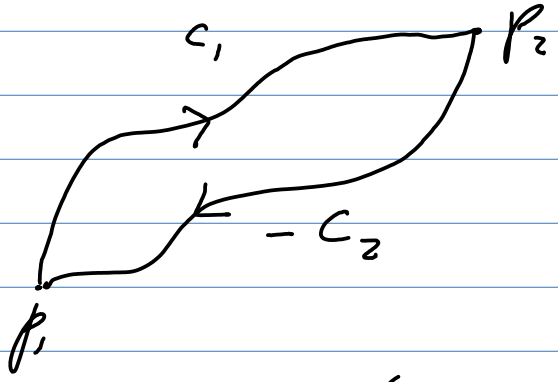
231 Annual Exam 2007 OUTLINE SOLNS 30 Jan 07

q3

(a) for $\underline{F}$ a smooth vector field & S a surface bounded by a curve C, oriented in the normal way (2)

$$\int_S \operatorname{curl}\underline{F}\cdot d\underline{A} = \oint \underline{F}\cdot d\underline{l} \quad (2)$$

(b) $\operatorname{curl}\underline{F}=0$



(8)

$$\oint_{C_1-C_2} \underline{F}\cdot d\underline{l} = \int_S \operatorname{curl}\underline{F}\cdot d\underline{A} = 0$$

$$\Rightarrow \int_{C_1} \underline{F}\cdot d\underline{l} = \int_{C_2} \underline{F}\cdot d\underline{l}$$

5 for good attempt

re knowing to use Stokes

4 for $\underline{F}=\nabla\phi \Rightarrow \ldots$

(c)

$$\underline{F} = \frac{y}{x^2+y^2}\underline{i} - \frac{x}{x^2+y^2}\underline{j}$$

$\operatorname{curl} \underline{F} = 0$ (3)

no. $\underline{F} = \underline{\nabla} \tan^{-1}\frac{x}{y}$ (3)

no. not single values. (3)

adds to (21).