Exam #4

Math 241 — C. Laskowski
9 December, 2005

All work to each problem must be shown. Correct answers without sufficient justification may not receive credit.

*** ANSWERS TO DIFFERENT PROBLEMS MUST BE PUT ON SEPARATE SHEETS ***

VERSION #12

Please write the Version number on ALL 4 of your answer sheets!

1. (25 points) Compute $\int_C (e^y - z^2)\,dx + (xe^y + z)\,dy + (y - 2xz)\,dz$, where C is the curve parameterized by $\mathbf{r}(t) = t^2\,\mathbf{i} + \sqrt{3t+1}\,\mathbf{j} + e^t\,\mathbf{k}$ for $0 \le t \le 1$.

2. (25 points) Compute $\int_C 3yz\,dx + 2x\,dy$, where C is parameterized by

$$\mathbf{r}(t) = \begin{cases} (\cos t^2)\,\mathbf{i} + (\sin t^2)\mathbf{j} & \text{for } 0 \le t \le \sqrt{\pi}; \\ (t - \sqrt{\pi} - 1)\,\mathbf{i} & \text{for } \sqrt{\pi} \le t \le 2 + \sqrt{\pi}. \end{cases}$$

   [Hint: First sketch the curve C.]

3. (25 points) Compute the flux integral $\iint_\Sigma \mathbf{F}\cdot\mathbf{n}\,dS$, where $\mathbf{F} = 2x\,\mathbf{i} + (3y + z^2)\,\mathbf{j} + \mathbf{k}$, Σ is the boundary of the solid region D that is bounded above by the plane $z = 2y + 5$, below by the xy-plane, and by the cylinder $x^2 + y^2 = 4$, and $\mathbf{n}$ is oriented outward.

4. (25 points) Compute the flux integral $\iint_\Sigma \mathbf{F}\cdot\mathbf{n}\,dS$, where $\mathbf{F} = 2x\,\mathbf{i} + 2y\,\mathbf{j} + z\,\mathbf{k}$, Σ is the portion of the paraboloid $z = 6 - x^2 - y^2$ lying between the cylinders $x^2 + y^2 = 1$ and $x^2 + y^2 = 4$, and $\mathbf{n}$ is oriented upward.