1. (a) grad (div \((x^2z)i + (y-z)^2j + xyk\)) =

(b) curl \((\cos(yz)i + \sin xj)\) =

(c) Find a unit normal vector of the surface \(z = \sqrt{x^2 + y^2}\) at the point \(P: (3, 4, 5)\).
2. (a) Find the volume of a parallelepiped if the edge vectors are $(1, 2, 3)$, $(1, 2, 4)$, $(2, 2, 5)$.

(b) Find an equation of the plane through $(1, 2, 3)$, $(0, 1, 1)$, $(2, 2, 0)$.

(c) Represent the following curve parametrically: $4x^2 + (y - 1)^2 = 9$, $y = z$.

(d) Find the length of the curve defined by $\mathbf{r}(t) = t\mathbf{i} + t^{3/2}\mathbf{j}$, where $0 \leq t \leq 4$. 
3. Assuming sufficient differentiability of the function $f$ and the vector functions $u$ and $v$. Show

(a) $\text{curl } (\text{grad } f) = 0$;

(b) $\text{curl } (u + v) = \text{curl } u + \text{curl } v$. 
4. Calculate $\int_C \mathbf{F}(\mathbf{r}) \cdot d\mathbf{r}$ for the following data: $\mathbf{F} = [2x, y, -z]$, $C: \mathbf{r} = [2t, \cos t, \sin t]$ from $(0, 1, 0)$ to $(4\pi, 1, 0)$. 
5. Evaluate the surface integral \( \int_S (x \mathbf{i} + y \mathbf{j} + 3z^2 \mathbf{k}) \cdot \mathbf{n} \, dA \), where \( S \) is the surface: \( z = x^2 + y^2, \ z \leq 4 \).
6. Show that $\mathbf{F} = (x + ye^{xy})\mathbf{i} + (xe^{xy} + z\cos(yz))\mathbf{j} + (y\cos(yz) + z^2)\mathbf{k}$ has a potential and find a potential function of $\mathbf{F}$ and evaluate $\int_{(0,0,0)}^{(1,1,1)} \mathbf{F} \cdot d\mathbf{r}$ using the potential function.
7. Evaluate \( \oint_C [(2z + e^{x^3}) \mathbf{i} - x \mathbf{j} + x \mathbf{k}] \cdot d\mathbf{r} \) by Stokes' theorem, where \( C \) is the \( x^2 + y^2 = 1, \ z = y + 1 \). (clockwise as seen by a person standing at the origin.)