

Math 241, Spring 2001, Exam 1

PRINT Your Name: _____

There are 10 problems on 5 pages. Each problem is worth 10 points. SHOW your work. **CIRCLE** your answer. **NO CALCULATORS!**

1. Graph and describe the graph of $xz = 0$ in 3-space.
2. Graph and describe the graph of $x^2 + z^2 = 0$ in 3-space.
3. Graph and describe the graph of $x^2 + z^2 = 1$ in 3-space.
4. Find the angle between $\vec{u} = 3\vec{i} - 2\vec{j} + \vec{k}$ and $\vec{v} = 2\vec{i} + \vec{j} - \vec{k}$.
5. **(There is no partial credit for this problem. Make sure your answer is correct.)** Let $\vec{a} = \vec{i} + 2\vec{j} + 3\vec{k}$ and $\vec{b} = 4\vec{i} + 6\vec{j} + 4\vec{k}$. Find vectors \vec{u} and \vec{v} with $\vec{b} = \vec{u} + \vec{v}$, \vec{u} parallel to \vec{a} , and \vec{v} perpendicular to \vec{a} .
6. Find the equation of the plane which contains the point $(2, 3, 1)$ and is perpendicular to the vector $\vec{N} = 2\vec{i} - 3\vec{j} + 2\vec{k}$.
7. Find the point on $(x - 1)^2 + (y - 3)^2 + (z + 1)^2 = 14$ which is closest to $x + 2y + 3z = 30$.
8. Find the equation of the sphere whose center is $(2, 4, 5)$ and which is tangent to the xy -plane.
9. Find the work done by the force $\vec{F} = 3\vec{i} - 6\vec{j} + 7\vec{k}$ as it moves an object in a straight line from $(2, 1, 3)$ to $(9, 4, 6)$. Force is measured in pounds. Distance is measured in feet.
10. The vectors \vec{v} and \vec{w} live in the xy -plane. The vector \vec{v} has a magnitude of 60 and points in the direction $\frac{\pi}{12}$ radians. The vector \vec{w} has a magnitude of 80 and points in the direction $\frac{4\pi}{7}$ radians. How long is $\vec{v} + \vec{w}$? (Angles are measured counterclockwise starting at the positive x -axis. You may leave "cos" and/or "sin" in your answer.)