Universiti Teknologi Malaysia
Department of Mathematical Sciences
Semester II 2016/2017

SSCE1993 Engineering Mathematics II **Quiz 2 (5%)**
Instruction: Answer all questions. **Time: 1 hour**

Name: _____
I.C. no.: _____

1. If C is a line segment from (3,4,1) to (4,6,-2), evaluate

$$\int_C (x + y + z^2)\, ds..$$

[6 marks]

2. If $\underset{\sim}{F}\left(x,y,z\right) = \left(2xy + z^3\right)\underset{\sim}{i} + x^2\underset{\sim}{j} + 3xz^2\underset{\sim}{k}$, show that $\int_C \underset{\sim}{F}\cdot d\underset{\sim}{r}$ is independent of path. Hence find the potential function of $\underset{\sim}{F}\left(x,y,z\right)$ and evaluate $\int_C \underset{\sim}{F}\cdot d\underset{\sim}{r}$, where C consists of the line segments from (1,0,0) to (1,0,-3) and to (3,4,0).

[7 marks]

3. Use Green's theorem to evaluate

$$\oint_C \left(\frac{xy^3}{3} - \csc^2 x\right)dx + \left(\frac{x^3}{3} + \sinh y\right)dy$$

where C is the boundary of a region bounded by $y = x$, $y = -x$ and $x = 2$ oriented in the anticlockwise manner.

[7 marks]

4. Use Gauss' theorem to evaluate

$$\iint_\sigma \underset{\sim}{F}\cdot \hat{n}\, dS,$$

$\underset{\sim}{F}\left(x,y,z\right) = 3x\,\underset{\sim}{i} + 2y\,\underset{\sim}{j} + z\,\underset{\sim}{k}$ and $\hat{n}$ is the unit normal with an outward orientation of σ, given that σ is the cylinder $x^2 + y^2 = 4$ closed at the top and below by the portions of the sphere $x^2 + y^2 + z^2 = 16$.

[7 marks]