



Uwa Wellassa University, Sri Lanka.
Btech. Science and Technology
End Semester Examination - Semester 1
January - 2009

MAT 301-1 Mathematical Methods

Answer all questions

Time Allowed: One (1) hour

- 01) If P , Q , $\frac{\partial P}{\partial y}$, $\frac{\partial Q}{\partial x}$ are single-valued and continuous in a simply-connected region R , bounded by a simple closed curve C , then state the Green's theorem.

Verify Green's theorem in the plane for

$\oint_C (yx^2 - y^3) dx + (2y^2 - xy) dy$ where C is a closed curve in a shape of a triangle with vertices $(0,0)$, $(4,0)$ and $(2,4)$.

- 02) Let S be a closed surface bounding a region of volume V . Choose the outward drawn normal to the surface as the positive normal and assume that α , β , γ are the angles this normal makes with the positive x , y and z axes respectively. Then A_1 , A_2 , A_3 are continuous and have continuous partial derivatives in the region.

If $A = A_1\mathbf{i} + A_2\mathbf{j} + A_3\mathbf{k}$ and $\mathbf{n} = \cos\alpha\mathbf{i} + \cos\beta\mathbf{j} + \cos\gamma\mathbf{k}$, then state the divergence theorem.

Verify the divergence theorem for $\mathbf{A} = (2xy + z)\mathbf{i} + y^2\mathbf{j} - (x + 3y)\mathbf{k}$ taken over the region bounded by $x = 0$, $x = 1$, $y = 0$, $y = 1$, $z = 0$, $z = 1$.

- 03) a) If $A = \{\text{Set of Real numbers}\}$
 $B = \{\text{Set of Complex numbers}\}$

Draw corresponding Venn-diagram for A and B

- b) Write 4 major operations in Complex numbers

If $Z_1 = r_1(\cos\theta_1 + i\sin\theta_1)$ and
 $Z_2 = r_2(\cos\theta_2 + i\sin\theta_2)$

Show that

- i. $|Z_1 Z_2| = r_1 r_2$ and $\arg(Z_1 Z_2) = \theta_1 + \theta_2$
ii. $\left|\frac{Z_1}{Z_2}\right| = \frac{r_1}{r_2}$ and $\arg\left(\frac{Z_1}{Z_2}\right) = \theta_1 - \theta_2$