Math 2177 recitation: Review of midterm 1, 2

TA: Yu Zhang

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(You can find all my recitation handouts and their solutions on my homepage http://u.osu.edu/yuzhang/teaching/)

Exercise 1. Consider the function $f(x, y) = 4x^2 + 10y^2$

(a) Find critical points of the given $f(x, y)$ and classify them. Compute the values of f at the critical points.

(b) Use the method of Lagrange multipliers to find the maximum and the minimum values of the given $f(x, y)$ on the circle $x^2 + y^2 = 4$.

(c) Find the absolute maximum and the absolute minimum values of the given $f(x, y)$ on the disk $x^2 + y^2 \leqslant 4$. Use parts (a) and (b).

Exercise 2. Evaluate the following integral by first converting to polar coordinates.

$$\int_{-1}^{1}\int_{-\sqrt{1-x^2}}^{0} cos(x^2+y^2)dydx$$

Exercise 3. Determine if the following vector fields are conservative and find a potential function for the vector field if it is conservative.

$$\bar{F} = (2x^3y^4 + x)\bar{i} + (2x^4y^3 + y)\bar{j}$$

Exercise 4. $\mathbf{A} = \begin{bmatrix} 2 & 3 & -1 & -9 \\ 0 & 1 & 1 & 1 \\ -1 & 2 & 3 & 4 \end{bmatrix}$.

(1) Find all solutions to $\mathbf{A}\overline{x} = 0$

(2) Find all solutions to $\mathbf{A}\overline{x} = \overline{b}$ given that $\overline{p} = \begin{bmatrix} 3 \\ -5 \\ 7 \\ 0 \end{bmatrix}$ is a solution to $\mathbf{A}\overline{x} = \overline{b}$.

Describe the solutions in parametric vector form, and give a geometric description of the solution sets.

Exercise 5. (1) Let $v_1 = \begin{bmatrix} 2 \\ -1 \\ 3 \\ 4 \end{bmatrix}$, $v_2 = \begin{bmatrix} 3 \\ 2 \\ -2 \\ 1 \end{bmatrix}$, $w = \begin{bmatrix} 5 \\ 8 \\ -12 \\ -5 \end{bmatrix}$. Determine whether w is a linear combination of v_1 and v_2.

(2) Determine whether v_1, v_2 and w are linearly dependent.