1. [10 pts] Let C be the space curve parametrized by $\mathbf{r}(t) = \langle \cos t, 0, \sin t \rangle$ for $0 \leq t \leq 2\pi$, and let $\mathbf{F}$ be the vector field

$$\mathbf{F}(x, y, z) = \langle \sin(x^3) + z^3, \sin(y^3), \sin(z^3) - x^3 \rangle.$$

Compute the line integral $\displaystyle\oint_C \mathbf{F} \cdot d\mathbf{r}$.

2. [10 pts] Calculate the double integral

$$\iint_S \mathbf{F} \cdot d\mathbf{S},$$

where $\mathbf{F}(x, y, z) = \langle x, y + z^3, e^y \rangle$ and S is the boundary of the solid region E determined by $E = \{(x, y, z) \mid x^2 + y^2 \leq 1,\ 0 \leq z \leq 1\}$. Orient S by the outward pointing unit normal field.