

MATH 264 Class Test
Tuesday March 7, 2006.

This is a closed book test. No calculators are permitted.
Each question is worth 10 marks.

1. Compute the line integral

$$\int_c (x + 2z) ds,$$

where c is the triangle in the XZ plane with vertices at $(0, 0, 0)$, $(1, 0, 0)$ and $(0, 0, 1)$.

2. Show that the vector field

$$\mathbf{F} = (3x^2y^2z + y \exp(xy), 2x^3yz + x \exp(xy), x^3y^2),$$

is conservative by finding a potential for \mathbf{F} . Compute the line integral

$$\int_c \mathbf{F} \cdot d\mathbf{r},$$

where c is the curve $\mathbf{c}(t) = (2 + t, 1 + 3 \cos(\pi t), 3t^4)$, $0 \leq t \leq 1$.

3. Compute the surface integral

$$\iint_S |xyz| dS,$$

where S is the portion of the surface $y = x^2 + z^2$ which lies below the plane $y = 4$.
(Note: Watch the absolute value sign in the integrand.)

4. Compute the outward flux of the vector field

$$\mathbf{F} = (xz, y, z)$$

across the surface S consisting of the cylinder $x^2 + y^2 = 1$, $0 \leq z \leq 1$, closed with the "lids" $x^2 + y^2 \leq 1$, $z = 1$ and $x^2 + y^2 \leq 1$, $z = 0$.