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Problem 6.3.10
http://people.tamu.edu/~mzr8136/mathhomework.html

6.3.10

Evaluate $I = \int_c \overrightarrow{A}(\overrightarrow{r}) \cdot d\overrightarrow{r}$ along the given curve in R^2 when

$A(x, y) = y\hat{i} - x\hat{j}$

C is the line segement from (0,0) to (10,10).

Solution:

Parametrize the equation defining C, using t as a parameter.

$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} t \\ t \end{pmatrix}$, and $\begin{pmatrix} \frac{dx}{dt} \\ \frac{dy}{dt} \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix} = d\overrightarrow{r}$

Therefore, $I = \int_0^{10} (t\hat{i} - t\hat{j}) \cdot (\hat{i} + \hat{j})\, dt$

$I = \int_0^{10} (t - t)\, dt = \int_0^{10} (0)\, dt = 0$

This agrees with what we would expect to find. The x and y values are equal along the entire line from (0,0) to (10,10). Therefore, $(y\hat{i} - x\hat{j}) = 0$ along the entire line.