

## Merit Math 242 Practice Exam 1, Fall 2005

All the obvious warnings apply - I am not writing Hour Exam 1 and I have not seen Hour Exam 1.

1. Find a vector  $\mathbf{z}$  perpendicular to both  $\mathbf{x} = 2\mathbf{i} + 3\mathbf{j} - 5\mathbf{k}$  and  $\mathbf{y} = 3\mathbf{i} - \mathbf{j} + 2\mathbf{k}$ .
2. What are the symmetric equations of the line perpendicular to the plane  $2x - 3y + 4z = 6$  that goes through the point  $(6, 2, 1)$ ?
3. What are the cylindrical coordinates of a sphere centred at  $(0, 0, 2)$  of radius 3?
4. What are the horizontal traces of the hyperboloid with two sheets  $z^2 - x^2 - y^2 = 1$ ?
5. Consider the curve with position vector  $\mathbf{r}(t) = 4t\mathbf{i} + 2/3t^3\mathbf{j} - 2t^2\mathbf{k}$ .
  - (a) What is  $\mathbf{r}'(t)$ ?
  - (b) What is  $\int_0^1 \mathbf{r}(t) dt$ ?
  - (c) Find the arc length of the curve traced out by  $\mathbf{r}(t)$  from the point  $P(0, 0, 0)$  to  $Q(4, 2/3, -2)$ .
6. A particle moves in space with parametric equations  $x = t$ ,  $y = t^2$ ,  $z = 4/3t^{3/2}$ . Find the curvature of its trajectory when  $t = 1$ .
7. Consider the lines:

$$\begin{aligned} L_1 : \quad & x = t + 1 \quad y = 3t - 1 \quad z = 15t - 12 \\ L_2 : \quad & x = 2 - s \quad y = 1 - 2s \quad z = -1 - 11t \end{aligned}$$

Find the unique plane  $P$  containing both of these lines.

What is the angle between the plane  $P$  and the  $xy$ -plane?

8. Write the equation of the surface obtained by rotating  $y = x^2$  around the  $y$ -axis.