

MAT 397 — SPRING 2005 — EXAM I REVIEW

Questions (1)–(11) refer to the vectors $\vec{u} = \langle 3, 1, -2 \rangle$ and $\vec{v} = \langle 0, -2, 3 \rangle$.

- (1) Find $6\vec{u} - 4\vec{v}$.
- (2) Find $|\vec{u}|$ and a unit vector in the direction opposite to \vec{u} .
- (3) Find $\vec{u} \cdot \vec{v}$.
- (4) Find $\vec{u} \times \vec{v}$.
- (5) Find the cosine and sine of the angle from \vec{u} to \vec{v} .
- (6) Find the direction cosines of \vec{u} .
- (7) Find the scalar projection of \vec{u} onto \vec{v} and the vector projection of \vec{v} onto \vec{u} .
- (8) Find two vectors orthogonal to \vec{v} .
- (9) Find the area of the parallelogram with vertices at $(0, 0, 0)$, $(3, 1, -2)$, and $(0, -2, 3)$ (note that this is only three vertices – how to find the fourth? do you need it?).
- (10) Find parametric and symmetric equations for the line through the point $(4, 4, 4)$ in the direction of \vec{u} . Find the coordinates of the points where that line intersects the three coordinate planes.
- (11) Find an equation for the plane containing the point $(1, 1, 1)$ and with normal vector \vec{u} . Find its intercepts. Find the distance from the point $(0, -2, 3)$ to that plane.
- (12) Sketch the traces of the quadric surface defined by $x^2 + y^2 - z^2 = 1$ in the planes $x = k$, $y = k$, $z = k$. Sketch the surface.
- (13) For each of the following equations in cylindrical coordinates, describe the graph and convert to Cartesian coordinates.
 - (a) $r = 0$
 - (b) $r^2 + z^2 = 25$
 - (c) $r^2 - z^2 = 1$
 - (d) $z = -1$
 - (e) $r = -2 \sec \theta$
 - (f) $z = 2r^2$
- (14) Same question, but these equations are in spherical coordinates.
 - (a) $\rho = 2$
 - (b) $\phi = \pi/4$ (don't convert)
 - (c) $\theta = \pi/6$ (don't convert)
 - (d) $\rho = 8 \sec \theta$