1 Let S be the part of the plane $z = 2x + y + 5$ inside the cylinder $x^2 + y^2 = 1$ with normal oriented upwards, and let $\mathbf{F} := x\mathbf{i} - z\mathbf{j} - y\mathbf{k}$

(a) Compute the area of S

(b) Compute $\iint_S \mathbf{F} \cdot d\mathbf{S}$

2 Let C be the straight line segment from $(1, 0, 1)$ to $(2, 2, 3)$ and let $\mathbf{F} := 4x\mathbf{i} - y\mathbf{k}$. Compute $\int_C \mathbf{F} \cdot d\mathbf{r}$.

3 Let S be the part of the ellipsoid $x^2 + y^2 + 2z^2 = 1$ which lies below the $x - y$ plane, with normal oriented "upwards". Compute $\iint_S \text{curl}\mathbf{F} \cdot d\mathbf{S}$

4 Let $\mathbf{F} := (2x - y)\mathbf{i} + (e^z - x)\mathbf{j} + ye^z\mathbf{k}$ and let C bew the line parametrized by $x = t, y = 2t, z = t^2$ for $0 \leq t \leq 1$. Compute $\int_C \mathbf{F} \cdot d\mathbf{r}$.

5 Let C be the closed curve obtained by intersecting the paraboloid $z = x^2 + y^2$ with the plane $x + y + z = 1$ oriented clockwise when seen "from above". Let $\mathbf{F} := z\mathbf{i} = y(x + z)\mathbf{j} = z(x + y)\mathbf{k}$. Compute $\int_C \mathbf{F} \cdot d\mathbf{r}$.