

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
Department of Mathematical Sciences

Math 301 Method of Applied Mathematics

Major Exam # 1

Term 041

Time Allowed 75 minutes

Name _____ ID # _____ Section # _____

| Q # | Grade |
|-------|-------|
| 1 | / 5 |
| 2 | / 4 |
| 3 | / 6 |
| 4 | / 5 |
| Total | / 20 |

Important Note

Show all work.

Use of programmable calculator is not allowed.

Mobiles and paging devices should not be carried during examination.

Instructor: F. D. Zaman

Q # 1(a) Find all points on $f(x, y) = 2x^3 - 24x + 3y^2 - 12y = 0$ for which $\|\nabla f\| = 0$. (2)

Q # 1(b) Evaluate the integral

$$\int_C 2xydx - 4ydy + e^{xy} dz \quad \text{where } C \text{ is the curve } x^2 + 4y^2 = 4, z = 2. \quad (3)$$

Q # 2) Use Green's theorem to evaluate $\oint_C \underline{F} \cdot d\underline{r}$ where $\underline{F} = \cos x^2 \underline{i} + xe^{y^2} \underline{j}$,
C being the triangle formed by vertices (0,0), (2,0) and(0,1). (4)

Q # 3) Consider a vector field $\underline{F}(x, y, z) = z\underline{i} + x\underline{j} + y\underline{k}$ and the surface formed by $z = \sqrt{x^2 + y^2}$, $0 \leq z \leq 3$. Evaluate the following integrals and state the result that is verified by the evaluations.

$$\oint_C \underline{F} \cdot d\underline{r} \quad \text{and} \quad \iiint_S (\text{curl} \underline{F}) \cdot \underline{n} ds \quad (6)$$

Q # 4) Use the Divergence theorem to evaluate the flux integral $\iint_S (\underline{F} \cdot \underline{n}) ds$ on the surface formed by $y = x^2$, $z = 9 - y$, $z = 0$, for the vector field given by $\underline{F} = 2x\underline{i} - e^z \underline{j} + z\underline{k}$. (5)