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Worksheet 7, Math 10560

1. Calculate $\int_C \mathbf{F} \cdot d\mathbf{r}$ where $\mathbf{F} = \langle x^2 + y, 3x - y^2 \rangle$ and C is the positively oriented boundary curve of a region D whose area is 8.

2. Consider the vector field $\mathbf{F} = \langle y, -x, 0 \rangle$. Determine if this vector field is conservative. Compute the line integral $\int_C \mathbf{F} \cdot d\mathbf{r}$ where C is the unit circle.

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3. Compute the line integral $\int_C xy^2 dx + 2x^2 y\, dy$ when C is the triangle with vertices $(0,0), (2,2)$ and $(2,4)$.

4. Show that for a function f and a vector field $\mathbf{F}$ we have the following 'product rule' for the divergence

$$\nabla \cdot (f\mathbf{F}) = f\nabla \cdot \mathbf{F} + \mathbf{F} \cdot \nabla f$$