



Teacher's Guide to the Math Forum's *Problems of the Week*

<http://mathforum.org/pow/teacher/guide.pdf>

Welcome!

Welcome to the Math Forum's Problems of the Week! Our program is built around a collection of inventive, out-of-the-ordinary problems that get your students thinking, talking, and doing mathematics. Your students will learn flexible, adaptive problem-solving skills and become better mathematical communicators. Working with these problems will help you analyze student thinking, design responsive instruction based on that thinking, and move your students toward becoming competent, independent problem-solvers.

This Guide is intended to help you use the Problems of the Week with your students. It describes the program's features, to familiarize you with the breadth of resources involved. It gives you strategies for beginning the program with your students, creating a problem-solving classroom culture, and fitting the program into your busy schedule. It also introduces the Math Forum's scoring rubric and feedback process. This will aid you in valuing student thinking and asking questions designed to take your students to the next step. The appendices offer complete, step-by-step instructions and more detailed information about our program.

We hope you find this a useful introduction to the Problems of the Week. We welcome your feedback on any aspect of the Guide. Please contact us using the page <http://mathforum.org/pow/contact.html>.

Program Overview

The Problems of the Week (PoWs) are creative, non-routine math challenges for elementary-, middle-, and high-school-level students. They are designed to stimulate students' interest in problem solving and to encourage them to communicate their mathematical thinking.

The Problems of the Week program is built around those PoWs. It's subscription-based, primarily for teachers, and offers tools and ideas for implementing the PoWs in the classroom. The basic subscription features four different levels of "Current Problems of the Week," while another level of subscription will give you access to a library of past problems, with archived student solutions and mentor commentary, that can expand the program's possibilities. There are also several free services hosted in the PoWs area of our site: KenKen, the Macalester PoW, Technology PoWs or tPoWs, and the Year Game. You'll need to sign up for these, to get a login name and password, but you won't need to pay for them.

Navigation tip: From the home page (mathforum.org), use the tabs at the top to find Problems and Puzzles, which is the main page of the PoWs. From there you can get to any part of the service.

Current PoWs

About

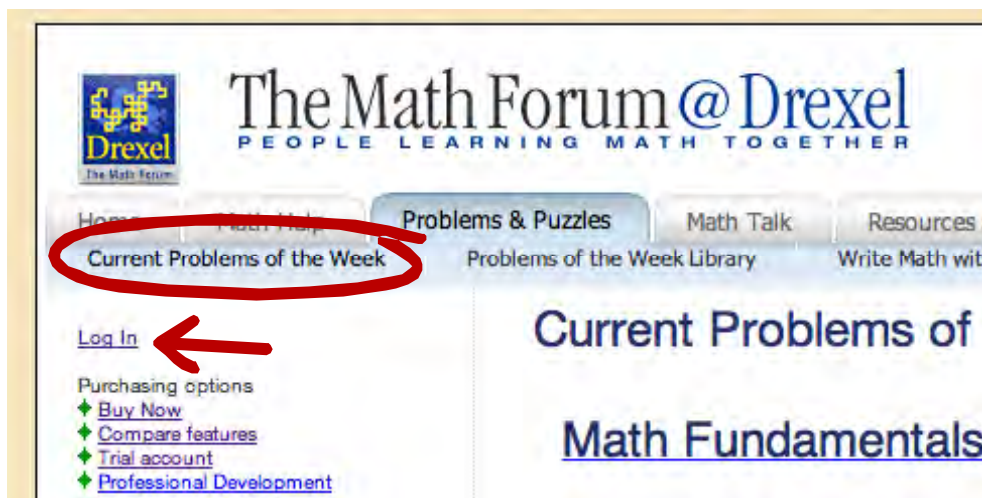
There are four services in the Current Problems of the Week (Current PoWs):

- Math Fundamentals (FunPoW), problems covering a range of upper-elementary content, including numbers, operations, measurement, geometry, data and chance, and algebraic thinking.
- Pre-Algebra (PreAlgPoW), problems that reinforce the content typically taught in late elementary through middle grades, including algebraic thinking, numbers and operations, measurement, geometry, data and chance.
- Algebra (AlgPoW), covering topics found in a formal Algebra I curriculum, and
- Geometry (GeoPoW), high-school-level problems.

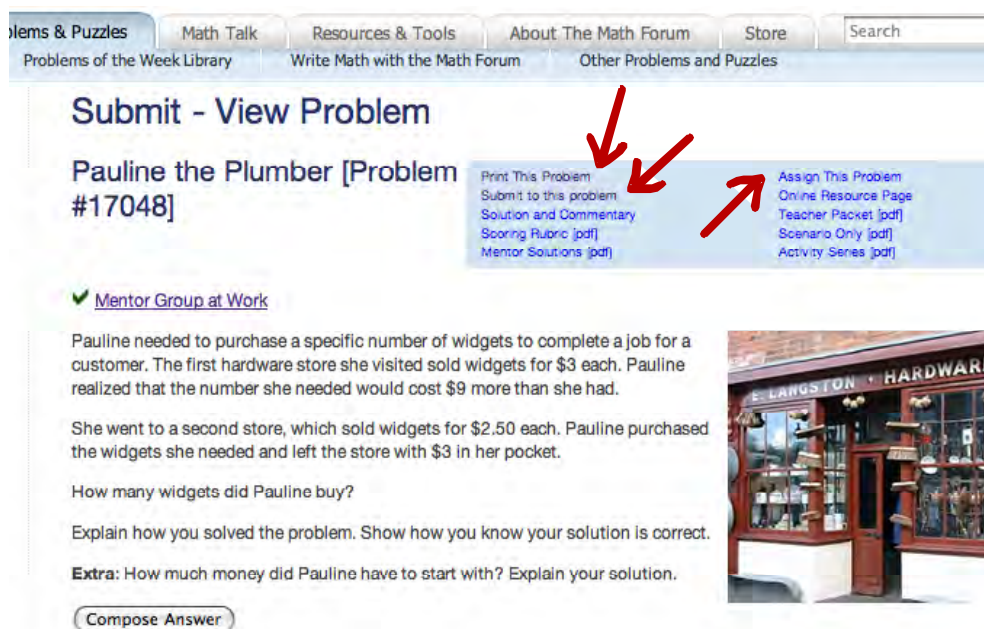
Problems are posted every two weeks during the school year, with FunPoW and AlgPoW posted concurrently, and PreAlgPoW and GeoPoW posted concurrently the following week. So a middle-school teacher might choose one problem to work on for two weeks, or alternate weekly between FunPoW and PreAlgPoW.

Current PoWs
Features

To view these features, click on “Current Problems of the Week” in the subhead under the Problems & Puzzles tab, then log in to the system. You can use the link at the top of the left sidebar. If you need help remembering your password, check the “Password Help” link below the login box.



Choose a specific problem and click “View Problem”. At the top of the page in the blue box, you’ll see links to “Print This Problem”, used to make a clean copy for handouts, and “Assign this problem to my students”, which lets you assign the problem to one or more of your classes.



The “Submit to this problem” link will bring you back to this page, and is useful after you’ve followed one of the other links in the blue box. The other links in the blue box are teacher support materials. Typically these will all be present for the Current PoWs: Online Resource Pages, Enhanced Problem Packet (or Teacher Packet), Strategy, Scenario Only, and Scoring Rubric.

- **Online Resource** pages (formerly called Teacher Support Pages) describe the key concepts in the problem and link to similar problems in the Library, as well as associated resources such as questions and answers from our Ask Dr. Math service, conversations from the Teacher2Teacher archive with instructional tips, and tools from our Math Tools community library.
- **Teacher Packets** (or Enhanced Problem Packets) include the problem and “answer check” (the answer we provide students after they submit their solution to a problem), an introduction

to the problem, the solution we provide for the mentors, our problem-specific scoring rubric, tips about how to introduce the problem to students, and ideas about how to move students forward. When the problem is one from our Problems of the Week Library, we also include samples of student work and comments about the solutions based on a category from the scoring rubric.

- The **Strategy** link provides a framework and classroom activities (from the Problem Solving and Communication Activity Series, <http://mathforum.org/pow/support/activityseries/>) for those who wish to enhance student competence and confidence in problem solving strategies and math communication, and to share best practices with other teachers. With each Current PoW, the Math Forum features a particular strategy (or two) along with related communication skill development. Each unit contains strategy development activities that can be applied to any problem, student handouts to help guide student work, and facilitation questions for the teacher. Our goal is for students to be able to move between multiple strategies flexibly as they attempt to solve interesting problems.

NOTE: all Library PoWs that were published in 2008-2009 and 2009-2010 have an additional **Strategy Examples** link that provides a complete set of strategy activities, student handouts, and *problem-specific examples* of how students could work with the activities.

- **Scenario Only** documents provide a version of the problem set-up, without the question. This is a good way to introduce the Problems of the Week in your classroom—see “Print this problem”, page 9, and Appendix II, page 24 of this document for details.
- **Scoring Rubrics** will help you think about how to score your students’ solutions using our scoring grid. For more information, see “Mentoring” below, page 7.

You may also see extra scenarios (when the problem has a complex set-up) or mentor solutions/instructions (when there’s a mentor group answering students’ submissions for a given problem). This is also where the Solution and Commentary shows up for problems from the Library.

At the bottom of the problem page, you’ll see a link to “Compose Answer”. This is what students click when they’re ready to submit their answer. They’ll follow the instructions on that page.

Back on the main Current PoWs page, you’ll also see a link to “Latest Solution” for each problem.

- Latest Solution is a direct link to sample solutions for the PoW most recently closed to submissions in a given service.

Pre-Algebra

Eight Squares on a Table - 03/01/2010

Find the number written on the first sheet laid on the table and identify which of the eight sheets it was.

[View Problem](#)

[Latest Solution](#)



When you log in, the system will provide a different set of links from when you are not logged in. The main difference is your My PoW Work page and the Message Center. Those are near the top of the links in the sidebar when you are logged in.



My PoW Work gives you access to all the things you can do with your teacher account, plus any answers you've submitted yourself.

- Problems Assigned to My Students lets you view the assignments you've made to any of your classes.
- Mentoring My Students lets you manage your mentoring options. The first bit lets you have your students' work automatically assigned to you so that you can mentor it if you choose. You can do it by entire classes, or you can choose individual students. The next section gives you a full listing of the student submissions waiting for your attention: new submissions, ones that have been revised by students, and any that might have been sent back to you by an approver for changes. You can also see all the replies you've already sent, as well as your work listed by problem. Learn more about Mentoring your Students' Work gives you more information about the Forum's mentoring options and techniques.
- My Students' Work lets you see all the work your students have done in the POW, including any scores and replies they have received.
- My Accounts has two functions. One is to let you add more students, up to the limit of your purchase, or any other account set-up tasks you haven't finished yet. The other is to let you view student and class information, and give you a place to change your students' passwords should you need to do so.
- Discussion Groups gives you quick links to any PoW discussions groups you're participating in. These are a good place to go to connect with other PoW users.
- The Message Center is a special web-based mail service with NO spam and NO other messages—only PoW messages. Your teacher account has its own Message Center, and

each student you register will also have one, so no need to worry about email privacy issues or mistyped addresses when you register your students.

- Below the horizontal line, you'll see other "entry points" for your work. This is where you'll see any answers you've submitted yourself, and view any exchanges with our staff or volunteer mentors.

There are other things in the left sidebar that show up whether you're logged in or not. Those are the Resources and the Help section.



The Resources section features a host of useful things.

- The Calendar page gives you a list of this year's problems listed in order by service, together with the dates they accept solutions and revisions, whether there's a mentor group working on the problem, and a link to the Library version of the problem.
- The Activity Series page collects the Activity Series documents by topic, spanning all four services at once. (So you'll see all the Logical Reasoning documents together, for all four services.)
- The Teaching with PoWs page links to the Calendar page, the Teacher's Guide, the Account Help page, and information about scoring rubrics and mentoring. The right side of the page links to a series of articles about implementing problem solving and writing in the math classroom. This is a great place to start exploring the possibilities of the PoWs as pedagogical tools.

The Help section features the following:

- Account Help gives you technical tips on using our services: setting up accounts, login difficulties, places to look for more information, and more.
- The Teacher's Guide [PDF] is the document you're reading right now! This link will have the latest available version of the Guide, which we keep as up-to-date as possible. (Be sure to point out any errors to fix or improvements we could make!)
- Intro Videos are short (under five minutes) Flash how-to guides to common areas of our site.



PoW, begun in 1993. Over the next six years, seven new Problems of the Week launched for new audiences:

- Elementary Problem of the Week (ElemPoW)
- Middle School Problem of the Week (MidPoW)
- Algebra Problem of the Week (AlgPoW)
- Trigonometry and Calculus Problem of the Week (CalcPoW)
- Discrete Math Problem of the Week (DMPoW)
- Math Fundamentals Problem of the Week (FunPoW)
- Pre-Algebra Problem of the Week (PreAlgPoW)

We've made all of these problems available through the Problems Library.

In addition to the problems themselves, the Problems Library contains a rich archive of student solutions to those problems, with highlighted solutions and mentor commentary on them. These can give you new insight into students' thinking, and help prepare you for what you might run into with your own students when you introduce a particular problem.

Problems Library Features

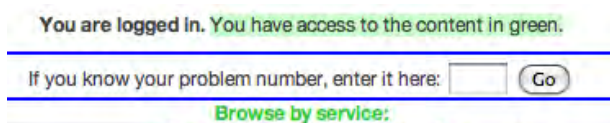
As we have developed new features such as the Online Resources pages and Teacher Packets, we've added these to the Problems Library as well. This explains why you won't see these on every problem in the Problems Library (and why sometimes they're named different things). The green "ts" icon  indicates the presence of a Teacher Support page for that problem (indicating any of the three types of support pages, but predominantly Online Resources at this point, as that is the most established of the three). Our oldest problems were created before we developed the mechanism for students to submit their answers online! If you don't see the yellow "active" icon  next to the problem name, online submission is not available. You can always print a paper copy to use with students.

A level of difficulty rating is provided for each problem. It focuses on the mathematical challenges represented by the problem, the difficulty of the mathematical concept, and the difficulty of mathematical calculations for students at a given level of problem solving. You are invited to read the full Rubric for Coding Problem Difficulty, at <http://mathforum.org/library/problems/difficulty.html>

After each problem listing in the Problems Library category pages, you'll see a link labeled [more>>](#). This will take you to a page with a full listing of the problem's title, author, and description, as well as direct links to the main problem page and solution page, and if it exists, the Teacher Support Resources (Online Resources Page and Enhanced Problem Packet).

Problems Library Browsing

From the main Problems Library page, you can go directly to a problem using its problem number, if you know it.



Otherwise, you can browse through the problems in several different ways.

The Problems Library consists of four broad categories, as with the Current PoWs: Math Fundamentals, Pre-Algebra, Algebra, and Geometry. In addition to the four current archives, there are static archives of our older Discrete Math and Trig & Calculus categories. These are presented the same way, except that new problems are not currently being added to these categories. The older ElemPoW is now categorized under FunPoW, and the Middle School PoW is now categorized under PreAlgPoW. The Trig/Calc and Discrete Math PoWs are included with both AlgPoW and GeoPoW. Once you log in, the content you've purchased will appear in green.

To browse by topic, select one of the six services shown at the top of each page. Then select a math topic; you will receive an alphabetical list of problems within that topic. Examples of math topics include: algebraic reasoning (math fundamentals, pre-algebra), factoring, graph theory (discrete math), pi, the Pythagorean theorem, and integration (trig/calculus). For the four current categories (FunPoW, PreAlgPoW, AlgPoW, and GeoPoW), we provide links at the top of the page to related resources in our Math Tools library, our Dr. Math area, and the NCTM Standard(s) addressed by each topic.

Once you're browsing through one of the six categories, you'll see a sidebar on the left side of the page. This provides a list of the main subject headings within that category. It also offers basic navigation links, such as to the main page of the Library. The link labeled "Browse all Algebra

Problems” (or other service you’re currently in) will take you to an alphabetical list of all the problems in that service—Algebra, in this case.

At the bottom of the introductory page for each service is a browsing area with topics of interest to teachers of that service, covering all of the problems in all of the services.

A subscription to our Write Math with the Math Forum (Write Math) service lets you find problems when you’re searching for something to match a specific level or topic, state standard, or textbook topic. The main Write Math page lets you choose which way to search: by level/topic, standard, or textbook. Use those searches to see a “tree” of categories, and drill down through the “branches” to find a specific problem. (For details on how to use those searches, see Appendix I, on page 11 of this Guide.)

Problems are categorized in as many categories as apply to them, so the parenthetical numbers after a category do not necessarily reflect the number of actual problems in the category.

2 Reasoning in Geometry (39)

2.1 Inductive Reasoning (2)

[Playing with a Pentadecagon](#)

Extend the sides AB and ED of the regular pentadecagon ABCDEFGHIJKLMNOP until they intersect. What is the measure of the angle at this intersection? (Geometry Problem Set) ...

[more>>](#)

[The Confession Letter](#)

Students are asked to decode the letter left by the murderer of last week’s puzzle. (Discrete Math Problem Set) ... [more>>](#)

2.2 Finding the nth Term (2)

[Playing with a Pentadecagon](#)

Extend the sides AB and ED of the regular pentadecagon ABCDEFGHIJKLMNOP until they intersect. What is the measure of the angle at this intersection? (Geometry Problem Set) ...

[more>>](#)

[The Confession Letter](#)

Students are asked to decode the letter left by the murderer of last week’s puzzle. (Discrete Math Problem Set) ... [more>>](#)

In this instance, the two problems fit in both categories shown, and so are aligned to both categories. They are counted as four alignments within the thirty-nine alignments in the “Reasoning in Geometry” category. It is those alignments that are counted in the numbers after each category: not the number of problems in each category, but the number of alignments of problems to that category.

The Math Forum provides mentoring to student submitters in several different forms. All mentors use the Math Forum’s scoring rubric, which covers several components of problem solving and mathematical communication. They also provide feedback to students designed to help them improve one or two specific aspects of their work. It is our hope that students who receive mentoring of any kind will take advantage of it to revise and improve their work.

All mentoring options require a subscription.

Free Mentoring (Current PoWs only, requires Class Membership or higher to the Problems of the Week Library): For opportunities when mentors will be available to reply to student submissions, please consult the dates and details on How to Use Free Mentoring, linked at http://mathforum.org/pow/free_mentoring.html.

Priority Mentoring (Current PoWs only, requires Class Membership or higher to the Problems of the Week Library): Math Forum staff and trained mentors reply to each student’s submission and subsequent revisions.

Assess Your Own (Class Membership or higher to the Problems of the Week Library): Teachers whose students are submitting solutions have the option to provide scoring and feedback to their own students at no extra charge. The Math Forum provides orientation to the scoring rubric, additional supporting material about the philosophy of mentoring, and, if desired, feedback on the teacher’s initial mentoring efforts. For more in-depth help with our mentoring system, we offer various professional development opportunities. For more details, see <http://mathforum.org/pd/>.

Local Mentor Development (School or District Membership or higher to the Problems of the Week Library): Institutional members can designate mentors from their own organization. The Math Forum will provide online training and support, which the mentors are required to complete in order to participate.

What the PoWs Can Do for Your Classroom

Through the process of working with the PoWs, your students have the opportunity to think through problems with a wide range of possible solution strategies; write explanations that develop their own understanding; and revise their work and develop as mathematics learners.

The Math Forum believes a key to increasing students' performance lies in writing math. When students write about their problem-solving process, they show their thinking. You as teachers can use that to see where students are experiencing difficulties, and help them unlock the door to better understanding—and ultimately to build both mathematics content knowledge and process skills on a solid foundation.

Research¹ on students who regularly participate in our PoWs shows that, regardless of students' initial level of math competence, after working with the PoWs, they make more connections to math, generate more effective strategies for solving problems, and work more independently on those problems.

The PoWs offer you new ways to gain valuable insights into student thinking. Use them to practice formative assessment, to address the NCTM Process Standards in your classroom, or to prepare your students for standardized tests using open-ended or constructed-response items.

How to Start Using Your Subscription

Once you've received your login information, look over the Current PoWs, and pick one to work on for yourself, before you even take it to the classroom.

Work the problem. Read it over, think about it, and solve it as you think appropriate. Write up your solution as if you were a student: **write your answer** in a full sentence, and then **explain** how you arrived at that solution.

Reflect on your solution. Did you interpret the problem correctly? Did you choose an effective solution strategy? Was your work accurate? Was your explanation complete—did you do something to solve the problem that you left out of your explanation? Was it clear—did you provide enough explanation that another person with your math background could follow what you did?

Revise. Use your reflection to improve your earlier description of your solution process.

Notice your thoughts and reactions as you go through this process. What might your students learn if they went through the same process?

For more about the process of solving problems and writing up resulting solutions, see <http://mathforum.org/pow/teacher/process.html>.

Finding More Problems

browsing and searching the Problems Library and Write Math

Which problem will you give them to start with? If you have a Current PoWs subscription, you have four choices during any given week, and one topic or another will be most appropriate for your class. If you have a subscription to the Problems Library or Write Math with the Math Forum, you have hundreds of past puzzles to choose from. Here are a few thoughts on selecting an appropriate problem from this larger pool.

In the Problems Library, start by choosing a service. Which of them is most appropriate for your students? Within services, problems are organized by broad topic. You'll notice subtopics listed under some of the main topic headings—these can give you an idea of what we mean by a particular topic name. Even more helpful is the description once you click on a topic. For instance, if you teach middle school mathematics students, but you're coming up on a geometry unit, you might want to see what sorts of problems we include in the FunPoW geometry category. The description on the geometry page says "Problems in this category require students to classify and understand the relations that exist in two-dimensional and three-dimensional objects. They may require students understand concepts of congruence, similarity, symmetry, or tessellations." That gives you an overview of the category, without having to read through numerous problem descriptions.

¹ Renninger, K. A., Farra, L., & Feldman-Riordan, C. (2000). The impact of The Math Forum's Problems of the Week on students' mathematical thinking. *Proceedings of ICLS 2000*. Mahwah, NJ: Lawrence Erlbaum Associates (www.mathforum.org/articles/rennin2_2000.html)

Now look at the problem list within your chosen category. Say one catches your eye, right off the bat. But it's difficulty level 4—is that high or low, and what does it mean? At the top of the left side of the page, you'll see a link to "About Levels of Difficulty." This page describes the coding scheme for the service you're in. For Math Fundamentals, it will let you know that level 4 problems may involve repeated calculations that can be a challenge for students to keep track of. Use this to inform your choice: how well can your students handle repeated calculations? Would this problem be an appropriate challenge for them, or would it require scaffolding or other support to keep it in reach?

Take a good look at the problem itself, which may have a Teacher Support page. By all means look at previous student solutions and mentor commentary. These will let you know the sorts of reactions that students have had to the problem, common misconceptions and different solution strategies, and generally help you decide if a problem is right for your students.

If you subscribed to Write Math with the Math Forum, you can use the topic search to pull up problems using topics like those in the Problems Library, only geared precisely to the grade band you bought. You can also pull problems for your grade band from the Write Math state standards search, and from the textbooks search, if you're looking to address a particular standard or topic in your curriculum.

Appendix I (page 12) has detailed instructions for the Write Math searches.

"Print This Problem"

taking the PoWs to the classroom

Because the PoWs rely so heavily on process to succeed, it's useful to model that process with your class. Here's one approach: begin using the PoWs in your class by throwing out the question!

You've chosen a problem from our Current PoWs or Problems Library or Write Math. Now erase the part of the problem that asks The Question. Read only the scenario through with your class. Ask them what they noticed about the scenario. What situation is being described? Is there anything else they can figure out based on those "noticings"? Something that isn't stated in the scenario, but that they can justify because of what it says? Is there something they're wondering about? Maybe one student drew a conclusion that another student doesn't see. Let the other students explain how they figured things out, and more than one student if possible, so that multiple approaches are heard.

You could ask your students if they think they know what question we asked when we wrote this problem. Pose the actual question and talk about it as a group. First, have students list the "noticings" they think will be useful in answering the question. Then, if they seem ready, try answering the question, either as a whole group or in smaller groups or pairs.

Your goal here is to get students engaged in the process and participating in discussion. The activity itself is a model for how they should work on the problems later on, in whatever format you decide to present them.

Read more about the problem-solving process in the classroom in Appendix II, How to Start Problem-Solving in Your Classroom (page 24). Read more about getting students noticing (and wondering) in the [Problem Solving and Communication Activity Series: Understand the Problem](#).

How to Start Your Students Using Their Subscriptions

basic set-up

Once you've introduced the process to your students, and begun to develop a problem-solving culture in your classroom, you're ready to start your students off with their own subscriptions. This applies to teachers with Class memberships to the Problems Library or Write Math. Current PoW memberships do not include online student access. (Those of you without access to the following online services may still wish to use the ideas they involve.)

Please note that there's a complete how-to with screenshots in Appendix I (page 12), in case you get a little lost.

The first step for your students to use the PoWs is for you to **register** them. You'll need to decide whether to register each student individually, or in small groups, or as a whole class. That will depend on how you're using the PoWs with your students—but do note that students with individual accounts can still submit as a group.

For privacy reasons, please review your school's Internet policy and our privacy policy at <http://mathforum.org/announce/privacy.html> **before** designating student usernames. We comply with the COPPA legislation that requires permission for students under 13. When you register students, you are indicating that you are authorized to grant this permission for your students. If your students' names must not appear on a Web site, you'll need to choose nicknames or use initials judiciously.

Once you've decided how to name your students online, you're ready to register them. You can do that through your My PoW Work page. You can refer to the step-by-step walkthrough in Appendix I (page 12) for details of the registration process.

Your students will need their login and password to view the problems—you'll have to give those to them. Once they've logged in, though, they won't need email to use the PoWs. Their online Message Center (in the left sidebar or linked on their My PoWs page) will record all messages sent from our program.

If you plan to mentor your own students, please assign them to yourself for mentoring through your My PoW Work page. If you've signed up for free mentoring, or if you've bought a paid mentoring option, you should make sure they're not assigned to you. When you first sign up for an account, the default is that they're not assigned to you. See Appendix I for step-by-step details.

Your next step is to **assign a problem** to your students. The easiest way to do this for teachers with class-level accounts is to click the link to "Assign this problem to my students" from any problem. You can assign the problem to one or more of your classes, and it will show up on the "My PoWs" page for those students. You can also give your students the problem number for any Library or Write Math problem (with its title to make sure they've got the right one), and they can access it from the top of any Problems Library page. (See Appendix I, page 12, for its location on the page.)

Ask your students to **submit their solution** online. The My PoW Work page has a function for tracking their work: the "View Work" link under the "My Students' Work" heading. If your students need some guidance in submitting, they can view Appendix I, with step-by-step instructions (page 12). Please remind them to log out when they are finished using the service.

Monitoring Your Students' Work

Any time after your students have submitted to a problem, you can view their work. Check to make sure they're "getting" the process. If you've signed up for free or paid mentoring, you can see any mentors' replies as well as your students' revisions. All this is accessible through your My PoW Work page—see Appendix I for details (page 12).

Mentoring Your Students' Work

All mentoring options require a Class membership or higher. Priority mentoring requires a fee on top of your subscription. Free mentoring and the Assess Your Own option are provided with no extra fee.

Free Mentoring. A limited number of replies are mentored for free by mentors in training and Math Forum staff. This applies to Current PoWs only, with a limited schedule. Your students can improve their chance of getting a mentor's response by following our stated Guidelines as they submit their answers. For more details, see http://mathforum.org/pow/free_mentoring.html.

Priority Mentoring. For a separate fee, Math Forum staff and trained mentors will assess and respond to your students' work, walking them through the revision process. Again, this requires students to follow our Guidelines as they submit their answers.

Assess Your Own. You can provide scoring and feedback to your own students using our rubric and software. We have extensive documentation linked through My PoW Work that introduces our scoring rubric, and describes and gives tips on our philosophy of mentoring and revision. All of those come with examples. If you're interested in pursuing this course, we recommend you go through those pages. But here's a quick outline to help you decide.

In order to provide the most helpful responses to our students, we developed two parts to each mentor reply. The first is the "score" of the submission, according to our rubric that breaks down a response into six categories of problem solving and communication (interpretation, strategy, accuracy, completeness, clarity, and reflection). This helps us tell students not whether they're "right" or "wrong", but exactly what they did well on and what parts of their submission could use improvement. We include scores last in our messages to students, since they are a guide, not a "grade."

The second part of a mentor's reply is a note to help the student reflect, revise, and improve their response in some way. We first try to comment on something they did well, from coming up with a creative solution to communicating clearly to formatting nicely, to attempting to answer at all. Then we focus on the one improvement we think will make the biggest difference to them. This is one place where the scoring may guide us—is there one category in which they were weakest? (We don't usually focus on reflection here, as that's a new concept to many students, and hard for them to grasp.) We try to give them something concrete to work on, and importantly, we try to make clear what they have to gain by working on that thing.

This should give you a taste of what mentoring is like in our system. For much more extensive philosophy as well as several examples of scoring and feedback, see <http://mathforum.org/pow/teacher/assessown/>—which is also linked from My PoW Work.

Become a Mentor

Interested in mentoring? Would you like more experience than with just your own students? Are you willing to commit to spending an hour or two each problem mentoring other students? If so, we're looking for you! If you'd like to learn more about our training process, please contact us using the form on this page: <http://mathforum.org/pow/contact.html>

Moving beyond This Guide the wider PoW community

Would you like to talk about the Problems of the Week with other users? We have a series of Web-based discussion groups just for PoW subscribers. They're linked from My PoW Work, and they use the same login and password with which you access your regular PoW account. There's one for each of the four main services.

You'll see posts from PoW administrators letting you know when free mentoring is available, or asking for feedback on aspects of problem writing. You'll also see discussions among fellow teachers using the PoWs, primarily sharing what they're doing in the classroom, and looking for feedback or alternative ideas, but sometimes with questions for administrators, too.

Moving beyond This Guide questions and feedback

If at any point you're having difficulty with your account that you can't solve by checking this Guide or our Account Help online (accessible at <http://mathforum.org/pow/accounthelp/>), please feel free to contact us. You can write to us using this page: <http://mathforum.org/pow/contact.html>. Or during regular business hours (8-6 Eastern), you can call 800-756-7823.

We welcome feedback at any time, as well, either about the program itself, or about this Guide. Please contact us using the page <http://mathforum.org/pow/contact.html>.

Math Forum Professional Development Opportunities

Our professional development offerings include courses focused both on problem solving and communication in general, and on using your PoW class membership effectively. The complete list of our offerings with full information, including syllabi, is on our site at <http://mathforum.org/pd/>.

Three of our online courses are based on PoW membership:

- **PoW Class Membership: Resources and Strategies for Effective Implementation**
 - This course is designed for current subscribers of the Problem of the Week. After completing the six-week course, you will be familiar with all of the features and resources associated with your PoW membership access. You will be able to make an informed decision of how to start implementing PoWs with your students, and you'll have an idea of next steps to try when you are ready.
- **Teaching Mathematics with the Problems of the Week**
 - This course is designed for current subscribers of the Problem of the Week who want to make the most of their membership. Course activities include submitting your own answers to and analyzing math in the Math Fundamentals Problem of the Week (FunPoW), guiding your students through the solution and submission process, and sharing ideas and reflections with classmates.
- **Differentiated Math Instruction: Using Rich Problems to Reach All Learners**
 - Rich problems invite a variety of solution strategies. They provide an effective vehicle for accommodating a range of levels and learning styles, and for addressing the Process Standards as well! We will share strategies for using problem solving to build skills and concepts for struggling students and to provide challenge for those who soar.

Appendix I
illustrated page
how-tos

When you buy a subscription to the Problems of the Week, we'll send you a confirmation email including your login name and a link to set up your account. You set your own password during that set-up process, but if you forget, you can have it reset by following the "Still can't log in?" link below the login box.

So once you've logged in, here's where to go next.

Current PoWs and Problems Library
basic access

Current PoWs and Problems Library:

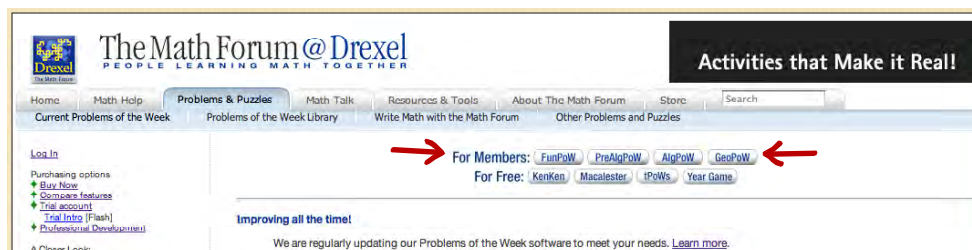
1. Go to the Math Forum Home page: mathforum.org.
2. Click on "Problems and Puzzles."



3. To see all the Current Problems of the Week at once, click the subhead under the Problems & Puzzles tab.



To see one in particular, use the appropriate button in the "For Members" section.



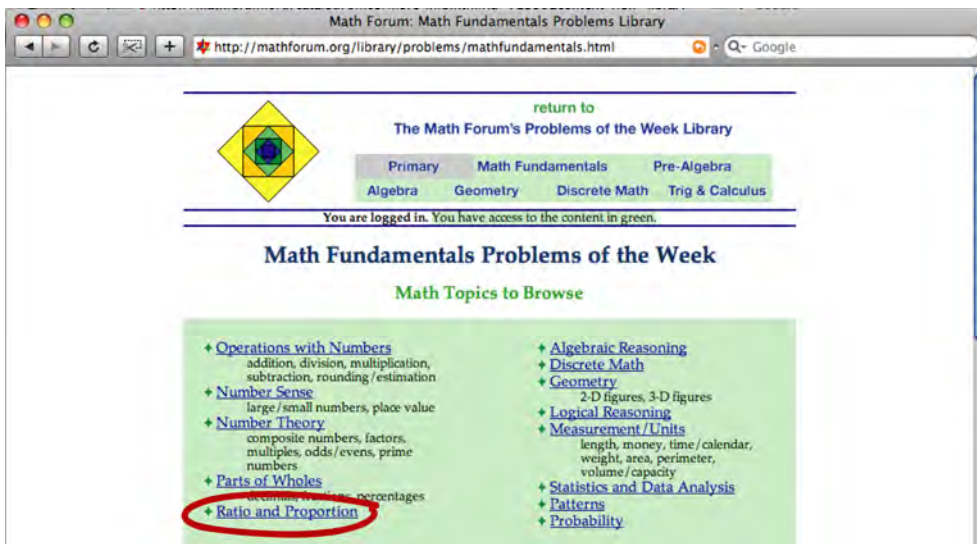
4. You may also have access to the library of previous Problems of the Week. To access this, go to mathforum.org, click on “Problems of the Week”, and the subhead under the Problems & Puzzles tab.



5. Log in at any point in your browsing, using the login button at the top of the page. If you choose not to log in yet, you'll be prompted for your username and password when you come to subscriber-only material.



6. Choose the service in which you'd like to browse, and you'll be presented with a list of topics within that service. Click on one in which you're interested.



7. Within that topic, you'll find a list of problems.

The screenshot shows a web browser window with the URL http://mathforum.org/library/problems/sets/fun_ratio.html. The page title is "Math Forum - Problems Library - Math Fundamentals, Ratio and Proportion". At the top, there is a navigation bar with "return to" and "The Math Forum's Problems of the Week Library". Below this are tabs for "Primary", "Math Fundamentals", and "Pre-Algebra", with sub-tabs for "Algebra", "Geometry", "Discrete Math", and "Trig & Calculus". A message states "You are logged in. You have access to the content in green." The main content area is titled "Ratio and Proportion" and includes a description: "These problems require students to understand and use ratios and proportions to represent quantitative relationships." There are sections for "Related Resources" and "Access to these problems requires a Membership." The sidebar on the left lists various math topics, with "About the PoW Library" circled in red. The main content area lists three problems: "Across Wisconsin" (active icon circled in red, difficulty level 2 circled in red), "Anthony's Famous Butter Rolls" (ts icon circled in red, difficulty level 2 circled in red), and "A Pound of Tea" (active icon circled in red, difficulty level 3 circled in red).

Students can submit answers online to any problem with a yellow “active” icon. Problems with a green “ts” icon have a Teacher Support page (see page 6 above). Each problem has a level of difficulty rating—for more on how those are created and what they mean, see “About the PoW Library”, linked on the left side of this page. “About the PoW Library” has more ideas about browsing by math topic, browsing across services, and seeing all the problems in one service.

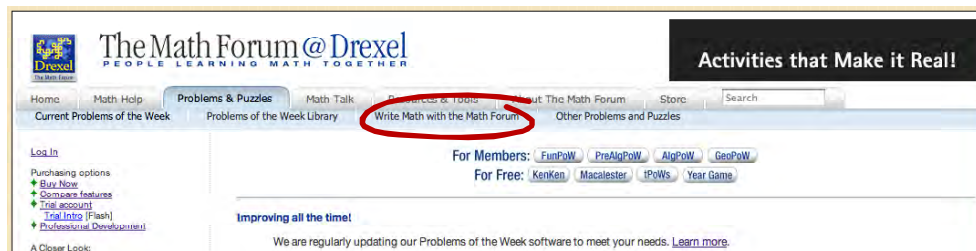
Are you finished with the service for now? Don't forget to log out!

**Write Math
with the Math
Forum**
basic access

1. Go to the Math Forum Home page: mathforum.org.
2. Click the “Problems & Puzzles” tab.

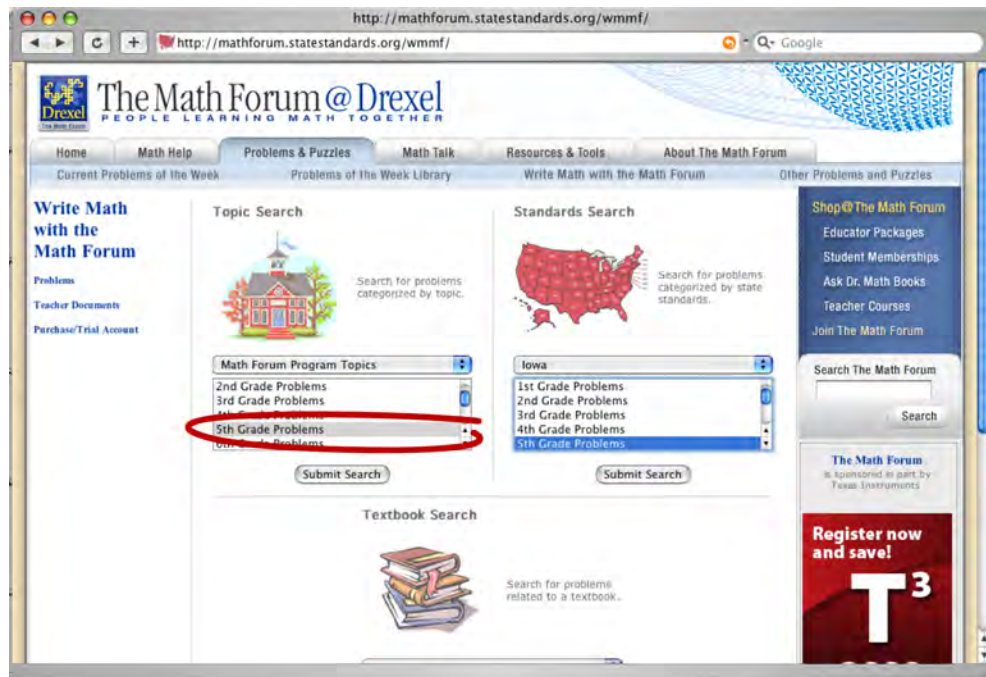


3. Click on the “Write Math with the Math Forum” subhead under the Problems & Puzzles tab.

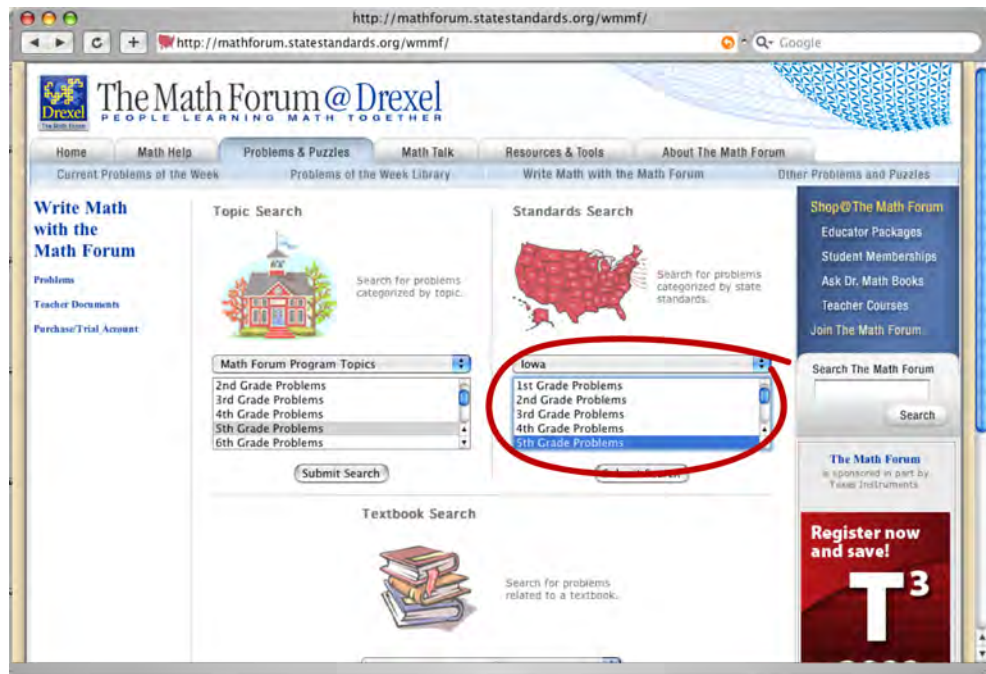


4. Write Math searches let you see how the problems are aligned to standards, textbooks, or the Math Forum’s program topics. You can see the complete distribution of problems by leaving the default selection of All Problems in the scrolling list for each search. As you browse the problems, their descriptions will indicate which problem set they come from—4- grade, 5- grade, etc. This will allow you to choose something a little easier or harder than your target search if you need to.

If you wish to search for alignments for only the problems in the grade(s) you teach, then start your search by selecting the appropriate grade level(s)/course(s), as illustrated. You can select multiple grades by holding down the command key (Mac) or the control key (Windows) while you click.



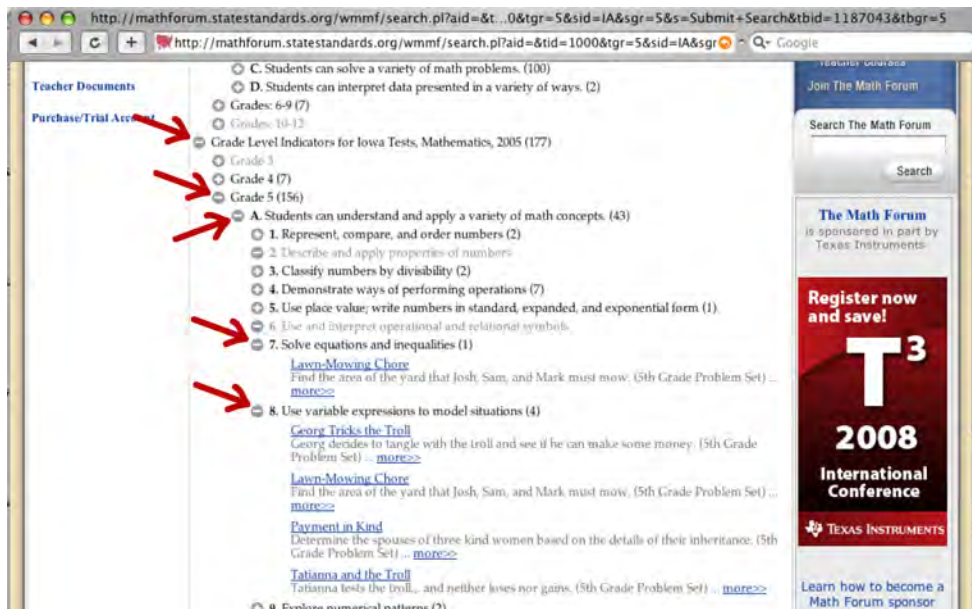
5. If you are using the Standards or Textbook search, remember to pick your state or textbook from the corresponding menu. The Standards search is illustrated here.



6. Click on the “plus” symbol to expand the section of alignments in which you are interested. Bold topics with numbers in parentheses after them have alignments associated with them. Some of these have sub-topics you can explore as well.

Note: Problems are categorized in as many categories as apply to them, so the parenthetical numbers after a category do not necessarily reflect the number of actual problems in the category. In this

instance, the problem “Lawn-Mowing Chore” is aligned to both “Solve equations and inequalities” and “Use variable expressions to model situations.” It is those alignments that are counted in the numbers after each category, not the number of problems in each category.



Are you finished with the service for now? Don't forget to log out!

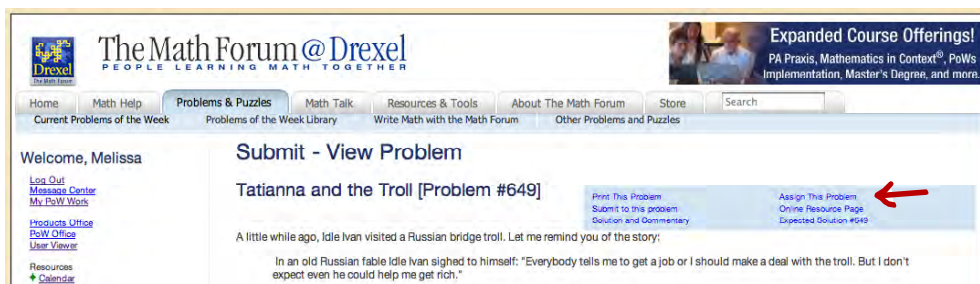
Making Assignments
from the
Problems
Library or Write
Math

1. Once you find a problem you're interested in through the searches described above, enter your Username and Password to view the problem, if you haven't already logged in.
2. For individual teacher members: Each problem has a number. You can note that number and have students go directly to that problem when they go to the Problems Library. This problem is number 649.



Note: As part of your license, you may also print out any problem and distribute it to your class at any time during the membership term.

3. For class-level teacher members: You, too, can use the problem number method given above, but there is also the option to assign a problem to one or more of your classes, using the link on each problem page.



This will cause the problem to show up on your students' "My PoWs" page.

Registering Your Students

1. There are two ways to get to the page where you set up student accounts. You can use the link in the email you received when you registered for an account. Or, you can get there from your My PoW Work page. To get there, go to <http://mathforum.org/>, click on the Problems & Puzzles tab.



Log in using the link at the top of the sidebar.

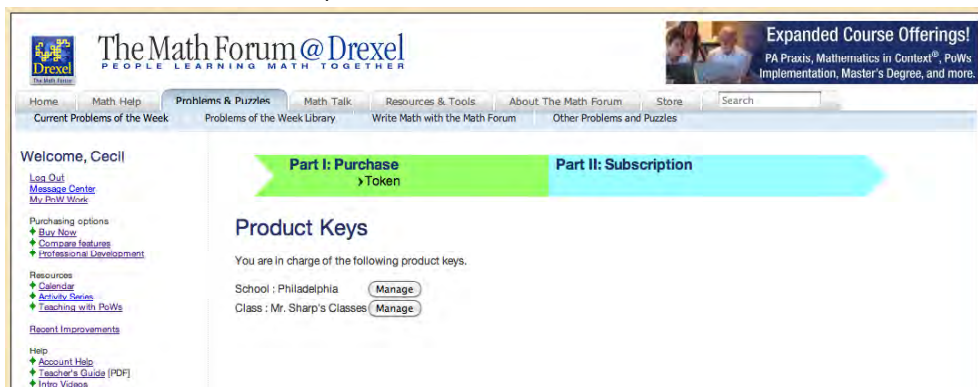


This takes you to the "My PoW Work" page. (If ever you want to get here from anywhere else while you're logged in, click the link to "My PoW Work" in the left navigation bar.)

At the right side of the “My PoW Work” page, under “My Accounts”, click on the link that says “Manage my purchase.”

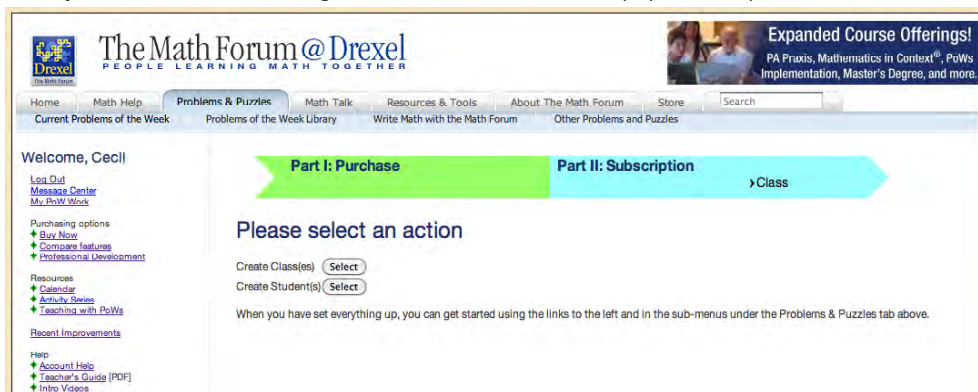


Here is what you see when you choose to manage your student accounts, or when you follow that link from the email you got to set up your account. This teacher has begun to set up classes and students, but has more available to set up.



Choose the “Class” link on this screen by clicking the “Manage” button next to it.

From the next screen, assuming you have set up one or more classes already and need to add students to them, choose “Select” next to “Create Student(s)”. (If you still need to create the class to which your students will belong, choose the “Create Class(es)” button.)

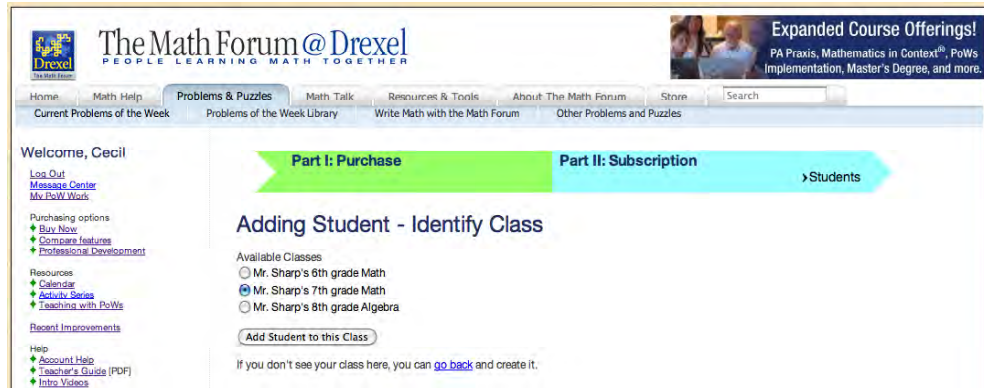


2. For privacy reasons, please review your school's Internet policy and our privacy policy (which you can find at <http://mathforum.org/announce/privacy.html>) before designating student usernames. We comply with the COPPA legislation that requires permission for students under 13. When you register students, you are indicating that you are authorized to grant this permission for your students. If your students' names must not appear on a Web site, you'll need to choose nicknames or use initials judiciously.

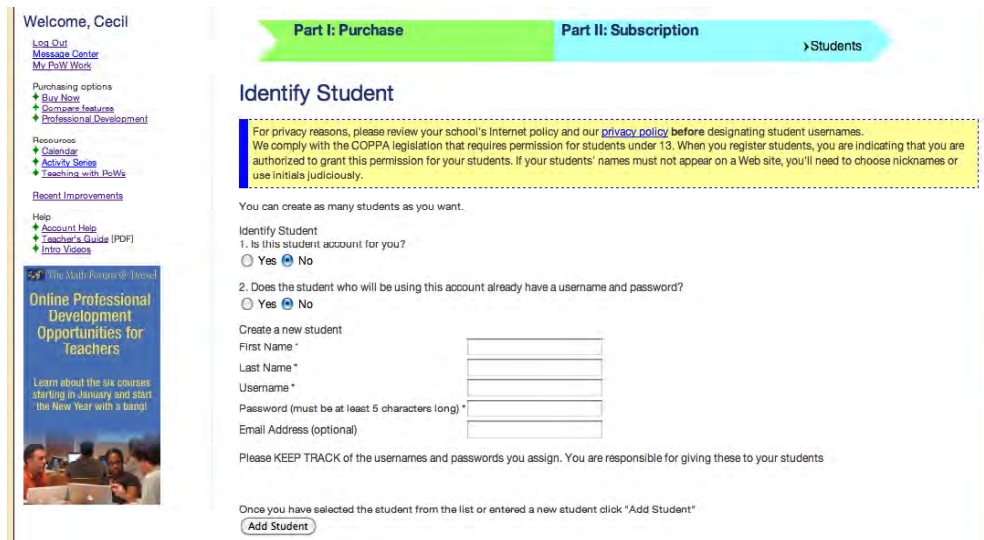
You generate your students' usernames and passwords yourself. You will not need to enter email addresses for your students, as there is a Message Center online for their Problem of the Week communications. Your **Message Center** can be found in the left sidebar when you're logged in: this is true for students as well. Or you can find it through your My PoW Work page (or for students, My PoWs.)

When they click on **Message Center** in their My PoWs page, they can view any email that the Math Forum Problem of the Week program has sent. It's a special web-based mail service with NO spam and NO other messages—only Math Forum messages.

Choose the class in which you want to add a student:



Here is the resulting screen:

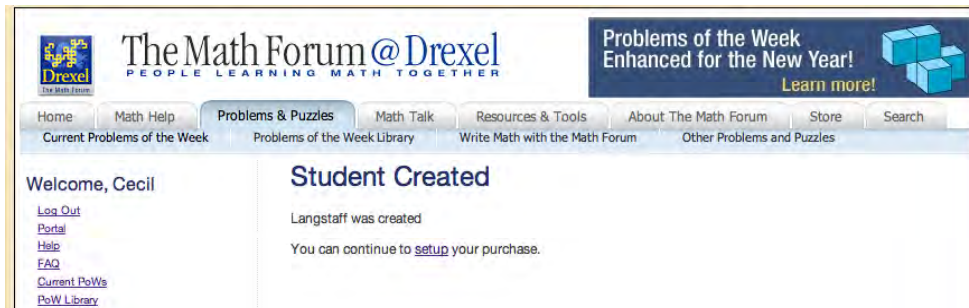


You can set up a student account for yourself in order to be able to submit your own answers to problems, but mostly you'll leave the radio button for that question set to "no". If your student already has a username and password, from a previous year perhaps, you can choose to identify those with the next radio button. If not, continue filling in the boxes for the form.

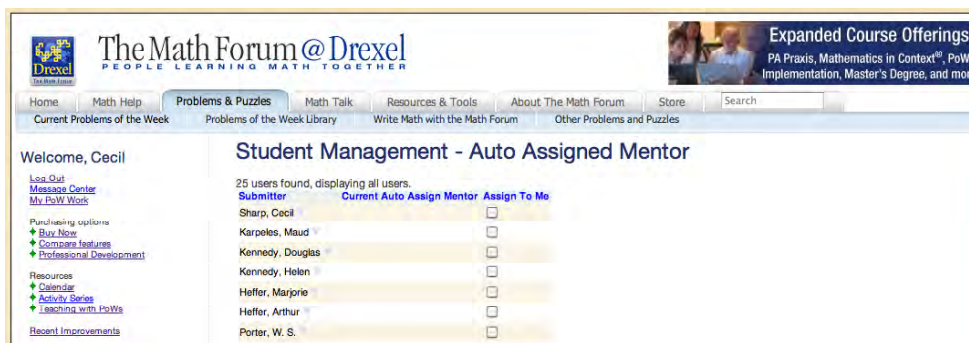
Keep track of what usernames and passwords you choose as you make them—you will be responsible for giving them to your students. Students will need their username and password to access the problems online and to submit their answers. Please remember that passwords are case sensitive: "CRIMPBUR" is not the same as "crimpbur".

We encourage you not to enter an email address at all, for the reasons stated above concerning privacy, as well as the dangers of mistyping an address.

Once you have created a student account, you can set up more students using the link given to “set up your purchase”, or you can go elsewhere in the service.



If you want to be able to mentor your own students' replies later, there's one more step to take. From My PoW Work, in the left column under Mentoring My Students, there's a heading that says "Manage automatic assignment of my students' work to me". You can choose to assess your own students on a class-wide basis or individually. Here is the top part of the individual "Student by Student" page:



If your students are not assigned to you, their work will be visible to you (through the “View Work” link in the “My Students’ Work” section at the top right of My PoW Work), but you will not be able to use our software to respond to them. If they are being mentored through one of our free mentoring opportunities or by a paid mentor instead of by you, don't assign them to yourself. You will see your name in the column “Current Auto Assign Mentor” when they are assigned to you.

Are you finished with the service for now? Don't forget to log out!

What Your Students Do When They Use the Library

1. Students go to mathforum.org, then the “Problems & Puzzles” tab and then log in using the username and password you chose for them. (See page 12 above.) (Please remind them that capitalization matters, as passwords are case sensitive.)
2. Any problems you've assigned them show up on their My PoWs page, linked from the left sidebar.

3. When students are ready to submit an answer, they click on “Compose answer” at the bottom of the problem page. This is the result:










Extra: Imagine another planet with 3 moons, each with a different orbital period. It takes exactly 15 days for those moons to return to a position of alignment. Find 3 possible orbital periods that would produce that result.




Credit for this problem will be given to: May Gadd





[Add Classmates](#)

Summarize your answer in a sentence or two:

Explain how you solved the problem. Include your math:

Source          **B** *I* U x_2 x^2

Font Size   

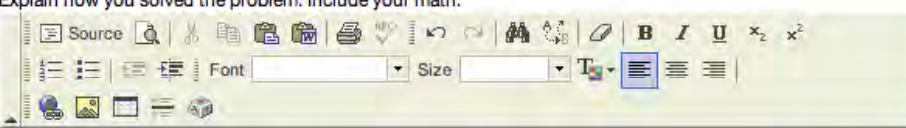
   

If students are submitting in groups, they may add other students to their submission using the “Add Classmates” link below their name.

Students should type in their summary answer in the field labeled “Summarize your answer in a sentence or two,” and their explanation of how they arrived at that answer in the field labeled “Explain how you solved the problem. Include your math.”

Here’s the screen below the explanation box:

Explain how you solved the problem. Include your math:



I looked for multiples of each orbit that would fit with multiples of the others—that means using the Least Common Multiple. I factored each orbital period to come up with:

7

$12 = 2 * 2 * 3$

$16 = 2 * 2 * 2 * 2$

Combining those to get the LCM means using 4 2's, a 3, and a 7: $7 * 3 * 2^4 = 336$

So the next alignment will be in 336 hours, which I divided by 24 to get days: $336 / 24 = 14$ days. Noon on May 13 plus 14 days is noon on May 27, so that's the next time the moons will line up.

File Upload

If you've created an image as part of your solution, you may upload it here.

You can upload jpg, jpeg, png or gif image files.

[Choose File](#) no file selected

[Submit Answer](#)

[I'll finish later](#)

Here, students have the option of uploading an image. This is useful for conveying visual representations that do not translate easily to text. We accept files saved in jpg, jpeg, png or gif formats. They can be digital photos, screen shots, computer generated drawings, or scanned images of a drawing on paper.

Finally, they should click “submit answer” only once. If they’d like to save their work so far and come back to it later, they can click “I’ll finish later” instead. Their My PoWs page will list it as a draft solution when they revisit it.

4. The results screen has three options:



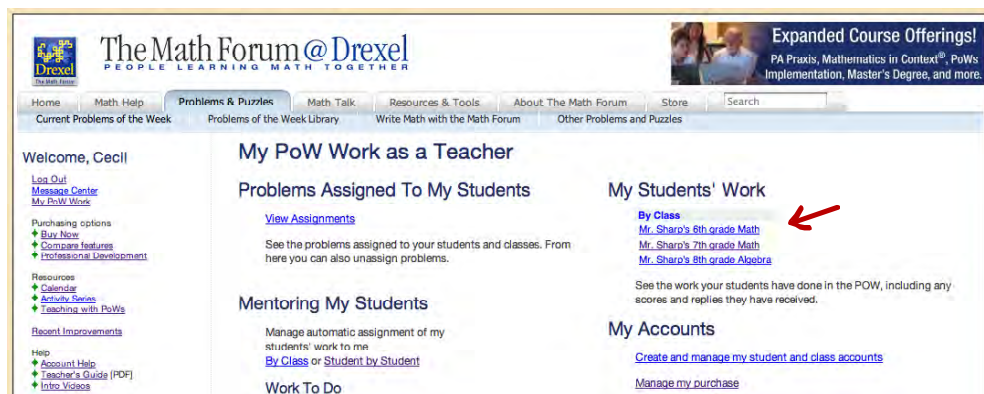
Their answer is already queued for mentoring by you if you have assigned the student to yourself for mentoring on your My PoW Work page, or by free or paid mentors if you’re using those services. It will also show up in your “View my students’ work” link on My PoW Work. To revise recent submissions, students should go to their My PoWs page, where they will see an option to resume work on unfinished answers.

Students may instead choose “Check Answer”—this will give their answer priority for mentoring if you’re using a free or paid mentor. Students may still revise their answer after this step.

Please remind students to log out when they are finished using the service.

Monitoring and Mentoring
your students’ work

You can see any work your students have submitted, whether or not they’re ready for mentoring, by clicking on the class you want under “My Students’ Work” at the top right section of My PoW Work.



You can mentor your students’ work, too: look for “Mentoring My Students” on My PoW Work. We have an introductory guide to the Math Forum scoring rubric there, as well as guidelines for mentoring, suggested responses, sample student responses with replies, and more. That’s under “Learn About Mentoring Your Students’ Work.” Once you’re ready to mentor, use the links under “Work To Do” which will give the number of threads waiting for your reply.

How to Start Problem Solving in Your Classroom

by Annie Fetter, the Math Forum @ Drexel

When you start doing problem solving in your classroom, keep in mind that one goal should be to create an environment that supports problem solving as an extended process. The intent is to engage students in the process, so the short term goal should be process over product. Don't worry about whether or not your students are solving all the problems correctly or completely. Are your students engaged? Are they all participating? Are they asking questions? Are they talking about math? If so, then the process is happening, and the product will follow.

Forget "The Question"

To put the focus more on the process, introduce the class to the problem by removing The Question. This can be done as a whole class (which is how I might start) or in small groups. The students must analyze the situation and focus on reading and interpretation instead of coming up with The Answer. (For an example of what this looked like in one class I taught, see the next page.)

1. Give students the text of the problem without the question (the overhead works great for this) or draw the associated picture on the board and tell them only what they need to know to understand the situation.
2. Go around the group and have each person list one thing they "notice". Responses might be as simple as "the lines go up", or even "there is one blue line and one red line", or as complex as "the blue line is going up twice as fast as the red line". Everyone can contribute something, and all the "noticings" are recorded for the group (on the class data pad or whiteboard, etc.) with minimal discussion.
3. Ask the students which items on the list they are wondering about (we often use the language of "wondering" instead of asking them what they don't understand). For example, a student might ask, "I'm wondering how you know that the blue line is going up twice as fast as the red line." Let the students respond to these questions. "Who would like to try to explain?" If possible or necessary, have more than one student explain each idea so that more student voices get heard.
4. At this point, I often ask students to pose a question for the situation presented. You might learn that sometimes math is pretty predictable—in my experience, kids almost always come up with a question that is a lot like the actual question!
5. Pose the actual question and talk about it as a group.
 - Have students list the observations they think will be helpful in answering The Question.
 - Let some kids take a stab at answering The Question. Depending on the readiness of your students, you may do this as a whole class or have students work in pairs.

Remember that the goal is to get your students engaged in the process of thinking mathematically and about how to solve problems. It is not about finding the solution, at least not initially. You will be able to judge the success of this activity as you listen to the buzz in the classroom and see how many more students are participating.

Other Ideas for Introducing Problems and Problem Solving

- Read the problem aloud.
- Talk about any vocabulary that students are wondering about (or that you are pretty sure they haven't seen recently).
- Have students retell the problem in their own words. Let them read it again if they're having trouble remembering.
- Make lists with questions such as what we know about the problem, what we want to figure out, and what questions we have.
- Talk about the questions and how we might figure out the answers.
- Draw pictures or a table or chart if it might help.

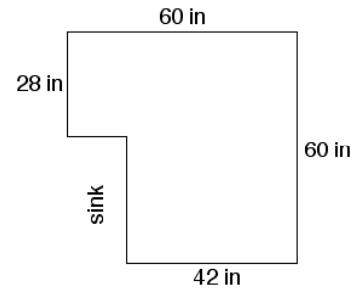
Appendix II
An Example of
"Forgetting the
Question"

Teresa's Tiles in an 8th Grade "Lowest Level" Class

In the spring of 2007, I presented "Teresa's Tiles" to a "lowest level" eighth grade class. I chose the problem because it is similar to problems on that state's Grade 8 assessment.

I drew this picture on the board and described to the students what we were about to do. "This is a picture of Teresa's bathroom floor. We're going to list as many things as we can about the picture. I'm going to ask each of you to offer one thing that you notice. Anything at all." Here's what they said:

- two sides are equal
- one side is 28 inches
- one side is 42 inches
- your lines aren't very straight
- the sink is a rectangle
- you can find the area of the whole thing by making it two pieces
- two sides are 60 inches
- they are longest
- it used to be a square
- the short side of the sink is 18"
- the long side of the sink is 32"



I was excited—that was a great list! I picked out the items I figured were most likely to be both important in eventually solving the problem and potentially confusing and asked for volunteers to explain them to me and the rest of the class. The following responses came from many different students.

AF: What does it mean to say that it used to be a square?

Student: The floor is like a square, but the sink is in the way.

AF: How do you know it is a square?

Student: Because all of the sides are 60 inches. That's a square.

AF: But all the sides in the picture aren't 60 inches long. Could someone show us on the board what you mean?

Student: *[drawing figure 1]* If the sink wasn't there, they would all be 60 inches.

AF: Okay. How do we know that the short side of the sink is 18 inches?

Student: Because it's 60 take away 42.

AF: How did you know to do 60 minus 42?

Student: 'Cause 60 is all the way and only want part of it.

AF: Would someone like to come up and show us what that means on the board?

Student: *[drawing figure 2]* That part is 42 because it is just like the bottom. So you do 60 take away 42.

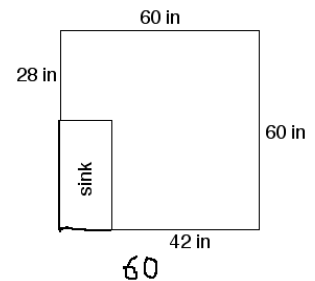


Figure 1

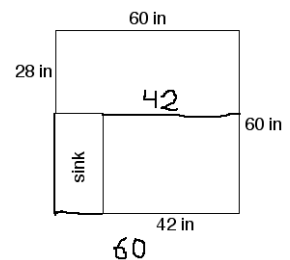


Figure 2

We went through a similar process with the ideas that the long side of the sink is 32" and that the area can be found by splitting the floor into two pieces. Then I explained that Teresa was going to put down new tiles, and that the new tiles are squares that are 4 inches by 4 inches. I drew a small tile on the board and labeled it 4" on each side. Then I said, "What can we say now?"

- the tiles are smaller than the floor
- it will take a lot of them!
- 15 tiles will fit across the top and the side
- each tile is 16 square inches
- 7 tiles will fit across the 28" side
- tiles won't fit across the bottom

At this point, we had reached the end of the class period. I gave each student a copy of the full text of the problem and told them that for tomorrow's class, they were to write down everything they remembered from our conversation. I told them that they should not to worry about solving the problem. I also told them that they had done an awesome job and that I had had a lot of fun!

I told the teacher that I had been really impressed with her students. Turns out she had been too! She was surprised by the number of things they had come up with and by how many of them had participated. A few days later I got an email saying that almost all of them had done their homework, and most had remembered more than half of what we talked about in class. A couple of the students had gone on to solve the problem, and when they worked on it in class the next day, many of them were engaged in the process. Not bad for their "first time"!

Why can't I log in?

This could be due to a number of factors. First, check our most common situation: when you purchased an account, did you follow the link in our order confirmation email to set it up? That's what gives you a username and password. If you did that but were interrupted and didn't finish the setup process, go back to the original email and follow the second link to resume the process.

If you've finished setting up your account and still can't log in, the error message shown when you try logging in should let you know which of these tips applies to your situation:

- ◆ If you're trying to access the Problems Library, you must have a class-level or higher membership. A \$25 teacher account does not include access to this service. We'd be happy to upgrade your account for you, and apply any money previously paid for the lower-level account towards your new account. Class-level memberships start at \$149 (\$119 for primary level).
- ◆ You may be entering the wrong username and/or password combination. Please check that you are using the correct combination, and that you are using correct capitalization, as passwords are case-sensitive. You can also double-check your original confirmation email, for your username.
- ◆ If you've tried these ideas and still can't access the PoWs, request a password change using the link in the login box: click "Log in" in the left sidebar, then use the link at the bottom of the blue box.

How do I change my password?

I don't remember my password.

Check the "Password Help" link below the box on the login page.

How do you come up with the Problems of the Week? Do you accept suggestions? Our class just created one...

We have a team of mathematicians and math educators who get together each week to hash out the problems and their wording. (They actually do the math for everything!) They're always happy to have suggestions—you can send yours in to us using the form at <http://mathforum.org/powcontact.html>. Be sure to include accurate contact information so we can get back in touch with you about it!

If I enter my students' first and last names when I'm setting up their accounts, will those names appear anywhere on the Internet?

For privacy reasons, please review your school's Internet policy and our privacy policy (which you can find at <http://mathforum.org/announce/privacy.html>) before designating student usernames. We comply with the COPPA legislation that requires permission for students under 13. When you register students, you are indicating that you are authorized to grant this permission for your students. If your students' names must not appear on a Web site, you'll need to choose nicknames or use initials judiciously.

I didn't put in any email address for my students. How do they get back to their solution to revise?

Since August of 2007, we've featured an individual Message Center for students and teachers. Students can access their Message Center through their My PoWs page, teachers through their My PoW Work page. The Message Center is a special Web-based email service with no spam and no other messages—only Math Forum messages.

I have another question about my account.

See our Account Help pages online, at <http://mathforum.org/pow/accounthelp/> for more answers about using student accounts and more.