1. (20 points) Compute the line integral $\int_C x \, dx + y \, dy + z^2 \, dz$, where $C$ is the curve parameterized by $\mathbf{r}(t) = \cos(2t)\mathbf{i} + \sin(2t)\mathbf{j} + 3t\mathbf{k}$ for $0 \leq t \leq \pi$.

2. (20 points) Compute the line integral $\int_C y \, dx + z \, dy + xz \, dz$, where $C$ is the curve of intersection of the ellipsoid $2x^2 + y^2 + z^2 = 18$ with the plane $z = y$, oriented counterclockwise when viewed from above.

3. (20 points) Compute the flux integral $\iint_{\Sigma} \mathbf{F} \cdot \mathbf{n} \, dS$, where $\mathbf{F} = 6x\mathbf{i} - xz\mathbf{j} + xy\mathbf{k}$, $\Sigma$ is the whole boundary of the solid region bounded above the plane $z = 4$ and bounded below by the upper nappe of the cone $x^2 + y^2 = z^2$, and $\mathbf{n}$ is oriented outward.

4. (20 points) Compute the line integral $\int_C (yz^2 + \cos z) \, dx + xz^2 \, dy + (2xyz - x \sin z) \, dz$, where $C$ is any smooth curve starting at $(0,0,0)$ and ending at $(1,2,\pi)$.

5. (20 points) Compute the flux integral $\iint_{\Sigma} \mathbf{G} \cdot \mathbf{n} \, dS$, where $\mathbf{G} = (x - 2xz)\mathbf{i} + (x - y)\mathbf{j} + z^2\mathbf{k}$, $\Sigma$ is the portion of the graph of $z = (11 - x^2 - y^2)^3$ lying above the plane $z = 8$, and $\mathbf{n}$ is oriented upward. [Hint: $\mathbf{G} = \text{curl}(\mathbf{F})$, where $\mathbf{F} = xz\mathbf{i} + xz^2\mathbf{j} + xy\mathbf{k}$.]