RDM Manufacturing
21 Bridge Street
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Calculus II Student
Adelphi University
1 South Ave
Garden City, NY 11530-0701

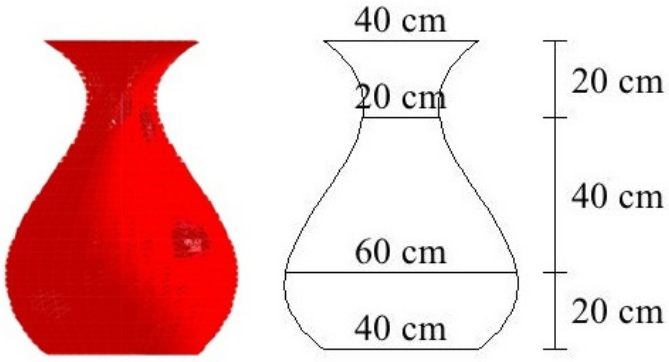
Dear Sir or Madam:

Our company was recently hired to manufacture several objects for the Mayor of Springfield, Mayor Joe Quimby. Unfortunately our engineers are too busy with other projects to spend time on this recent bid. As you are our top consultant, you have been hired to complete the assessment of this job for us. We are thankful for your help.

In regards to the project, these are tough economic times, and even the city of Springfield is affected by the ongoing crisis. As the mayor's reelection campaign is about to kick off, he is doing his best to remind the good people of Springfield that he is very successful in bringing federal funds to the town. As a result, the soon to be approved federal stimulus bill will provide just what is needed.

While some public officials may focus on the mundane (over-crowded schools, understaffed police and fire departments, crumbling bridges, unsafe water supply, aging power grid, blah–blah–blah), the mayor thinks in much grander terms. Babylon may have had its Hanging Gardens, but the mayor has commissioned Christo and Jeanne-Claude to design The Mayor Joe Quimby Floating Gardens of Springfield^{TM}. He is hoping for a display longer than the two weeks that The Gates were up in Central Park, but those negotiations are a little tricky. The plans are mostly set, but there are still a few loose ends that need to be tied up before the project can be classified as "shovel ready" and eligible for funds under the terms of the stimulus.

The basic idea is that we will have hundreds of large vases floating in Lake Springfield, each containing a tasteful botanical arrangement. As you may know, Lake Springfield is not necessarily the cleanest body of water in the United States, so the vases will be constructed of lightweight, one centimeter thick stainless steel. Also, the botanical arrangements will consist entirely of silk flowers and plants to avoid the embarrassing wilting that occurs when any live vegetation gets too near Lake Springfield. The basic design of the vases is the following:



To meet the artistic vision of Christo and Jeanne-Claude, we will add play sand to the vases so that they will float at different heights, where 50 cm, 30 cm, 20 cm or 5 cm of the vase is visible above

the waterline. I have been promised by my engineering team that the vases will float, but after the whole experience with the Green Day concert, I don't want to take any chances. This is where I need your help. I need you to verify that the vases will float when empty, and I need to know how much sand to add to achieve each of the desired heights.

After describing the needs to our engineers, they suggested that you might find the following pieces of information useful:

- The stainless steel we will be using weighs approximately 4 grams per cubic centimeter, that play sand weighs approximately 1.5 grams per cubic centimeter, and that the weight of the silk arrangements is negligible.
- It may also be useful to know that if an object floats, the object displaces an amount of water that is equal in weight to the weight of the object. i.e. A floating object that weighs 10 kilograms will displace 10 kilograms of water.
- You might find it interesting that one cubic centimeter of water weighs one gram.

I need you to write up a full report to our team of engineers. They are interested in the mathematics, so make sure you explain your ideas. Also, some of them have been away from math for a while, so if you use any interesting facts, please make sure and cite them. I have heard that the book by James Stewart is a nice reference.

We have hired a writing consultant, Anustha Shrestha, to help with the write-up of this project. Please seek her help if you have any quetions.

In order to get at the front of the queue for the stimulus funds, I will need your report by March 30.

Yours Faithfully,

Roy D. Mercer