Mathematics 221   Spring 2004   Project 1

Due: January 27 at 3:00 P.M.

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Name
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Directions: Be sure to follow the guidelines for writing up projects as specified in the course information sheet (passed out on the first day of class). Whenever appropriate, use in-line citations, including page numbers and people consulted when you present information obtained from discussion, a text, notes, or technology. **Only write on one side of each page.**

"In mathematics you don't understand things. You just get used to them." — John von Neumann

Project Description

Determine how to solve both of the following but submit your written efforts on only one (1) of them.

1. There are many ways to specify geometric objects to an audience. For example, when describing spheres it is usually easiest to give the center and radius since those two bits of information completely specify a unique sphere. By using the points $A(-1, -4, 3)$ and $B(5, 2, -2)$, show that it is also possible to specify a sphere as the set of points P such that the distance from point P to the point A is three times the distance from point P to point B. In particular, write the equation of the sphere in standard form $(x - h)^2 + (y - k)^2 + (z - l)^2 = R^2$.

2. Form a new XY coordinate system by rotating the xy coordinate system counterclockwise around the origin by an angle of θ radians. If $\vec{x} = \langle a, b \rangle$ is an arbitrary vector in the xy coordinate system, determine the components of $\vec{x}$ in the XY coordinate system. [Hint: first do the following and then use the results to finish the analysis. If $\widehat{\mathbf{i}} = \langle 1, 0 \rangle$ and $\widehat{\mathbf{j}} = \langle 0, 1 \rangle$ are vectors in the xy coordinate system, determine the components of these vectors in the XY coordinate system.]