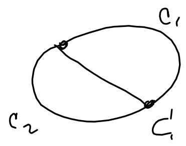
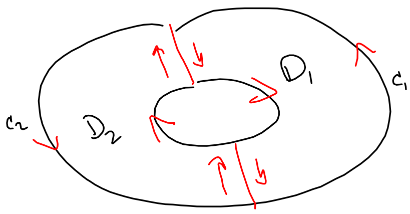
16-2?

16-3?

16-4?



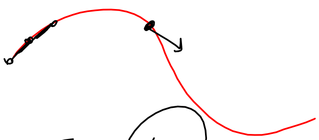
$$\int_C P\,dx + Q\,dy = \iint_D (Q_x - P_y)\,dA$$



$$\int_{C_1} + \int_{C_2} = \iint_{D_1} + \iint_{D_2}$$

$$\int_C \bar{F}\cdot d\bar{r} = \iint_D \mathrm{curl}(\bar{F})\cdot \bar{k}\,dA \;.$$

$$\int_C \bar{F}\cdot\bar{n}\,ds = \iint_D \mathrm{div}(\bar{F})\cdot dA$$



$$\bar{F}\cdot\bar{T}\,ds \rightarrow \|\bar{r}'(t)\|\,dt$$

$$\bar{T} = \frac{\bar{r}'}{\|\bar{r}'\|}$$

$$\bar{F}\cdot\|\bar{r}'(t)\|\,dt = \bar{F}\cdot d\bar{r}$$

S 16.5 #29 $\operatorname{curl}(\operatorname{curl}(\bar{F})) = \operatorname{grad}(\operatorname{div}\bar{F}) - \nabla^2\bar{F}$

$\bar{F} = \langle P, Q, R\rangle$

$\nabla \times \bar{F} = \operatorname{curl}\bar{F} = \langle R_y - Q_z, P_z - R_x, Q_x - P_y\rangle$

$\nabla \times (\nabla \times \bar{F}) = \langle Q_{xy} + R_{xz}, R_{yz} + P_{yx}, P_{zx} + Q_{zy}\rangle = \operatorname{curl}(\operatorname{curl}(\bar{F}))$

$\nabla^2 \bar{F} = \langle P_{xx}, Q_{yy}, R_{zz}\rangle$

$\operatorname{grad}(\operatorname{div}(\bar{F}))$:

$\operatorname{div}\bar{F} = \nabla \cdot \bar{F} = P_x + Q_y + R_z$

$\operatorname{grad}(\nabla \cdot F) = \langle P_{xx} + Q_{yx} + R_{zx}, P_{xy} + Q_{yy} + R_{yz}, P_{xz} + Q_{yz} + R_{zz}\rangle$

#38 Given

$\operatorname{div}\bar{E} = 0, \quad \operatorname{div}\bar{H} = 0$

$\operatorname{curl}\bar{E} = -\frac{1}{c}\frac{\partial \bar{H}}{dt}, \quad \operatorname{curl}\bar{H} = \frac{1}{c}\frac{\partial \bar{E}}{\partial t}$

SHOW:

$\nabla \times (\nabla \times \bar{E}) = -\frac{1}{c^2}\frac{\partial^2 \bar{E}}{\partial t^2}$ $\qquad \nabla^2\bar{E} = \langle P_{xx}, Q_{xx}, R_{xx}\rangle$

By the above $\nabla \times \bar{E} = -\frac{1}{c}\frac{\partial \bar{H}}{\partial t}$ $\qquad$ #29

$\nabla \times (\nabla \times \bar{E}) = \operatorname{curl}(\operatorname{curl}\bar{E}) = \operatorname{grad}(\operatorname{div}\bar{E}) - \nabla^2\bar{E}$

$= \operatorname{grad}(0) - \nabla^2\bar{E} = -\nabla^2\bar{E} = -\frac{\partial^2}{\partial t^2}\bar{E}$ Flawed

$= -\nabla^2\bar{E}$

$\nabla \times \left(-\frac{1}{c}\frac{\partial \bar{H}}{\partial t}\right) = -\frac{1}{c}\frac{\partial}{\partial t}\left[\nabla \times \bar{H}\right] = -\frac{1}{c}\frac{\partial}{\partial t}\left[\frac{1}{c}\frac{\partial \bar{E}}{\partial t}\right]$

$= -\frac{1}{c^2}\frac{\partial^2}{\partial t^2}\bar{E}$

IF I can pass $\frac{\partial}{\partial t}$ through the "x" operation,