Math 241, Fall 1997, exam 1

PRINT Your Name:______________________________

There are 10 problems on 4 pages. Each problem is worth 10 points. SHOW your work. $\boxed{CIRCLE}$ your answer.

NO CALCULATORS!

1. Describe the graph of $xz = 0$ in $3-$ space.

2. Describe the graph of $x^2 + y^2 = 9$ in $3-$ space.

3. Find the work done by the force $\overrightarrow{\boldsymbol{F}} = 3\,\overrightarrow{\boldsymbol{i}} + 4\,\overrightarrow{\boldsymbol{j}}$ pounds in moving an object from $(1,0)$ to $(6,8)$, distance is measured in feet.

4. **(There is no partial credit for this problem. Make sure your answer is correct.)** Find the equation of the plane through $(1,0,1)$, $(2,2,3)$, and $(3,5,6)$.

5. Let $\overrightarrow{\boldsymbol{a}} = 3\,\overrightarrow{\boldsymbol{i}} + 2\,\overrightarrow{\boldsymbol{j}}$ and $\overrightarrow{\boldsymbol{b}} = \overrightarrow{\boldsymbol{i}} - 2\,\overrightarrow{\boldsymbol{j}} + 3\,\overrightarrow{\boldsymbol{k}}$. Compute $\overrightarrow{\boldsymbol{a}} \times \overrightarrow{\boldsymbol{b}}$.

6. Let $\overrightarrow{\boldsymbol{a}} = 3\,\overrightarrow{\boldsymbol{i}} + 2\,\overrightarrow{\boldsymbol{j}}$ and $\overrightarrow{\boldsymbol{b}} = \overrightarrow{\boldsymbol{i}} - 2\,\overrightarrow{\boldsymbol{j}} + 3\,\overrightarrow{\boldsymbol{k}}$. Find the angle between $\overrightarrow{\boldsymbol{a}}$ and $\overrightarrow{\boldsymbol{b}}$.

7. Find the vector of length 10 which has the same direction as $\overrightarrow{\boldsymbol{b}} = 2\,\overrightarrow{\boldsymbol{i}} - 3\,\overrightarrow{\boldsymbol{j}} + 3\,\overrightarrow{\boldsymbol{k}}$.

8. **(There is no partial credit for this problem. Make sure your answer is correct.)** Let $\overrightarrow{\boldsymbol{a}} = -2\,\overrightarrow{\boldsymbol{i}} + 3\,\overrightarrow{\boldsymbol{j}}$ and $\overrightarrow{\boldsymbol{b}} = 2\,\overrightarrow{\boldsymbol{i}} - 2\,\overrightarrow{\boldsymbol{j}} + 3\,\overrightarrow{\boldsymbol{k}}$. 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 $\overrightarrow{\boldsymbol{a}}$.

9. Find the distance between $3x + 2y + 3z = 2$ and $3x + 2y + 3z = 4$.

10. Find the point on $(x-2)^2 + (y-3)^2 + (z-3)^2 = 16$ which is closest to $2x + 3y + 4z = 1000$.