Part of Hints for Hw 10

Math 321

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One important concept problem

b). $d\vec{r} \cdot \vec{e}_x = (dx\vec{e}_x + dy\vec{e}_y) \cdot \vec{e}_x = dx$. In the cases, $dx = x'(t)dt$ and $dx = x'(y)dy$. Similar for dy
c). Just use the relationship $\hat{n} = \hat{t} \times \vec{e}_z$

3.4

1. You would get $-2Area(A)$. Area of the triagle can be calculated using $\overrightarrow{AB}$ and $\overrightarrow{AC}$.
2.

$$-\frac{d}{dt}\int_S \vec{B} \cdot d\vec{S} = -\int_S (-\frac{\partial \vec{B}}{\partial t}) \cdot d\vec{S} = \int_S \nabla \times \vec{E} \cdot d\vec{S} = LHS$$

3.5

The correct formula would be:

$$\int_C F\hat{s} \cdot n dr = \int_A \nabla \cdot (F\hat{s}) dA$$

by (106). You can see that $\nabla \cdot (F\hat{s})$ equals $\frac{\partial F}{\partial s}$ only if $\hat{s}$ is constant. Otherwise, we would have $\frac{\partial F}{\partial s} + F\nabla \cdot \hat{s}$ instead.

3.6

c). Gauss's theorem is always correct. Here, the problem is at $r = 0$. There, the divergence of $\vec{v}$ is infinity and the integral can be nonzero.

More problems for 3.5 in next set of homework problems.