1. Evaluate $\int_C xy \, dx + y \, dy$, $C$ is the sine curve $y = \sin x$, $0 \leq x \leq \pi/2$.
   
   Answer: $\frac{3}{2}$. Hint: $\int x \sin x \, dx = -x \cos x + \int \cos x \, dx$
2. \( \mathbf{F}(x, y, z) = e^y \mathbf{i} + (xe^y + e^z)\mathbf{j} + ye^z \mathbf{k}, \)

(a): Show that \( \mathbf{F} \) is conservative,
(b): Evaluate \( \int_C \mathbf{F} \cdot d\mathbf{r} \), where \( C \) is the line segment from \((0, 2, 0)\) to \((4, 0, 3)\).
Answer: (a) \( \mathbf{F} \) is conservative, (b) 2.
3. Evaluate \( \int_{C} x^2y \, dx + \ln \sqrt{1+y^2} \, dy \), where \( C \) is the triangle from \((0,0)\) to \((2,2)\) to \((0,2)\) to \((0,0)\) with counterclockwise orientation.

Answer: \(-\frac{4}{3}\).
4. Evaluate \( \iint_S \mathbf{F} \cdot \mathbf{n} \, dS \), where \( \mathbf{F}(x, y, z) = x^2 \mathbf{i} + xy \mathbf{j} + z \mathbf{k} \) and \( S \) is the part of the paraboloid \( z = x^2 + y^2 \) below the plane \( z = 1 \) with upward orientation.

Answer: \( \frac{\pi}{2} \).
5. Evaluate $\int_{\partial Q} \mathbf{F} \cdot \mathbf{n} dS$, where $\mathbf{F} = < x^2 - y^2z, x \sin z, 4y^2 >$, $Q$ is bounded by $4x + 2y - z = 4$ ($z \leq 0$) and the coordinate planes.
Answer: $-\frac{2}{3}$. 
6. Evaluate \( \int \int_S \text{curl} \mathbf{F} \cdot \mathbf{n} dS \), where \( \mathbf{F}(x, y, z) = x^2yz \mathbf{i} + yz^2 \mathbf{j} + z^3e^{xy} \mathbf{k} \), \( S \) is the part of the sphere \( x^2 + y^2 + z^2 = 5 \) that lies above the plane \( z = 1 \), and \( S \) is oriented upward.
Answer: \(-4\pi\).
7. Evaluate $\int_C \mathbf{F} \cdot d\mathbf{r}$, where $\mathbf{F}(x, y, z) = xy\mathbf{i} + yz\mathbf{j} + zx\mathbf{k}$ and $C$ is the triangle with vertices $(1, 0, 0), (0, 1, 0)$, and $(0, 0, 1)$, oriented counterclockwise as viewed above. Answer: $-\frac{1}{2}$. 
Evaluate $\int \int_S \mathbf{F} \cdot \mathbf{n} dS$, where $\mathbf{F}(x, y, z) = x^3 \mathbf{i} + y^3 \mathbf{j} + z^3 \mathbf{k}$ and $S$ is the surface of the solid bounded by the cylinder $x^2 + y^2 = 1$ and the planes $z = 0$ and $z = 2$.

Answer: $11\pi$. 