Homework 3

Mutivariable Calculus

Due on Wednesday, February 12

11.5 Parametric Equations of Lines

1. Find the parametric equations for the line that passes through the points $(6, 3, -3)$ and $(4, -3, 0)$.

2. Find the parametric equations for the line that passes through the origin and parallel to the line $x = 2t$, $y = 1 - t$, $z = 4 + 3t$.

11.6 Planes

3. Find the point at which the line with parametric equations $x = 2 + 3t$, $y = -4t, z = 5 + t$ intersects the plane $4x + 5y - 2z = 18$.

4. Find the equation of the plane that contains the line

$$x = 3 + 2t, \quad y = t, \quad z = 8 - t$$

and is parallel to the plane $2x + 4y + 8z = 17$.

5. Find an equation of the plane that passes through (-1,4,-3) and is perpendicular to the line

$$x = 2 + t, \quad y = -3 + 3t, \quad z = -t.$$

6. Find an equation of the plane that passes through the points $P = (1, 3, 2)$, $Q = (3, -1, 6)$ and $R = (5, 2, 0)$.

7. Find the formula for the shortest distance from the point (x_0, y_0) to the straight line $ax + by = c$ where a, b, c are constants.

12.1 Vector Functions and Space Curves

8. Sketch the line segment represented by each vector equation.

   a) $\mathbf{r} = (1 - t)(\mathbf{i} + \mathbf{j}) + t(\mathbf{i} - \mathbf{j})$; $0 \leq t \leq 1$

   b) $\mathbf{r}(t) = \langle t^4 + 1, t \rangle$.

12.2 Calculus of Vector Functions

9. Given $\mathbf{r}(t) = (1+t)\mathbf{i} + t^2\mathbf{j}$.

   a) Sketch the plane curve of $\mathbf{r}(t)$.

   b) Find $\mathbf{r}'(t)$.

   c) Sketch the position of vector $\mathbf{r}(t)$ and the tangent vector $\mathbf{r}'(t)$ for $t = 1$.

10. Evaluate the integral

$$\int (e^t\mathbf{i} + 2t\mathbf{j} + \ln t\mathbf{k})\, dt.$$

11. Find $\mathbf{r}(t)$ if $\mathbf{r}'(t) = t^2\mathbf{i} + 4t^3\mathbf{j} - t^2\mathbf{k}$ and $\mathbf{r}(0) = \mathbf{k}$.