to find the area of a room 21 feet by 14 feet. On the left side tell whether this problem was easy or hard for you and why and also tell how areas are used in the world beyond the classroom.

Assignment: Keep a problem-solving journal. You may record interesting problems, describe what strategies you used or thought about, explain how you verified solutions, identify similar or related problems, or record problems posed by other students.

JOURNAL

1. **WHO** should write in your journal?

   You should.

2. **WHAT** should you write in your journal?

   New words or new ideas or new formulas or new concepts you've learned
   Profound thoughts you've had
   Wonderings, musings, problems to solve
   Reflections on the class
   Questions—both answerable and unanswerable
   Writing ideas

3. **WHEN** should you write in your journal?

   After class each day
   As you are preparing, reading, or studying for class
   Anytime an insight or question hits you

4. **WHERE** should you write in your journal?

   Anywhere—so keep it with you when possible.

5. **WHY** should you write in your journal?

   *It will record ideas that you might otherwise forget.
   *It will be worthwhile for you to read later on so that you can note your growth.
   *It will facilitate your learning, problem solving, writing, reading, and discussion in this class.

6. **HOW** should you write in your journal?

   In wonderful, long, flowing sentences with perfect punctuation and perfect spelling and in perfect handwriting
   Or in single words that express your ideas, in short phrases, in sketches, in numbers, in maps, in diagrams, in sentences

Sample response:

Student's journal entry: When it comes to tests, I get everything backwards. And I guess on a lot of the answer's. Who know's. I might of did OK. But if I study before a test I usually do alright. You study by practicing what we already did.

Teacher's reply: What would you do differently if you could take the test again? And, what could I do that would help you do better?

From "No Time for Writing in Your Class?" by Margaret E. McIntosh, *Mathematics Teacher*, Sept. 1991, p. 430-431.

Writing + Mathematics = Learning

We hope this equation will be helpful!!!