

Name: _____

Please show all work and justify your answers. Supply brief narration with your solutions and draw conclusions.

1. Let $\mathbf{r} = [x, y, z]$ and $r = |\mathbf{r}|$. Express $\nabla \cdot (r^n \mathbf{r})$ in terms of r .
2. Let $\omega = y dx - x dy$ and $\eta = x dy dz + y dz dx + z dx dy$. Compute $d\omega$, $d\eta$ and $\omega \wedge \eta$.
3. Given a steady temperature distribution $f(x, y) = e^{xy}$, what is the rate of change of temperature as you start moving from the point $[1, 2]$ towards $[3, 3]$ with unit speed?
Hint: What unit vector gives the direction of travel?
4. Find the work done by the force $F = [y, x]$ in moving an object along the straight line segment from the origin to a point $[X, Y]$.
5. Find the flux of $F = [0, 0, x^2]$ through the unit disc oriented with the downward normal.

1	2	3	4	5	total (50)	%

Prelim. course grade: %