



Using the PoWs: Introduction

What are the Problems of the Week and Why Should I Use Them?

The Math Forum's Problems of the Week (PoWs) were started in 1993 to give geometry students an opportunity to use the newly-available Internet and its electronic mail to practice written communication about their mathematical problem solving. In the years since, problems in other areas of math have been added and teachers have used the problems in many different ways, but our goals have remained the same: to encourage the application of mathematical knowledge and the development problem solving strategies, and to create an environment in which students explore, discuss, start and start over, and communicate about mathematics.

I was observing students work out a problem together. When they finally "got" it, one of the students exclaimed, "We are so smart!" Isn't that what we are striving for? Not "the teacher is so smart," not "they are so smart," but "we are." In that statement, I heard both confidence and community.

—Cynthia Lanus, former high school teacher

At its most basic level, a "Problem of the Week" is an open-response math problem that can be printed out and handed to the students. But there's a lot more available in the online environment!

For teachers, the PoWs offer:

Enhanced Problem Packets: These guides for our Current PoWs include: the problem text and the answer check for students after they submit, an introduction to the problem, the solution that we write for our mentors, a problem-specific scoring rubric, tips about how to introduce the problem to your students, ideas about how to move students forward in their thinking and writing, and a list of the common mistakes. About half of the problems in each service are drawn from our Library, which enables the packet to also include sample student solutions from previous rounds with those problems. These solutions are accompanied by brief comments and a score from one dimension of our rubric (for example, we might give the Strategy score for each of the solutions so that teachers can see examples of the progression from Novice to Apprentice to Practitioner to Expert).

Problem Solving and Activity Series: This year-long, coherent sequence of activities is designed to help students develop and deepen their use of mathematical problem-solving and communication. These lessons can be used in coordination with each round of the Problems of the Week, but are developed for more general use. The first section of the document contains activities that can be used with any problem and the second section illustrates possible student responses based on the Current Problem of the Week.

Online Resources: Through these web pages we offer: online starting points for the key concepts in the problem and links to similar PoWs in our Library, helpful questions and answers from our Ask Dr. Math archives, tips on teaching the content from our Teacher2Teacher service, and applets from our Math Tools library. We have made these pages for all of the problems we've written in the last six years and a few of the earlier problems.

Past Solutions: problems in our Library are accompanied by highlighted student solutions and commentary on those solutions, the different methods students used, and the common mistakes we saw.

Teacher Office: teachers can view their students' work online and see whether or not students viewed the answer check, revised their work, or left a comment. Teachers can also choose to mentor their students' work using our scoring rubric and online messaging center.

For students, the PoWs offer:

The Answer Check: after students submit their solution online, they can choose to check their answer, which means to look at the answer that we provide (we don't tell them how we got that answer, just what it is). Along with that, we provide hints and questions for students whose answer doesn't agree with ours, as well as for those whose does.

Revision: students can revise their work, either after viewing our answer check or at any time after that, for the remainder of the school year.

I liked being able to do it and revise it. The hints were really helpful. You don't want to look at the answer before you try it yourself. But after you try it, you look at the answer and see if the hints will help. You don't read all of them, because they won't all help, but you find the ones that do. Then you might be able to figure it out.

—Tahira, age 14

Why Should You Use PoWs in Your Classroom?

One can look at the Problems of the Week as merely another source of good problems for students to work on to supplement the curriculum. However, there are some specific issues in math classrooms that have shaped the design and use of the PoWs by teachers over the years, enabling them to play a significant role in students' development as mathematical thinkers.

We all know adults who say they were “never any good at math”. It’s likely that math never made sense to them. Their experience with math was that they learned to discount their own thinking and instead to focus on and try to remember the ideas and techniques someone else had already figured out. Math didn’t come “naturally” to them, because it was never about their ideas. It was about getting the right answer as quickly as possible, to be over and done with it.

The PoWs’ particular combination of non-routine, supplemental problems, an asynchronous online system, a two-week time frame (in the Current PoWs), and the expectation of written explanations makes for certain opportunities for students. The more obvious are:

- To be challenged
- To apply concepts
- To use higher order thinking skills

The one with crickets, or grasshoppers. That was hard! Maybe it's because it was the first problem we did. Maybe if we had the same problem now, we'd be able to do it.
—Keairra, age 15

The less obvious but equally important include:

- There’s no one right way: Connect to your own way of thinking. Build from your ideas and experience.
- Persistence: Develop confidence in the ability to do problem-solving and to come up with ideas when you didn’t think you could.
- Learn mathematical strategies: Use an understanding of number to test cases, systematically explore for patterns, generalize, transform to recognizable representations, efficiently name and organize for manipulation, prove (explain), multiple representations, explore and look for variation and constants, etc.
- Appreciate the value of writing for learning as well as for communicating. Move from description to explanation to reflection.

Don't think you're gonna get it right the first time. Be conscious of the fact that hardly anyone will get it right the first time.
—Jazmine, age 14

The PoWs and the Common Core State Standards

The opportunities created by the PoWs, for students to make sense of mathematics, to use their own ideas in novel ways, to reflect and revise, and to communicate their thinking to their teacher, peers, and the Math Forum community, support students to develop the Mathematical Practices. Our focus on sense-making and communication means that each PoW supports students to improve at:

Making Sense of Problems and Persevering (Mathematical Practice 1): The “Scenario” version of each PoW supports students to make sense of the situation before leaping into calculations; the “I Notice/I Wonder” activity featured in the *Understand the Problem* portion of the *Problem-Solving and Communication Activity Series* helps all students get started and persevere in problem solving. Other activities that support students’ sense-making and persevering are found in our *Solve a Simpler Problem*, *Get Unstuck*, and *Guess and Check* documents.

Constructing Viable Arguments and Critiquing the Reasoning of Others (Mathematical Practice 3): Students who participate in the PoWs are becoming part of a community of mathematical thinkers, which motivates them to express their ideas clearly and seek to understand others’ spoken and written explanations. Whether they are writing for the Math Forum audience in hopes of being one of the “highlighted” solutions, or for their peers or teachers, the process of drafting and revising supports students learning to build on their own thinking and use the full power of communication for exploring, solving, explaining, justifying, generalizing, and connecting.

Mathematical Practices 2 and 4 – 8: Each Current PoW is aligned with a problem-solving strategy (or two or three); each problem-solving strategy is accompanied with classroom activities that support students to reflect and improve their Mathematical Practices. Whether it’s learning to *Make Use of Regularity in Repeated Reasoning* through the *Make a Table* activities, or learning to *Look For and Make Use of Structure* through the prompts in the *Solve a Simpler Problem* strategy, the strategy activities in the *Problem-Solving and Communication Activity Series* support students making use of all eight Mathematical Practices. To learn more about these alignments, check out [“Mastering the Common Core Mathematical Practices Through Problem-Solving Strategies”](#) and this related blog post: [“Problem-Solving Strategies and the Common Core Practice Standards”](#)