NAME
Pledge

Show all work. **NO CALCULATORS ALLOWED.**

I.) (20)

a.) Find a potential function for the conservative field

\[ \mathbf{F} = (2xy^3z + 3e^x \sin z) \hat{i} + (3x^2y^2z - 4\ln z) \hat{j} + (x^2y^3 + 3e^x \cos z - \frac{4y}{z} + 2) \hat{k} \]

b.) Find the work done in carrying a particle from \( A(1, 1, 1) \) to \( B(2, 2, 2) \) along a straight line in the field of part "a."
Evaluate \[ \int_C xyz \, ds \] where 
\[ C : x = t, \quad y = \frac{4}{3} t^{\frac{3}{2}}, \quad z = t^2, \quad 0 \leq t \leq 1. \]
III.) (20)

a.) State Green’s Theorem.

b.) Verify Green’s Theorem if $\vec{F} = (x - y)\hat{i} + x\hat{j}$ and $C$ is the unit circle.
IV.) (15)

Calculate \( \iint xz \, dS \) where \( S \) is \( z^2 = x^2 + y^2 \) between \( z = 2 \) and \( z = 3 \). DO NOT EVALUATE
V.) (15)

Use Stokes' Theorem to calculate $\oint_{\partial S} \vec{F} \cdot d\vec{r}$

where $\vec{F} = z \vec{i} - x \vec{k}$ and

$S : r = 2 + \cos \theta$ above $xy$-plane and below $z^2 = x^2 + y^2$

and $\vec{n}$ is the outward normal.
VI.) (15)

Use the divergence theorem to calculate the flux if 
\[ \vec{F} = x^3 \hat{i} + y^3 \hat{j} + z^3 \hat{k} \] and \( S \) is \( x^2 + y^2 = 1, \ z = 0, \) and \( z = 2. \)