18.02 Recitation
Problems
12 December 2011

1. Find the equation for a plane passing through the point $(1, 1, 1)$ and containing the line given parametrically by $(1, 0, 0) + (1, 0, 1)t$. What angle does this plane make with the vector $(0, 1, 0)$?

2. (2I-2) Using Lagrange multipliers, tell which point P in the first octant and on the surface $x^3y^2z = 6\sqrt{3}$ is closest to the origin.

3. Compute the work $\int_C \vec{F} \cdot d\vec{r}$ where C follows the parabola $y = x - x^2$ between $(0, 0)$ and $(1, 0)$, and $\vec{F} = \langle 2xy, x^2 \rangle$. Can you do it via: direction calculation, Green's theorem, fundamental theorem for line integrals?

4. Solve the linear system $x + y - z = 0$, $-x + 2y - z = 0$, $2x + y + z = 7$. Hint: the inverse matrix is of the form

$$\begin{pmatrix} 1 & 1 & -1 \\ -1 & 2 & -1 \\ 2 & 1 & 1 \end{pmatrix}^{-1} = \frac{1}{7} \begin{pmatrix} 3 & -2 & 1 \\ -1 & 3 & 2 \\ -5 & 1 & a \end{pmatrix}$$

5. Evaluate $\iint_S \vec{F} \cdot \vec{n}\, ds$, where S is the part of $z = 1 - x^2 - y^2$ lying above the plane $z = 0$, $\vec{F} = \langle zy, zx, 1 + z \rangle$.

6. Consider the surface $x^2 + 4y^2 + 2z^2 = 1$. What is the tangent plane at $(1/2, 1/4, 1/2)$?

7. Let $f(x, y, z) = x + y + z$. Find $\left(\frac{\partial f}{\partial x}\right)\Big|_y$ subject to remaining on the above ellipsoid, at the same point.

8. Consider the point $(1, 1, 1)$. What is this point in spherical coordinates? How fast does ρ change when x and z each increase at a rate of 1?

9. Find the area of the region bounded by $x^2 + y^2 = 1$, $x^2 + y^2 = 4$, $x/y = 0$, $x/y = 1$. Use a change of coordinates in a double integral.