MATH 251 (Spring 2004) Exam 1, Feb 25th

No calculators, books or notes! Show all work and give **complete explanations** for all your answers. This is a 65 minute exam. It is worth a total of 75 points.

(1) [10 pts] Let \mathbf{u} and \mathbf{v} be the vectors shown in the sketch and suppose that $|\mathbf{u}| = 2$.

Use the geometric definition of the dot and cross products to find

(a)
$$\mathbf{u} \times \mathbf{v} =$$

(b)
$$\mathbf{u} \bullet \mathbf{v} =$$

(2) [15 pts] Let $\mathbf{r}(t)$ be the parametrized curve $\mathbf{r}(t) = (t, \cos t, 2\sin t)$.
(a) Sketch the curve. [Hint: First find and sketch a surface on which the curves lies.]
(b) Compute the velocity vector of the curve ${\bf r}$ at $t=0$.
(c) Compute the parametric equation of the tangent line to the curve at $t=0$.

(3) [20 pts]

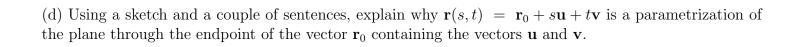
Consider the plane through the points

P = (1, 2, 3), Q = (1, -2, -5), and R = (3, 0, 7).

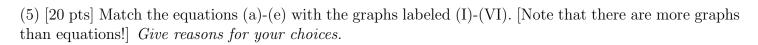
(a) Find a vector that is perpendicular to this plane.

(b) Write down an equation of the form ax + by + cz = d for this plane.

(c) Find a parametrization of this plane.



(4) [10 pts] Let P be the point with spherical coordinates $\rho = 4$, $\theta = \pi$, $\phi = \pi/6$. Find the rectangular and cylindrical coordinates of P.



(a)
$$y^2 = x^2 + z^2$$

(b)
$$x^2 + y^2 + z^2 = 2y$$

(c)
$$\rho = 1$$

(d)
$$y^2 = x^2 + z^2 + 1$$

(e)
$$r = 2$$

Pledge: I have neither given nor received aid on this exam

Signature: