

UNIVERSITY TEKNOLOGI MALAYSIA
DEPARTMENT OF MATHEMATICAL SCIENCE

SEM 2 2012/13

SSCE 1993: Engineering Mathematics Test 2 (20%) 1 ½ hours

Answer all questions

1. Evaluate the following integral using polar coordinates

$$\int_{-2}^0 \int_0^{\sqrt{4-y^2}} \frac{yx^2}{(x^2+y^2)^2} dx dy \quad [5 \text{ marks}]$$

Answer: $-2/3$

2. A lamina of density $\delta(x, y) = xy$ occupies a region R bounded by a parabola $y = 2 - x^2$ and the line $y = x$. Find the mass of the lamina. [5 marks]

Answer: $27/24$

3. Evaluate $\iiint_G 2x^2 dV$ where G is a solid tetrahedron in the first octant bounded by $x + 3y + z = 1$ and the coordinate planes. [8 marks]

Answer: $1/5$

4. By using the cylindrical coordinate system, find the volume of a cylindrical solid $x^2 + y^2 = 4$ that lies between the xy -plane and the hemisphere $z = \sqrt{16 - x^2 - y^2}$. [8 marks]

Answer: $\pi(2 - \sqrt{3})$

5. Use spherical coordinate system to evaluate $\int_{-2}^2 \int_{-\sqrt{4-x^2}}^0 \int_0^{\sqrt{4-x^2-y^2}} z^2 \sqrt{x^2 + y^2 + z^2} dz dy dx$

Answer: $32\pi/9$

[8 marks]

6. A curve is defined by $\mathbf{r}(t) = (t^2 + 1)\mathbf{i} + t\mathbf{j} + 3\mathbf{k}$.

(a) Sketch $\mathbf{r}(t)$ for $-3 \leq t \leq 3$

(b) Find and sketch position vector $\mathbf{r}(0)$ and tangent vector $\mathbf{r}'(0)$.

Do all sketches on the same graph.

[6 marks]

Answers: $\mathbf{r}(0) = \mathbf{i} + 3\mathbf{k}$

$\mathbf{r}'(0) = \mathbf{j}$