Crystal Creations
2313 Glassy Way
Tallahassee, FL 32300

November 5, 2003

Mathematically Amazing Consultants (MAC), Inc.
Suite 217, Hoffman Teaching Lab
Florida State University
Tallahassee, FL, 32306

Dear MAC,

Our glass blowing company, **Crystal Creations**, is a leader in manufacturing crystal glassware. We take pride in creating quality and beautiful glassware using traditional glass blowing techniques. We are in a position where we are able to update our current line of glasses and we would like to design new glassware. We wish to contract your highly recommended firm for its mathematical expertise. To help with our design process, we wish to investigate the construction and volume of existing types of drinking glasses. We would like you to pick a drinking glass of your choice (for example, a wine glass, coffee mug, juice glass, *etc.*) and study its construction. You are to inspect the shape of the glass and determine its volume. Then determine the dimensions such a glass should have in order to minimize the cost of creation (material and glass blowing labor) while maintaining the volume and basic shape of the original container.

The Glass Materials Division of **Crystal Creations** are providing you with the following design specifications and glass blowing costs.

- The glass material used in glass blowing costs 10 cents per cubic centimeter.
- The techniques of glass blowing result in the thickness of the glass on the sides being 1/20th of the height of the glass used in that portion and the thickness of the glass on the base being 1/20th of the radius or maximum length of the glass used in that portion.
- Any patterns imprinted into the glass cost 5 cents per cubic centimeter.
- Any seams require an extra one centimeter of glass thickness over the attachment area to allow for glass melting which acts as the 'glue' between pieces.
- Labor for glass melting (for attaching extra pieces) costs 2 cents per cubic centimeter of extra seam material.
- Labor costs for glass blowing varies based on the amount of glass used. The more glass that is used, the easier it is for the glass blower to create the final product. The cost for labor is $C = 180 - g/10$ cents where g is the amount of glass used in cubic centimeters, for up to 800 cm^2 of glass, otherwise the cost is fixed at \$1.00 per cubic centimeter of glass used.

We are requesting a final report including the following items.

- A description of the entire process that you use.
- A photograph and sketch of the glassware that you are modeling.
- Details of the construction of the glassware – omitting or ignoring any details in the model must be justified.
- Justification of any assumptions made to simplify the model (such as number of seams, handle size or stem length) and commentary on how those assumptions may or may not affect the final results.
- A recommendation as to whether it is worth changing the current dimensions of the model glassware to minimize the cost of manufacturing, and if so, what are the new dimensions.
- The first page of the report is to be a summary of your findings for the president of the **Crystal Creations**, I. Blowglass. Please keep in mind that Mr. Blowglass has little or no knowledge of Calculus. The remainder of the document should detail the mathematics you used and the items described above so our scientists can study your report in detail.

We are also requesting a poster presentation of your results and modeling process to decide if we should consider using your firm for future projects.

We wish to receive your final report and poster presentation on Monday November 24, 2002. To assist you with your investigations, one of our scientists, Dr. M. K. Hurdal, has agreed to answer any questions you may have. She has also agreed to look at a draft report to verify your progress and offer extra advice should you wish to submit a draft by November 12. We at **Crystal Creations** are sure that this will be a profitable endeavor for everyone and look forward to receiving your report.

Sincerely,

I. Blowglass,
President, **Crystal Creations**