MATH 241 EXAM #1 Problem 1 Dec. 8, 2004

Name: TA: Section:

1. [25] Let C be the line segment from $(1, 2, 3)$ to $(4, 0, 2)$.

a) Find $\int_C x\, dy$.

b) Find $\int_C x\, ds$.

HONOR PLEDGE: I pledge on my honor that I have not given or received any unauthorized assistance on this examination.

Signature

MATH 241 **EXAM #1** **Problem 2** **Dec. 8, 2004**

Name: TA: Section:

2. [25] Let $\mathbf{F}(x, y, z) = (3y + yze^{xz})\mathbf{i} + (3x + e^{xz})\mathbf{j} + xye^{xz}\mathbf{k}$.

a) Show that $\mathbf{F}$ is conservative.

b) Calculate $\int_C \mathbf{F} \cdot d\mathbf{r}$ where C is the curve parameterized by $\mathbf{r}(t) = (t^2 - \sqrt{3 + t^2})\mathbf{i} - t\cos(\pi t)\mathbf{j} + (t^6 - 1)\mathbf{k}$ for $-1 \leq t \leq 1$.

c) Calculate $\int_C \mathbf{F} \cdot d\mathbf{r}$ where C is the circle in the plane $z = 3$ with center $(1, 2, 3)$ and radius 4, oriented clockwise when viewed from above.

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3. [25] Let R be the region bounded by the paraboloids $y = 2x^2 + 2z^2$ and $y = 12 - x^2 - z^2$. Let $\mathbf{F}(x, y, z) = \sin(yz)\mathbf{i} + (z - y)\mathbf{j} + e^{xy}\mathbf{k}$. Let Σ be the boundary of R, oriented outwards. Calculate $\int\int_\Sigma \mathbf{F} \cdot \mathbf{n}\, dS$.

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4. [25] Let Σ be the portion of the paraboloid $z = x^2 + y^2$ below the plane $z = x$. Let $\mathbf{F}(x, y, z) = xy^2\mathbf{i} - z^2\mathbf{j} + e^x\mathbf{k}$.

a) Without using Stokes' Theorem, set up (but do not evaluate) $\int\int_\Sigma \text{curl}\mathbf{F} \cdot \mathbf{n}\, dS$.

b) Evaluate $\int\int_\Sigma \text{curl}\mathbf{F} \cdot \mathbf{n}\, dS$ by any (correct) method you wish.