1. For each of the following vector fields, decide if F is conservative. If it is conservative, find its scalar potential function.

   (a) $F(x, y, z) = (x + y, y + z, x + z)$

   (b) $F(x, y, z) = (2x, 3y^2, 4z^3)$

   (c) $F(x, y, z) = (yz, xz, yz)$

   (d) $F(x, y) = (ye^x, e^x)$

2. Evaluate $\int_C -e^y \sin(x)dx + e^y \cos(x)dy + dz$ over the curve C where C is the straight line from the point $(0, 0, 0)$ to $(\pi, \pi, 1)$.

3. Evaluate the integral

$$\int_0^1 \int_0^{\sqrt{1-y^2}} \int_{x^2+y^2}^{\sqrt{x^2+y^2}} xyz dz dx dy$$

4. Compute the integral

$$\int\int_D \sqrt[3]{y^2/x} dA$$

   over the region D defined by $0 \leq x^2/y \leq 1$ and $0 \leq y^2/x \leq 8$. (Hint: use the change of variables $u = \sqrt[3]{y^2/x}$ and $v = \sqrt[3]{x^2/y}$ and its inverse transformation $x = uv^2$ and $y = u^2v$)

5. Find the volume of the region between a sphere with radius 1 and a sphere with radius 2, in the region of $\mathbb{R}^3$ bounded by $x \geq 0$, $y \geq 0$, $z \geq 0$

6. Evaluate the integral over the region R which is bounded by the lines $y = x, y = x - 2, y = -2x, y = 3 - 2x$

$$\iint_R (3x + 4y)dA$$

Use the linear transformation $x = 1/3(u + v)$ and $y = 1/3(v - 2u)$ to evaluate the integral.

7. Compute the integral

$$\iiint_W \sqrt{x^2 + y^2} dV$$

Where W is the region inside the cylinder $x^2 + y^2 = 1$ with $x \geq 0$, $y \geq 0$, $z \geq 0$ and below the surface $z = 2xy$