1. Prep-Final B

Problem 1: Find the parametric equations of the line that is tangent to the curve

$$\vec{r}(t) = (e^t, \sin t, \ln(1-t))$$

at $t = 0$.

Problem 2: Find the minimum cost area of a rectangular solid with volume 64 cubic inches, given that the top and sides cost 4 cents per square inch and the bottom costs 7 cents per square inch. Just set up the equations using Lagrange multipliers, you do not have to solve them.

Problem 3: Compute the average of the function x^4 over the sphere centered at the origin whose radius is $R > 0$.

Problem 4: Compute the flux

$$\int_S \vec{F} \cdot \vec{n} d\sigma$$

where S is the hemisphere $x^2 + y^2 + z^2 = 4, z \geq 0$, $\vec{n}$ points toward the origin and

$$\vec{F} = (x(z-y), y(x-z), z(y-x)) \ .$$

Problem 5: Compute the line integral $\int_C \vec{F} \cdot \vec{dr}$ where C is the curve given by the intersection of the sphere $x^2 + y^2 + z^2 = 4$ and the plane $z = -y$, counterclockwise when viewed from above, and

$$\vec{F} = (x^2 + y, x + y, 4y^2 - z) \ .$$