

Advanced Calculus - In class problems for Quiz 1

1. Let $\mathbf{F} = \langle x^2 - y^2, 2xy \rangle$ and let C be the curve parametrized by $\mathbf{p}(t) = \langle t^2, t \rangle$ over the time interval $0 \leq t \leq 1$. Compute

$$\int_C \mathbf{F} \cdot d\mathbf{T}.$$

2. Let $\mathbf{F} = \langle x^2 + y^2, 2xy \rangle$ and let C be a curve from the origin to the point $(1, 1)$. Compute

$$\int_C \mathbf{F} \cdot d\mathbf{T}.$$

3. Let $\mathbf{F} = \langle x^2y, x^3y^2 \rangle$ and let C be the closed boundary of the unit square oriented outwards. Use Green's theorem to compute

$$\oint_C \mathbf{F} \cdot d\mathbf{n}.$$

4. Let $\mathbf{F} = \langle x^2 - y^2, 2xy, z \rangle$ and let S be the unit cube. Use the divergence theorem to compute

$$\int_S \mathbf{F} \cdot d\mathbf{n}.$$

5. Let $F = \langle x, y, z \rangle$ and let S be the portion of the unit sphere in the first octant. Compute

$$\int_S \mathbf{F} \cdot d\mathbf{n}.$$

6. Parametrize the tube of radius 2 wrapped around the line parametrized by

$$\mathbf{p}(t) = \langle t, 2t, -t \rangle.$$