Math. 302-05
Fall, 2016
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First Examination

Tuesday, September 13, 2016

Instructions: This exam should be done on your own paper. Your name should be on each sheet and on the back of the last sheet; the answers should appear written carefully and in order. If in doubt, show intermediate steps: Full credit may not be given, even for correct answers, unless work is arranged clearly and explained. This exam is closed book. You may leave after handing in your exam paper, but be sure to check your answers carefully. You may keep this exam sheet. Each problem is worth 16 points, and 4 points are free.

1. Find the center and radius of the sphere corresponding to the equation

$$x^2 + y^2 + z^2 + 4x - 8y + 6z = 7.$$

2. Find the components of the unit vector pointing from $P(1, 2, -1)$ to $P(-1, -2, -3)$.

3. Decompose the vector $\boldsymbol{u} = \langle 1, 2, 3 \rangle$ into $\boldsymbol{u} = \boldsymbol{v} + \boldsymbol{w}$, where $\boldsymbol{v}$ is in the direction of $\boldsymbol{b} = \langle -1, 0, 1 \rangle$.

4. Write down a vector equation for the line through $P(1, 2, 3)$ and $Q(4, 5, 6)$.

5. Write down an equation for the plane that passes through the points $P(0, 0, 0)$, $Q(1, 0, 1)$ and $R(1, 2, 0)$.

6. Find the spherical coordinate representation for the point with rectangular coordinates $\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, -1 \right)$.