

starting points for using

mathematics journals



“

We record our thought processes and how we've changed our thinking in our journals. Contradictions in reasoning that go against ideas I believe frequently pop up, and questions are raised that set me up for new discoveries.

— Mathematics Student

”

Starting Points for Using Mathematics Journals

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Starting Points for Using

Mathematics Journals

By Linda Cooper Foreman

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 Standards

The suggestions that follow provide starting points for organizing and implementing the Student Journal Masters from The Math Learning Center. These suggestions are based on our classroom experiences and reports we have received from other teachers. We hope reading about these ideas will provoke questions, new thoughts, and discussions as you design your own strategies for implementing journals. We also hope that you will contact us regarding successful ways that you adapt our suggestions.

■ Journal Contents and Purposes

Following are the contents and purposes of the Student Journal Masters. We encourage you to adapt these ideas to meet your needs.

Title Page This opening page of the journal is designed by each student at the end of the year and contains the student's title for the journal, and the date and location of "publication."

About the Mathematician–Author, Beginning of the Year Each student completes this brief mathematical autobiography at the start of the year.

About The Mathematician–Author

About the Mathematician–Author
Beginning of the Year

About the Mathematician–Author, End of the Year This two page entry is completed by each student at the end of the year and emphasizes special aspects of the student's mathematical growth during the year.

About The Mathematician–Author

About the Mathematician–Author
End of the Year

Table of Contents These five pages reference important mathematical moments and evidence of mathematical growth that are documented in the journal. The student completes this list at the end of the year, giving a descriptive title and page number for each journal entry they wish to highlight.

Table of Contents

Table of Contents (Complete at end of year)
Important Mathematical Moments

Preface This two page introduction is completed at the end of the year. It previews the journal contents, special features, and strengths of the journal. A few specific examples are cited as illustrations.

Preface

Preface (Complete at end of year)

Goals for Learning Mathematics These are our classroom goals, which provide the basis for many journal entries during the year. You may wish to add to the list, have your students add to the list, or replace the list based on your classroom goals.

Goals for Learning Mathematics

Goals for Learning Mathematics

We are a community of mathematicians working together to develop our:

- a) visual thinking,
- b) concept understanding,
- c) reasoning and problem solving,
- d) ability to invent procedures and make generalizations,
- e) mathematical communication,
- f) openness to new ideas and varied approaches,
- g) self-esteem and self-confidence,
- h) joy in learning and doing mathematics.

A Philosophy About Learning Mathematics These provide the philosophical basis for all math activities in our classrooms. Many journal entries throughout the year focus on these ideas.

Learning Mathematics

A PHILOSOPHY ABOUT Learning Mathematics

There is a mathematician within each of us.

Experiences with models for math concepts help us understand, invent and remember important math ideas.

Learning math is a social activity.

Learning math is an ongoing process of knowledge construction.

"Disequilibrium" is a sign of new learning.

Mathematics is a fascinating world of its own.

The world of mathematics connects to many other worlds.

“ Each student's journal is different, as a journal is a place for records of personal struggles, discoveries, and insights that help illustrate what we have been working on in class.

— Mathematics Student

”

Opening Journal Entry This entry is completed on the first day that journals are used in class.

Opening Journal Entry

Opening Journal Entry

DATE _____

This journal will help tell the story of my journey through mathematics this year. In it I will:

- describe the mathematics I explore, invent, and discover;
- celebrate my struggles and successes;
- keep track of my questions;
- pay attention to ways my understanding is growing and ways I am growing as a learner;
- explain my thinking as a way to help myself make sense of an idea or to help me identify my questions;
- wonder about, challenge, and experiment with ideas.

Some thoughts (hopes, worries, questions, ideas, etc.) I have as I begin this journey are...

Blank Grid Paper Students make daily entries, in and out of class, in this 137 page section of the journal. You may wish to increase or decrease the number of pages in this section, based on your plans.

What to Emphasize in Your Journal This gives students information about the qualities the teacher looks for when reviewing journals. Edit this to include criteria that you will emphasize when you assess their journals.

What to Emphasize in Your Journal

What to Emphasize in Your Journal

When you write in your journal, remember to record the problem or question you are writing about so that your entry will make sense when you or your teacher reads it later. Be sure to date each journal entry. Emphasize the following in your journal entries:

- mathematical communication (describe your understanding of concepts and your methods or ideas in words, diagrams, and math symbols)
- mathematical reasoning (whenever possible, support your ideas with logical arguments)
- your own solutions to math problems and ideas you get from others
- your conjectures and generalizations
- your AHA!s and "lightbulb" moments
- your feelings (joy, disequilibrium, excitement, confidence, worries, etc.)
- your questions and math ideas you wonder about
- ways your thinking about a math concept or procedure has changed
- connections you notice among math ideas, between math and other subjects, and between math and your life outside of school

Regularly review your journal. When you do this, write a new journal entry describing the mathematical growth, strengths, and needs you notice.

It is important *not* to erase a journal entry, even if you feel what you wrote before is wrong. Instead, show growth by adding new ideas (write the date that you make the addition). Or, on another page describe how your thinking has changed.

Mathematics Journal / Page _____

Thought Starters I–IV These are intended to motivate thoughtful journal entries by students. Sometimes the teacher assigns thought starters from these lists; sometimes students choose from the lists; and frequently class activities and discussions prompt other journal entries.

Thought Starters

Thought Starters I

- a) Today I felt my inner mathematician at work when...
- b) Today I experienced the power of a model when...
- c) Today I felt the importance of math as a social activity when...
- d) Math is an ongoing process! Today I developed a better understanding of..., when...
- e) Math is an ongoing process! Today I learned for the first time that...
- f) I felt disequilibrium today when...
- g) A mathematical idea that fascinated me today was...
- h) Today I saw a connection between _____ and _____ when...
- i) A math problem I'm working on (or wondering about) is..., and here is my reasoning so far...
- j) I think...
- k) I wonder...
- l) AHA!...
- m) What if...
- n) A conjecture I have is...
- o) A generalization I have is..., and here is how I decided...
- p) A questions I have is...
- q) Here is where I became "stuck" today...
- r) What happened to help me get "unstuck" was...

Page _____ / Mathematics Journal

Thought Starters

Thought Starters II

- a) In my own words the meaning of _____ is...
- b) A relationship, idea or fact about _____ that I didn't know before or now understand better is... What happened to help me understand was...
- c) Some mathematical patterns or relationships I noticed today are...
- d) A discovery I made today about myself as a mathematician is...
- e) A discovery I made today about mathematics is...
- f) The method of _____ that I feel least/most confident with is..., because...
- g) How I feel about solving _____ problems is...
- h) Here is how I use a model to...
- i) What is most important to understand about _____ is...
- j) Here is my letter to a classmate who could not attend class today. In my letter I explain the class activity so that she can understand what she missed and have benefit of the discussions and observations that occurred in class. I show diagrams or sketches to support my explanations.
- k) Here is a multiple choice question I created about _____ and my explanation of how each of the wrong answers could be considered logical:
- l) Here is how I think _____ and _____ are related and how they are different...
- m) The images that come to mind when I think about _____ are...
- n) Here are two different approaches to solving _____:
- o) Reflecting on today's activity, I am pleased that I...
- p) What I learned today by exploring another student's model was...

Mathematics Journal / Page _____

Thought Starters I–IV (cont.)

Thought Starters

Thought Starters III

- a) After teaching an adult about _____, using models and methods like those we used in class, here is my explanation of what I did, their reactions, and what I learned during the process:
- b) Here is my “mathography” in which I describe my feelings about and experiences in mathematics, both in and out of school...
- c) How I feel about mathematics now as compared to before I took this class...
- d) Following is my letter to a student who will be enrolling in this class for the first time next year. In it I offer suggestions that will make the transition into the class smooth, erase doubts, or provide encouragement so that student can benefit the very most from the class.
- e) What I feel is the single most important math idea I learned this term... and why I feel this way is...
- f) Looking back through my journal, I notice the following evidence that my understanding of the concept of _____ is developing:
- g) After looking back through my journal, I notice I used to think that..., but now I think...
- h) The area I need most help with right now is...
- i) On a scale of 1–5, the rating that best describes my understanding of _____ is _____ because...

Page _____ / Mathematics Journal

Thought Starters

Thought Starters IV

- a) When I work with a group I feel...
- b) Next time I work on a group investigation I will...
- c) When I worked with my group today I was pleased with the way that I...
- d) Ways my group participation was appropriate and helpful today are...
- e) Related to being a good collaborator, what I need the most help with now is...
- f) What is hardest/easiest for me about working in small groups is...
- g) Some ways that I have grown as a collaborator this year are...
- h) Here is a paragraph explaining how I plan to improve my mathematical communication:
- i) If I could change one thing about the way I interact with my group, it would be..., because...
- j) An example of a way that I built on a classmate’s idea today is...
- k) An example of one of my groupmates building on an idea of mine is...
- l) Our groupwork today helped me understand better when...
- m) My group could improve in the following ways:
- n) My group made mathematical connections today when...
- o) As a group, here are some ways we have grown as collaborators...
- p) The two most important mathematical ideas we learned today are:
- q) The quality of communication in our group has improved in the following ways:
- r) To be a better functioning group, I think we need to...
- s) The strengths of our group are...

Mathematics Journal / Page _____

Colored dividers Including blank colored sheets in the journal, as shown in the Student Journal Masters, helps students find journal sections more easily. Students may also find book marks and snap-in rulers from daily planners convenient for marking their most recent entry or daily report.

■ Journaling Procedures

Journal entries are frequently assigned by us and many are initiated by the students. The journaling process helps students trace and clarify their mathematical thinking and questions, and helps us understand the development of each student’s thinking and engagement in the mathematical process. Students write in their journals during class activities and at home. Journal entries include:

- their self-initiated reflections about important mathematical moments during class and at home;
- their explorations or drafts of ideas for homework problems;
- their responses to thought starters or questions posed by us which are based on ideas that come up during class activities or assigned from Thought Starters I–IV.

If students are unfamiliar with the use of journals, we set aside at least 5 minutes of class time each day during the first 2–3 weeks of the school year for journaling in response to specific thought starters posed by us (from the lists in the back of the journal or based on an idea that comes up in class). During these first 2–3 weeks, we also ask that students make at least three at-home journal entries each week in response to specific thought starters or problems posed by us. For the next 1–2 weeks, we allow 5 minutes of free-write (they pick the topic or thought starter) time in class each day and require at least

three additional free-write entries at home. After that, we periodically pose thought starters or problems, and we expect students to make a minimum of four thoughtful entries each week.

Although we want to encourage students to reflect on their feelings about mathematics and to reflect on the development of their attitudes toward mathematics, sometimes it is necessary to require a minimum number of entries that focus on the "meat" of the mathematics they are exploring in class. Another way to keep emphasis on students' mathematical thinking is to assign a specific problem or thought starter related to a math idea.

Journals provide a convenient place for students to gather their thoughts and respond to questions and ideas that come up "on the spot" in class. On those occasions when an activity has not been completed in class and hence, students are not ready to begin work on a homework assignment you have prepared, journals provide a setting for students to reflect on the development of ideas so far.

We find it helpful to keep a class poster that documents (including dates) all journal assignments.

■ Daily Reports

Daily Reports serve several purposes: to encourage students to keep track of and reflect about their daily assignments; to assure students a chance each day to privately tell us about their needs and accomplishments; and to enable us to get a quick sense of the needs and progress of the class as a whole.

Following is one way that we quickly spot check Daily Reports for questions and concerns: At the end of class on Monday, for example, students record the assignment, and then prior to class on Tuesday, they complete their homework and the rest of Monday's Daily Report. At the start of class on Tuesday, students open their journals to Monday's Daily Report. Throughout the class period, we randomly review these as we circulate around the classroom to look for any pressing questions or issues to address during class. Students can call our attention to special questions at this time. Notice the overall quality of Daily Reports is assessed on the Journal Self-Assessment form (see page 8).

■ Journal Assessment and Feedback

In the beginning, you may wish to collect journals every 2–3 weeks to provide encouragement for the journaling process. As students become more comfortable with the process, we collect journals only at the middle and end of each grading period. Prior to collecting journals for review by us, we distribute blank Journal Self-Assessment forms (see page 8) for the students to complete. Notice that this form requires students to code each entry with one or more of the letters A–J to indicate the emphasis of the entry. Each time the students complete a Journal Self-Assessment, we ask them to tape it in their journals following their most recent entry.

“

I use my journal as a place to assess my growth. I use this information to assess which areas I'm more comfortable with and which areas I should try to expand on.

– Mathematics Student

”

“ Our journals and the mathematical content in them has definitely helped us to become much stronger mathematicians.

– Mathematics student

Journal Self-Assessment		Journal Self-Assessment	
Journal Self-Assessment		Week of	Dates of ALL Entries
Mark one or more of the letters A–J next to entries in your journal that show evidence of:		Quality of Each Entry 1 2 3 4 5	
A Mathematical communication	Number of entries marked		
B Mathematical reasoning			
C My own solutions and ideas I get from others			
D Conjectures and generalizations			
E AHA!s and lightbulb / moments			
F Explanations of my joy, disequilibrium, excitement, confidence, worries, what helps me, etc...			
G My questions and math ideas I wonder about			
H How my thinking about a math idea has changed			
I Connections I notice			
J Self reviews of the math content in my journal			
Overall		____ Out of ____ Required Entries	Average (mean) Rating ____
Journal Self-Assessment: A B C D F			
Comments / Supporting Statements			
Teacher Assessment: A B C D F			
Comments			
Glossary (circle one)		1	2
		3	4
		5	

When we review the students' journals, we sometimes write brief comments to draw attention to specific entries. These comments:

- are non-judgmental and hence, encourage students to speak candidly,
- help students see what evidence is revealed by their statements,
- reinforce certain types of entries.

However, to encourage students' "ownership" of their journals and to avoid our becoming overwhelmed by the amount of time required, we minimize comments from us. Most of our comments are written in the Teacher Comments section of the Journal Self-Assessment form.

Some other ideas that facilitate the journal feedback process include:

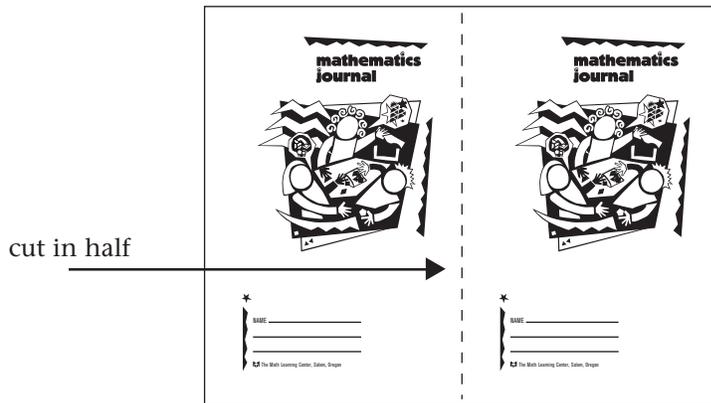
- Have students number all journal pages so it is easier to reference specific entries.
- Ask students to circle or highlight journal entries they especially want you to read (students' selections can be very telling about their views of mathematics and of themselves as mathematicians).
- Give students the option of taping paper labeled "private" over entries they prefer that you not read.
- Collect and review journals from a different class (or subgroup of a class) each week.
- Keep in mind that as journals become more useful to students, the need for teacher feedback diminishes.
- Store students' completed journals with their portfolios to use as a source of evidence of growth over time.

Journal Assembly

The Student Journal Masters packet contains masters for two student journals. You may assemble journals in the following ways:

■ Option One

The packet may be cut in half and bound to create two student journals. You may wish to copy the front cover on heavier/colored cardstock. Using a blank piece of cardstock as a back cover will make the journals more durable.

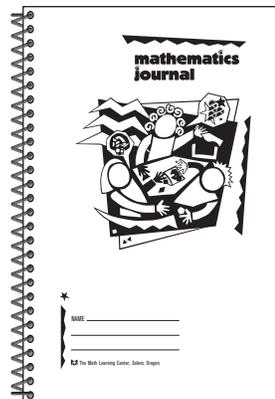


■ Option Two

The packet may be used as a blackline master to create multiple student journals. Remove the colored sheets from the packet, noting their location in the journal. Choose the 2-sided to 2-sided or duplex to duplex option on your copy machine. After copies are complete, insert colored sheets where there were colored sheets in the master packet. Each completed packet can then be cut into two journals and bound. To make your journals more durable you may wish to copy the front cover on heavier/colored cardstock and use blank cardstock as a back cover.

■ Finishing the Journal

With either option, we suggest taking the completed copies to your school's copy center or a local copy center to be cut. Journals should be bound on the left side and will measure $5\frac{1}{2}'' \times 8\frac{1}{2}''$ when finished.



Journal Self-Assessment

Mark one or more of the letters A-J next to entries in your journal that show evidence of:	Number of entries marked
A Mathematical communication	
B Mathematical reasoning	
C My own solutions and ideas I get from others	
D Conjectures and generalizations	
E AHA!'s and lightbulb / moments	
F Explanations of my joy, disequilibrium, excitement, confidence, worries, what helps me, etc...	
G My questions and math ideas I wonder about	
H How my thinking about a math idea has changed	
I Connections I notice	
J Self reviews of the math content in my journal	

Glossary (circle one)

1

2

3

4

5

Week of	Dates of ALL Entries	Quality of Each Entry 1 2 3 4 5
Overall	____ Out of ____ Required Entries	Average (mean) Rating ____
Journal Self-Assessment: A B C D F		
Comments / Supporting Statements		
Teacher Assessment: A B C D F		
Comments		

Journal Self-Assessment

Mark one or more of the letters A–J next to entries in your journal that show evidence of:	Number of entries marked
A Mathematical communication	
B Mathematical reasoning	
C My own solutions and ideas I get from others	
D Conjectures and generalizations	
E AHA!'s and lightbulb / moments	
F Explanations of my joy, disequilibrium, excitement, confidence, worries, what helps me, etc...	
G My questions and math ideas I wonder about	
H How my thinking about a math idea has changed	
I Connections I notice	
J Self reviews of the math content in my journal	

Glossary (circle one)

1

2

3

4

5

Week of	Dates of ALL Entries	Quality of Each Entry 1 2 3 4 5
Overall	____ Out of ____ Required Entries	Average (mean) Rating ____
Journal Self-Assessment: A B C D F		
Comments / Supporting Statements		
Teacher Assessment: A B C D F		
Comments		

“

We write in math journals in which we keep track of all of our mathematical thinking. Not only are they a place where we can measure our mathematical growth, but they are also a good reference tool. In a way they are like our own text books, but we make them ourselves.

– Mathematics Student

”



For more information about this or any other of
The Math Learning Center's products call 1 800 575-8130,
or visit our website at www.mathlearningcenter.org