Suffolk County Community College

Michael J. Grant Campus

Department of Mathematics

Tuesday, December 18, 2018

MAT 203: Calculus with Analytic Geometry III

Final Exam

Instructor:

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Please print the requested information in the spaces provided:

Student:

Name:	
Student Id:	
Email:	*include to receive the final grade via email* ONLY *if you are not getting email updates*

- *Notes and books are permitted on this exam.*
- *Graphing calculators, computers, cell phones and any communication-capable devices are prohibited. Their mere presence in the open (even without use) is a sufficient reason for an immediate dismissal from this exam with a failing grade.*
- *You will not receive full credit if there is no work shown, even if you have the right answer. Use back pages if necessary. Please don't attach additional pieces of paper: if you run out of space, please ask for another blank final.*

Problem 1. Consider the points $A = (1, 4, 2)$, $B = (-1, 3, 5)$ and $C = (3, 5, 7)$ in the three-dimensional linear space $\mathbb{R}^3$.

(1). The fourth point D is defined by the condition that the points A, B, C, D are the consecutive vertices of a certain parallelogram. Find the coordinates of the point D.

Space for your solution:

(2). Give an **explicit** equation that defines the plane in which the parallelogram $ABCD$ lies.

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(3). Compute the area of the parallelogram $ABCD$.

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(4). Find the distance from the point $P = (1, 1, 1)$ to the plane that passes through the points A, B, C. (Hint: compute the volume of the parallelepiped generated by the vectors $\overrightarrow{BA}$, $\overrightarrow{BC}$, and $\overrightarrow{BP}$. Then use the area found in the previous subproblem.)

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Problem 2. The region R on the (x, y)-plane is given as the solution set of the system

$$\begin{cases} x^2 + y^2 \leq 1 \\ x + y \geq 0 \end{cases}$$

(1). Sketch this region in (x, y)-coordinate system.

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(2). Find a system of equations or inequalities that describes all the **interior** points of the region R relative to the (x, y)-plane.

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(3). Find a system of equations or inequalities that describes all the **boundary** points of the region R relative to the (x, y)-plane.

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(4). Find all the critical points of the function $f(x, y) = y + x^2$ which are interior to the region R.

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(5). Find all the critical points of the function $f(x, y) = y + x^2$ on the boundary of the region R.

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(6). Find the maximum and the minimum values of the function $f(x, y) = y + x^2$ on the region R, and the corresponding points of maxima and minima.

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(7). Draw the contour diagram of the function $f(x, y) = y + x^2$ to confirm your work above.

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Problem 3. Compute the work of the force $\overrightarrow{F} = -\overrightarrow{k}$ when moving along the path γ parameterized by

$$\begin{cases} x = t \\ y = \cos(t) \\ z = \sin(t) \end{cases}$$

with $t \in [0, \frac{\pi}{2}]$.

Space for your solution: