Scaffolding for the Math Writing (and talking) Process
The Math Forum @ Drexel

Writing to figure out a solution path:
What is this problem about? What does the information in the problem mean?
What do you notice? What questions do you have?

Writing to explain a solution:
What did you do? Why did you do it?

What did you figure out?

Why does it work/not work?

What does your result mean?

Learning to ask good questions when stuck: Here are some models to follow throughout the talking/writing process:
Seeking specific information
e.g. "What is the meaning of _____?"

A problem-solving strategy to try
e.g. "I've tried making a diagram and estimating, but I think I need another approach. Do you have a suggestion?"

Review of a particular section of your work
e.g. "I think I might be making a mistake here because I am confident of everything before that. What can I do that would show me where I am going wrong?"

Is this approach ok?
e.g. "I did it differently but got the same answer, is that ok?"

Why does this work?
e.g. "I know how to do this but I can't explain why it works. How do I figure that out?"

Reflection that improves and extends solutions
- How did you check your answer? Did you use a different approach or line of reasoning from your main solution path?
- Does the solution make sense?
- Are there new problems that this one makes you think of?
- What other types of problems or situations does this remind you of?
- What parts of the problem solving process were the most satisfying or interesting? Least satisfying?

- What did you learn about problem-solving or about the math that you would do differently the next time?

Typical learning and writing stages, somewhat developmentally organized:

- Expressing confusion and asking questions.

- Sharing your first thoughts and what you notice.

- Telling us an answer.

- Showing what you did and aiming for completeness: both in terms of doing all tasks in the problem and in terms of reporting all the relevant work.

- Explaining the thinking behind your results and calculations.

- Giving good mathematical reasons.

- Convincing explanation for knowing why a solution or an approach is correct (proof).

- Reflecting on the implications, connections, and questions prompted by a given problem and its solutions.

  - saying what you found hard or interesting about this problem,
  - connecting this problem to an approach you have used in other problems,
  - discussing what you learned in doing the problem,
  - naming and exploring other math questions that this one leads you to think about,
  - identifying skills you could practice that would make it easier to solve problems like this,
  - describing real world situations where this math applies or might be useful,
  - …

Responding to reluctance to writing out solutions: "It's exhausting"

- **Unique and critical benefits**: Writing provides perspective and connects students to their own thinking, leads to self-correction and the development of ideas, makes it possible for others to engage and appreciate, etc.
- **Math is a language**: Symbols and diagrams can communicate a lot. Don't focus only on words.

- This is meant to be only **one element of math instruction**, not a recommendation to focus on this exclusively.
- There are times when it makes sense to **differentiate instruction**. For some students, the writing task is too big and you can focus on one aspect, such as organizing the presentation of their work. For other students, the task is mastered more easily and detailed explanation becomes annoying. You can back off of the level of completeness required but make it clear that there are times when it's helpful and expect them to begin to recognize that (when stuck, or when the audience will need it, or when looking for new insights and clarity).
- It can be **more tiring when the work is done on paper and has to be transferred**, rather than done electronically in the first place, although even this has its benefits, particularly when trying to craft something with care.