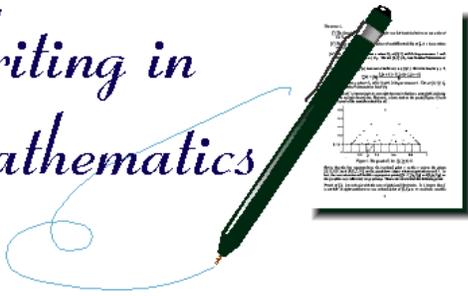




Math Journal Writing

Strategies, Prompts, and Assessments

Writing in Mathematics



Teaching Strategies for Incorporating Writing into Math Class:

Moving From Open-Ended Questions to Math Concepts

Starting Out Gently with Affective, Open-Ended Prompts

Writing about thinking is challenging. For this reason, it's best not to start out having students write about unfamiliar mathematical ideas. First get them used to writing in a math class. Begin with affective, open-ended questions about students' feelings.

- Reflect on your participation in class today and complete the following statements:
 - I learned that I...
 - I was surprised that I...
 - I noticed that I...
 - I discovered that I...
 - I was pleased that I...
- Describe how you feel about solving _____ problem.
 - Have students write a "mathography"-a paragraph or so in which they describe their feelings about and experiences in math, both in and out of school. (This is a good tool to get to know students early in the year, and to make comparisons later when looking for signs of progress.)
 - Find ways to keep students writing for the allotted time:
 - Encourage students to keep their pencils moving.
 - Use a timer. Ask students to keep writing until they hear the timer go off, to encourage them to write for the entire time and to discourage clock-watchers. Start by giving them two minutes to write, and work up to five or ten minutes at a time.

Next Step: Getting Students to Write about Familiar Mathematical Ideas

1. Once your students have become accustomed to writing about their attitudes and feelings toward mathematics in their journals, they are ready to write about simple, familiar math concepts. It is important not to make the writing too difficult by asking them to write about unfamiliar math ideas. Using writing to review familiar math ideas will increase confidence and skill in writing as well as revisit important math concepts.
 - Explain in your own words what _____ means.

- Explain what is most important to understand about _____.
2. Use student writing samples to help them refine their writing. (Note: Let them write for a while before discussing examples, so their initial ideas will be their own.)
 3. Introduce the term metacognition to help students understand the reason and audience for their writing.

Moving On: Writing about More Advanced Math Concepts

When you feel your students are ready, ask them to write about more complex mathematical ideas, including concepts being taught at their current grade level. To help you move your students into this more advanced level of writing about their thinking. Here are some other suggestions to help you:

1. Encourage your students to use drawings and graphs to explain their thinking.
- Research shows that using simple visual aids (diagrams, graphs, etc.) improves mathematical problem-solving ability.
2. As student writing progresses, ask students to write about their small group work.
- Ask the group to write a summary of how they reached a solution, including any "false starts" or "dead ends."
 - Ask each individual to write an explanation of the group's work on a problem. Have the small groups discuss the individual explanations.
- After a small group assignment, have students "explain and illustrate two different approaches to solving a problem.
3. Provide feedback.
 - Let students know you took time to read their journals.
 - Put stars by sentences that helped you see their thinking.
 - Clearly communicate to students the purpose of writing in math class.
 - Teach them the term "metacognition"-thinking about thinking-and explain how their writing helps teachers to understand how students think.
 - Other purposes of writing: Writing is a concrete way to show students' thinking that they can look at and think about. Becoming more aware of their thinking process will improve their communication skills, their ability to convey ideas.
 - Use students' writing samples to help them refine their writing.
 - Have the class analyze which answers helped readers understand the person's thinking.

Writing Opportunities in Math Class

 Justify thinking

 Argue for or against

 Defend answers

 Construct a different way to think about a topic

How and When to Use Journal Writing

1. When new material has been introduced.

- Ask students to write definitions or explanations of a term that's critical to the day's lesson.
 - Explain in your words the meaning of the term _____.

2. When the class looks disengaged or confused.

- Ask students to write an explanation of something you were doing or a term you used. Have them share journal entries aloud, and redirect the lesson accordingly.
 - Write down two questions you have about the work you are doing / the lesson we're working on.

3. When collaboration with fellow students is appropriate.

- Have students form small groups and work together to solve a problem on paper. This will get them to talk to each other-to ask questions and give explanations-all with the common goal of solving the problem.

4. When teaching the value of revising their work.

- Occasionally ask students to pick a journal entry and revise it. This helps emphasize that journal writing is an initial effort that can be rethought and improved upon-the end product is less important than the process.
 - Review the last three entries in your journal. Select one to revise. Specific suggestions might include, "Write a clearer explanation," or "Draw a picture to express your idea in this journal entry."



The Art of Questioning in Mathematics

Help Students Work Together to Make Sense of Mathematics

- ❖ What do others think about what _____ said?
- ❖ Do you agree? Disagree? Why or why not?
- ❖ Does anyone have the same answer but a different way to explain it?
- ❖ Can you convince the rest of us?

Help Students to Rely More on Themselves to Determine if Something is Correct

- ❖ Why do you think that?
- ❖ How did you reach that conclusion?
- ❖ Does that make sense?
- ❖ Could you show us how you figured that out?

Help Students Learn to Reason Mathematically

- ❖ Does that always work? Why or why not?
- ❖ Can you think of another example?
- ❖ How could you prove that?

Help Students Learn to Conjecture, Invent, and Solve Problems

- ❖ What would happen if _____?
- ❖ Do you see a pattern?
- ❖ Can you predict the next one? The last one?
- ❖ What is alike and what is different about your method of solution and _____'s method?

Help Students to Connect Mathematics, its Ideas, and its Applications

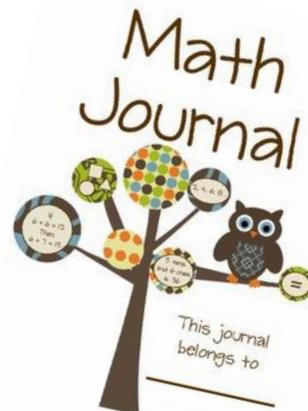
- ❖ *How does that relate to _____?*
- ❖ *What have we learned before that was helpful in solving this problem?*
- ❖ *Can you give an example of _____?*
- ❖ *Pinpoint a confusing or easily misunderstood mathematical idea (for example: Do 0.2 and 0.020 equal the same fraction? Explain your answer.).*

Help Students to Clarify their Thinking

- ❖ *What do you do first?*
- ❖ *Why?*
- ❖ *Can you describe your solution?*
- ❖ *Do you see any patterns?*
- ❖ *Is there more than one way to solve the problem?*

Math Journaling Prompts

Students should always have a clear, well-defined purpose for writing in their math journals. They need to know exactly what to write about and who the audience is, and they should be given a definite time frame within which to write. Here are some suggestions for prompts to get students thinking; however, the possibilities are endless.



Concepts and Problem Solving Prompts

- Write an explanation about why _____ is the same as _____.
- Explain to a student in grade _____ (or who was absent yesterday) what you learned today about _____.
- What about the math we did today was easy? What has challenging? What do you still have questions about?
- If you got stuck with solving the problem today, where did you get stuck? Why do you think that part was tricky for you? If you did not get stuck, what idea helped you solve the problem?
- After you arrived at a solution today, what did you do so that you were convinced your answer was correct? How are you sure your answer is correct?
- How could you prove that your answer is correct to the rest of the class?
- Using diagrams and sketches show your thinking to this point about _____?

Affective Prompts

- I think the answer is _____; I think this because _____.
- What I like most (or least) about mathematics is _____.
- Write a “mathography.” Tell about your experiences in mathematics outside of school and how you feel about the subject.
- Mathematics is like (a) _____ because _____.
- Write to an imaginary friend who is the same age as you, telling how you feel about what we did in mathematics this week.

Genuine Questions

Following are some examples of questions for individuals or small groups that can be adapted to any topic or problem by filling in the blanks. The purpose of these questions is to elicit student thinking. They can be used as the basis for oral or written discussion.

- What do you think?
- How would you explain _____ to a student who doesn't understand?
- Could you explain _____ in another way?
- How can you be sure that _____?
- Can you explain your reasoning?
- Can you draw a picture or build a model to illustrate _____?
- How do you feel about _____?
- Is there anything you don't understand about _____?
- What are your conjectures about what will happen?
- What else would you like to know?
- What do you plan to do next?
- What is the most important idea or fact you learned while working on _____ and why do you feel that way?
- What were your first thoughts about _____?
- What was/is the most challenging/easiest part of _____ for you?
- What do you understand now that you didn't understand before?
- What caused you to have a breakthrough in your understanding of _____?
- What pictures do you have in your mind to help you think about _____?
- How else do you think you could solve this problem?
- How would you describe this problem in your own words?
- What mathematical connections did you make?
- What didn't work?
- Are there any relationships in this problem that will always be present in similar situations?
- What if _____?
- What's your idea?
- What were your thought processes while you worked on _____?
- What do you wonder about regarding _____?
- Where did you get "stuck" and what helped you get "unstuck?"
- What mathematical insights did you have and what do you think prompted them?
- What are your observations about _____?

