

# Problems of the Week, aka “Special Problems”

*Using multi-step challenge problems over time to cultivate “grit” and a capacity for extended rigor.*

Problems of the week (POWs) address a wide range of student capacities that are essential for improved performance in math; capacities often overlooked or simply not accessed by traditional instructional practices. Over time the use of POWs with a sound instructional protocol can shift the culture of math learning in a classroom by transforming students precepts of what it means to do math. The shift can cultivate more developed mathematical habits of mind and work such as inquiry, self-direction, constructivism, tolerating ambiguity and challenge, being persistent and creative in problem solving, communication and collaboration, and more. Expanding students’ capacity in these areas is essential for them to approach the level of rigor aspired to in the Common Core and Career and College Readiness Standards.

## Targeted Student Learning in the use of POWs

1. **Metacognition** – Students learn about their own problem solving styles, habits, reactivity to challenge, self imposed limitations, and how to use that knowledge to become more effective math learners.
2. **Tolerance of ambiguity** – students gain a willingness and comfort level with not knowing or being challenged, and can proceed productively in spite of it.
3. **Authentic problem solving, “grit”** – students realize that real problems require effort over time and that challenge and struggle is the norm and not the sign of some dysfunction or inadequacy.
4. **Self direction** – students gain the habit of independently choosing multiple resources and tools on their own.
5. **Collaborative inquiry** – connecting with partners, parents, family members on the problems is encouraged, and problems are chosen that foster such interaction. Students gain an orientation toward collaboration and greater skills in doing so.
6. **Math communication** – students significantly raise their capacity in how to effectively communicate math concepts, solutions, ideas, etc. in written and verbal forms. This is emerging as a critical skill for success in math and STEM careers, and is increasingly reflected in standardized tests.

## POW instructional protocol suggestions:

1. **Choosing POWs:**
  - POW problems must be of high challenge and not solvable in one sitting by students. This design is important for many reasons. Students’ math schooling largely conditions them to expect to solve a single problem within a minute or less. This practice leaves students unprepared to approach genuinely challenging problems and does not train them for persistence, tenacity, and yes, “grit.” A key purpose of using POWs is to help them develop the habit of mind of being persistent in the face of challenge.

- Also, it is not essential that POWs be exactly aligned with the specific math knowledge and skill that is being taught at that time in the primary curriculum. It can of course be very useful to do so, but keep in mind that a key purpose of POWs is to develop broader habits of mind and work which will transfer to all students' math work. POW work can spiral content from other points of the curricular sequence, as well as other grade levels.
2. **POWs do not need to be worked over a single week;** “problem of the week” is a euphemism in a sense. POW simply refers to a multi-step larger open ended problem that requires multiple days or weeks to solve, either because of its length, difficulty, or in some cases requiring subsequent instruction in specific skills to solve (backwards design, “need to know” structure of problem based learning).
  3. **Initial introduction of a POW to students:**
    - Engage in an explanation with students of the what and why about POWs. Share the targeted learning above (in developmentally appropriate language of course...). You might bring in a story or some examples of big problems that took long periods of time to solve. Be sure to emphasize that your expectations of their performance will be different than many or most of the types of instruction the class may typically engage in. Exact, quick answers are not expected. Discussion, collaboration, questioning, flexible thinking, experimenting, and being patient will be emphasized.
    - Introduce the POW initially with little to no explanation or support beyond establishing a clear understanding of what the problem is asking. Leave it at this for several days. Explain to students to explore it the best they can, to engage in conversations about it with others, family, friends, etc. BE SURE to assure them that they are not expected to “get it” at this point, and that “hints” and analysis will follow in time. Most of your students who may initially, almost in a knee jerk fashion reject the problem as “I don’t get it!” will find that after several days of coming and going to the problem insights will arise for them on their own. Offering the problem with minimal support initially also provides a valuable opportunity to provide real challenge for some of the exceptionally math talented students you may have, a good differentiation tool.
  4. **Work sessions:** At intervals over the time that the POW is assigned, bring the class together and share strategies that students are coming up with. At these junctures you can begin giving support to students who are still struggling to make inroads into the problem. You can expect a variety of students will solve the problem well before others are up and running. This is ok.
  5. **Write up:** Follow the writeup format provided or design your own, but keep in mind a key capacity we are developing here is communication of math ideas, both written and verbal.
  6. **Student presentations:** These can be great if you have time.