

Calculus III Final Exam Review

1. Find the volume below the cone $z = \sqrt{x^2 + y^2}$ and above the ring $1 \leq x^2 + y^2 \leq 4$.
2. Evaluate $\iiint_T xz \, dV$, where T is the solid tetrahedron with vertices $(0, 0, 0)$, $(1, 0, 1)$, $(0, 1, 1)$, and $(0, 0, 1)$.
3. Evaluate $\int_C \mathbf{F} \cdot d\mathbf{r}$, where $\mathbf{F}(x, y, z) = \sin x \mathbf{i} + \cos y \mathbf{j} + xz \mathbf{k}$ and C is given by $\mathbf{r}(t) = t^3 \mathbf{i} - t^2 \mathbf{j} + t \mathbf{k}$, $0 \leq t \leq 1$.
4. Find the curl and divergence of $\mathbf{F}(x, y, z) = \langle \arctan(xy), \arctan(yz), \arctan(zx) \rangle$.
5. Find the area of the helicoid (or spiral ramp) with vector equation $\mathbf{r}(u, v) = \langle u \cos v, u \sin v, v \rangle$, $0 \leq u \leq 1$, $0 \leq v \leq \pi$.