Mansoura University
Faculty of Engineering
Math. & Eng. Physics. Dept.

Mathematics 3

من الخارج

1st year Dept.
Final Exam, January 2012
Time Allowed: 3 Hours.

يتألف الإختبار من ٤ أسئلة في ورقتين. برجاء بدء إجابة كل فرع من إحدى نهايتي ورقة الإجابة.

Question (1)

(a) Find the directional derivative of $u(x, y, z) = x \sin(yz)$ at (1, 3 , 0) in the direction of

$\vec{S} = \mathbf{i} + 2\mathbf{j} - \mathbf{k}$

(b) Test for local maxima and minima for the function

$$f(x, y) = 6x^2 + 6y^2 + 6xy + 36x - 5.$$

(c) Find the volume of the solid bounded by the region $y = x^2$ and $y = 2x$, and the plane $z = x + 2y$.

Question (2)

(a) Evaluate the line integral $\int_c F \bullet dr$, where $\vec{F} = x^2 y\mathbf{i} - xy\ \mathbf{j}$ and c is given by the vector function $r(t) = t^3\ \mathbf{i} + t^4\ \mathbf{j},\ 0 \le t \le 1$.

(b) Use Gauss theorem to evaluate $\iint_\Sigma \vec{F} \odot \hat{n}\ ds$, where Σ is the unit sphere centered at origin and the vector field is given by $\vec{F}(x, y, z) = 2x\,\hat{i} + y^3\hat{j} + z^2\hat{k}$.

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