NAME _____

SHOW YOUR WORK!

- 1. Let $\vec{F} = \langle 3xy, -1, 1/(z+1) \rangle$ be a force field.
- (15) (i) Compute the work done in displacement along the helix given by $\vec{r}(t) = \langle \sin t, \cos t, t \rangle$ for $0 \le t \le \pi/2$.

Answer:

(15) (ii) Compute the work done by the same force \vec{F} in displacement along the line from (1,2,3) to (2,3,3).

Answer:

2. Let P = (0, 1, 0) be a point on a surface S given by $y^4 z = \ln(x + y)$.

(15) (i) Find the upward unit normal \vec{n} to S at P.

Answer:

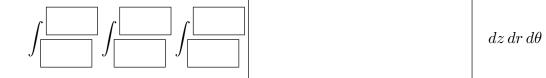
(10) (ii) Find the equation of the tangent plane to S at P.

Answer:

- 3. Let $\vec{F} = \langle x, y, z \rangle$ and T be the solid region given by $x^2 + y^2 \le z \le 2$.
- (15) (i) Without using the divergence theorem, compute the surface integral $\iint_S \vec{F} \cdot \vec{n} dA$, where S is the entire boundary of T, and \vec{n} is the outward unit normal. Note that S is the sum of two smooth surfaces.

Answer:

(15) (ii) Using the divergence theorem, set up but do not evaluate, the volume integral corresponding to (i).



4. (15) Let $\vec{F} = \langle y, 0, 2 \rangle$, and S be the surface given by z = x + y for $0 \le x \le 1$ and $0 \le y \le 1$. Let C be the curve bounding S and traversed in the positive direction with respect to the upward unit normal \vec{n} to S. Using Stokes's theorem, compute the line integral $\int_C \vec{F} \cdot d\vec{r}$. (You do not have to compute the integral two ways; only by the area integral in Stokes's theorem).

Answer: