136.270

Assignment 1 (Sections 13.1-13.7, 14.1-14.2)

Handed: October 4, 2004. Due: October 11, 2004 in
Show your work. Providing answers without justifying them will not be sufficient.

1. [6 marks] Find parametric equations of the line through the point (0,1,2), that is perpendicular to the line $x = 1 + t,\ \ y = 1 - t,\ \ z = 2t$ and intersects that line.

2. [5 marks] [3] (a) Sketch the surface $x^2 + y^2 = -z$. Sketch at least two traces of that surface with planes of type $y = c$ (c various constants) and at least two traces with planes of type $z = c$ (c various constant). (You may, if you want, use computers to do this; in particular, you may use the webMathematica page for this course.)

[2] (b) Find parametric equations of the curve in the intersection of the surface in (a) and the plane $-x - y - z = 3$.

3. [7 marks]

[1.5] (a) Find the rectangular coordinates of the point $(r,\theta,z) = \left(5, \frac{\pi}{6}, 6\right)$ given in cylindrical coordinates.

[1.5] (b) Find the rectangular coordinates of the point $(\rho,\theta,\phi) = \left(2, \frac{\pi}{4}, \frac{\pi}{3}\right)$ given in spherical coordinates.

[1.5] (c) Find the cylindrical coordinates of the point $(x,y,z) = (3,4,5)$ given in rectangular coordinates.

[1.5] (d) Find the spherical coordinates of the point $(x,y,z) = \left(1,1,\sqrt{2}\right)$ given in rectangular coordinates.

[1] Plot all of the above points in a single coordinate system.

4. [7 marks].

[2] (a) For $\vec{\mathbf{r}}(t) = \left(e^{-t}, \frac{t-1}{t+1}, \tan^{-1} t\right)$ find $\lim_{t\to\infty} \vec{\mathbf{r}}(t)$.

[3] (b) Find all points on the curve $\vec{\mathbf{r}}(t) = \left(1 - t^2, 4t^2 - 1, t^4 - 8t^2\right)$ where that curve has tangent lines parallel to the vector $\mathbf{v} = (-2,-8,12)$.

[2] (c) Find the unit tangent vector of the curve $\vec{\mathbf{r}}(t) = \left(3t + 1, 4t^2 - 1, t^4 - 8t^2\right)$ at the point $(1,-1,0)$.