WANTED: CHALLENGE PROBLEMS

MathWorks Math Modeling (M3) Challenge is an Internet-based, applied mathematics contest for high school juniors and seniors. M3 takes place each year in March. Teams of 3–5 students are given 14 hours to solve an open-ended, applied math-modeling problem related to a real-world issue. Winners will receive college scholarships totaling $100,000. Registration and participation are free.

The goal of the Challenge is to motivate students to study and pursue careers in STEM disciplines, especially applied mathematics, computational science, economics, and finance. The problem is revealed to the students only after they login on their selected Challenge day. Solutions are judged on the approach and methods used and the creativity displayed in problem solving and mathematical modeling.

Previous problem statements can be viewed at m3challenge.siam.org/resources/sample-problems.

Problem structure
Within the problem statement, there should be three questions for teams to answer:

• Question One: A warm up — every serious team can answer.
• Question Two: The guts — framed so that every team can have some success and many teams will cover it well.
• Question Three: The discriminator — many teams will do something, while only a few will have striking results.
• Data — Having some data sets and/or other references to get teams started is very desirable.

Honoraria
• $50 for problems found suitable to add to the M3 problem reserve “bank”
• $50 additional for problems posted on the website as sample modeling problems
• $500 for problems selected from the reserve bank to be used as “the” Challenge problem

To submit new ideas or get more information, contact:
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Please see reverse for sample problem and more information.
Got a Problem?
Want to have a big impact on a lot of students? Submit a problem for MathWorks Math Modeling (M3) Challenge! Since 2006, more than 37,000 high school students have tried their hand at solving M3 Challenge problems.

Math problems are everywhere. But presenting a very rich question — one with a variety of potential approaches and for which students can make necessary simplifications as needed — is difficult! Adding to the difficulty is the need to take into consideration the differences in the backgrounds and sophistication of the students.

In addition, an M3 problem statement needs to be presented as a real problem, i.e., in a context that represents the open-ended nature of the problem and provides a meaningful, non-mathematical context in which the “solution” is to be delivered. Previous M3 problems required that results be presented in the forms of a report to Congress or a newspaper article, for example. The importance of connecting a problem to a believable “deliverable” is a necessity.

It’s not easy — but helping to challenge the next generation of mathematicians is critical! We welcome your suggestions.

An Example — the 2013 Challenge Problem Statement:

### Waste Not, Want Not: Putting Recyclables in Their Place

Plastics are embedded in a myriad of modern-day products, from pens, cell phones, and storage containers to car parts, artificial limbs, and medical instruments; unfortunately, there are long-term costs associated with these advances. Plastics do not biodegrade easily. There is a region of the Northern Pacific Ocean, estimated to be roughly the size of Texas, where plastics collect to form an island and cause serious environmental impact. While this is an international problem, in the U.S. we also worry about plastics that end up in landfills and may stay there for hundreds of years. To gain some perspective on the severity of the problem, the first plastic bottle was introduced in 1975 and now, according to some sources, roughly 50 million plastic water bottles end up in U.S. landfills every day.

The United States Environmental Protection Agency (EPA) has asked your team to use mathematical modeling to investigate this problem.

**Question 1: Warm up**

How big is the problem? Create a model for the amount of plastic that ends up in landfills in the United States. Predict the production rate of plastic waste over time and predict the amount of plastic waste present in landfills 10 years from today.

**Question 2: The guts**

Making the right choice on a local scale. Plastics aren’t the only problem. So many of the materials we dispose of can be recycled. Develop a mathematical model that a city can use to determine which recycling methods it should adopt. You may consider, but are not limited to:

- providing locations where one can drop off pre-sorted recyclables
- providing single-stream curbside recycling
- providing single-stream curbside recycling in addition to having residents pay for each container of garbage collected

Your model should be developed independent of current recycling practices in the city and should include some information about the city of interest and some information about the recycling method. Demonstrate how your model works by applying it to each of the following cities: Fargo, North Dakota; Price, Utah; Wichita, Kansas.

**Question 3: Discriminator**

How does this extend to the national scale? Now that you have applied your model to cities of varying sizes and geographic locations, consider ways that your model can inform the EPA about the feasibility of recycling guidelines and/or standards to govern all states and townships in the U.S. What recommendations does your model support? Cite any data used to support your conclusions.

Submit your findings in the form of a report for the EPA.

The following references may help you get started:

http://www.epa.gov/epawaste/nonhaz/municipal/index.htm
http://5gyres.org/what_is_the_issue/the_problem/