Math 241, Fall 2000, Exam 1

PRINT Your Name:____________________________

There are 10 problems on 4 pages. Each problem is worth 10 points. SHOW your work. $\boxed{\textit{CIRCLE}}$ your answer. **NO CALCULATORS!**

1. Graph and describe the graph of $xz = 0$ in $3-$ space.

2. Graph and describe the graph of $x^2 + y^2 = 4$ in $3-$ space.

3. Find the angle between $\overrightarrow{\boldsymbol{u}} = 2\overrightarrow{\boldsymbol{i}} + 3\overrightarrow{\boldsymbol{j}} - \overrightarrow{\boldsymbol{k}}$ and $\overrightarrow{\boldsymbol{v}} = 3\overrightarrow{\boldsymbol{i}} + 2\overrightarrow{\boldsymbol{j}} + \overrightarrow{\boldsymbol{k}}$.

4. What is the distance from the point $(1, 2, 3)$ to the z-axis.

5. Find the center and radius of the sphere $x^2 + y^2 + z^2 + 2x - 6y - 10z + 34 = 0$.

6. If $\overrightarrow{\boldsymbol{u}} = \overrightarrow{\boldsymbol{i}} + 2\overrightarrow{\boldsymbol{j}} + 3\overrightarrow{\boldsymbol{k}}$ and $\overrightarrow{\boldsymbol{v}} = 5\overrightarrow{\boldsymbol{i}} + y\overrightarrow{\boldsymbol{j}} - 3\overrightarrow{\boldsymbol{k}}$ are perpendicular, then find y .

7. **(There is no partial credit for this problem. Make sure your answer is correct.)** Let $\overrightarrow{\boldsymbol{a}} = \overrightarrow{\boldsymbol{i}} + 3\overrightarrow{\boldsymbol{j}} + 4\overrightarrow{\boldsymbol{k}}$ and $\overrightarrow{\boldsymbol{b}} = 3\overrightarrow{\boldsymbol{i}} + 7\overrightarrow{\boldsymbol{j}} + 7\overrightarrow{\boldsymbol{k}}$. Find vectors $\overrightarrow{\boldsymbol{u}}$ and $\overrightarrow{\boldsymbol{v}}$ with $\overrightarrow{\boldsymbol{b}} = \overrightarrow{\boldsymbol{u}} + \overrightarrow{\boldsymbol{v}}$, $\overrightarrow{\boldsymbol{u}}$ parallel to $\overrightarrow{\boldsymbol{a}}$, and $\overrightarrow{\boldsymbol{v}}$ perpendicular to $\overrightarrow{\boldsymbol{a}}$.

8. Find the distance between $x + 2y + 3z = 1$ and $x + 2y + 3z = 2$.

9. Find the equation of the plane which contains the point $(1, 2, 3)$ and is parallel to the plane $2x - 3y + 4z = 2$.

10. Find the point on $(x - 1)^2 + (y - 2)^2 + (z - 3)^2 = 6$ which is closest to $x + y + 2z = 20$.