King Fahd University of Petroleum & Minerals
Department of Mathematics & Statistics
Math 302 Major Exam 2
The Third Semester of 2012-2013 (123)
Time Allowed: 120 Minutes

Name: _____ ID#: _____

Instructor: _____ Sec #: _____ Serial #: _____

- Mobiles and calculators are not allowed in this exam.
- Write all steps clear.

Question #	Marks	Maximum Marks
1		12
2		12
3		16
4		15
5		15
6		15
7		15
Total		100

Q:1 (12 points) Find equation of the tangent plane and normal line to the graph of $z = 2x^2 - 3y^2$ at $(2, 1, 5)$.

Q:2 (12 points) Show that $\vec{F}(x,y) = (x^2+y^2+1)^{-2}(x\mathbf{i}+y\mathbf{j})$ is conservative. Find a potential function $\phi(x,y)$ such that $\nabla\phi = \vec{F}$. Use $\phi(x,y)$ to evaluate $\int_C \vec{F}\cdot d\vec{r}$ along any path from $(0,0)$ to $(1,1)$.

Q:3 (16 points) Evaluate the line integral $\oint_C \dfrac{-y^3\ dx + xy^2\ dy}{(x^2+y^2)^2}$, where C is an ellipse $4x^2+y^2=4$.

Q:4 (15 points) Evaluate the surface integral $\iint_S (2x + 3y + z)\, dS$, where S is the portion of the surface $z^2 = x^2 + y^2$ between $z = 3$ and $z = 5$.

Q:5 (15 points) Use Stoke's theorem to evaluate $\oint_C \vec{F} \cdot d\vec{r}$ where C is the trace of the cylinder $x^2 + y^2 = 4$ in the plane $x + y + z = 2$.

Q:6 (15 points) Use divergence theorem to evaluate $\iint_S (\vec{F}.\hat{n})\, dS$ where $\vec{F} = 6xz\mathbf{i} + 5y^2\mathbf{j} - 3z^2\mathbf{k}$ and D the region bounded by $z = y$, $z = 4 - y$, $z = 2 - \frac{1}{2}x^2$, $x = 0$ and $z = 0$.

Q:7 (6+9 points) (A) Write as $a + ib$, $\dfrac{\left[9(\cos\frac{3\pi}{8} + i\sin\frac{3\pi}{8})\right]^3}{[3(\cos\frac{\pi}{16} + i\sin\frac{\pi}{16})]^{10}}$

(B) Find all solutions of $z^4 + 1 = 0$.