Solution to 2

1 2.1 a) $\underline{\nabla} \times \underline{E} = -\partial \underline{B} / \partial t$

1 b) $\underline{\nabla} \times \underline{H} = \underline{J} + \dfrac{\partial \underline{D}}{\partial t}$

1 c) $\underline{\nabla} \cdot \underline{D} = \rho_v$

1 d) $\underline{\nabla} \cdot \underline{B} = 0.$

1 2.2 a) $\displaystyle\int (\underline{\nabla} \times \underline{E}) \cdot d\underline{s} = \oint_c \underline{E} \cdot d\underline{L} = -\frac{\partial}{\partial t} \int \underline{B} \cdot d\underline{s}$

1 $\displaystyle = -\frac{\partial \phi}{\partial t}$

1 b) $\displaystyle\int (\underline{\nabla} \times \underline{H}) \cdot d\underline{s} = \oint_c \underline{H} \cdot d\underline{L} = \int \underline{J} \cdot d\underline{s} + \int \frac{\partial \underline{D}}{\partial t} \cdot d\underline{s}$

1 $\displaystyle = \underline{I}_{conduction} + \int \underline{J}_d \cdot d\underline{s}$

1 $= I_{conduction} + \underline{I}$ displace

1 c) $\displaystyle\int (\underline{\nabla} \cdot \underline{D})\, dv = \int \rho_v\, dv = Q_{encl} = \oint_s \underline{D} \cdot d\underline{s}$

1 d) $\displaystyle\int (\underline{\nabla} \cdot \underline{B})\, dv = \oint_S \underline{B} \cdot d\underline{s} = 0.$

2 $\underline{F} = \hat{R}\dfrac{Q_1 Q_2}{4\pi\varepsilon_0 R^2}$ (N) $\underline{F} = \dfrac{I\, d\underline{L} \times \hat{R}}{4\pi R^2}$ (N)

2 b) $\underline{\nabla} \cdot \underline{D} = \rho_v$ $\underline{\nabla} \times \underline{H} = \underline{J}$

2 c) $\oint \underline{D} \cdot d\underline{s} = Q_{encl}$ $\oint_c \underline{H} \cdot d\underline{L} = I_{encl}$

2 d) $\oint_s \underline{D} \cdot d\underline{s} = \int (\underline{\nabla} \cdot \underline{D})\, dv$ $\oint_c \underline{H} \cdot d\underline{L} = \int (\underline{\nabla} \times \underline{H}) \cdot d\underline{s}$

2 e) $\underline{E} = -\underline{\nabla} V$ $\underline{H} = \dfrac{1}{\mu_v} \underline{\nabla} \times \underline{A}$

2 f) $C = \dfrac{Q}{V} = \dfrac{\oint \underline{D} \cdot d\underline{s}}{-\int \underline{E} \cdot d\underline{L}}$ $L = \dfrac{N\Phi}{I}$

1 g) $\nabla^2 V = -\dfrac{\rho_v}{\varepsilon}$

1 h) $\nabla^2 V = 0$ subject to two boundary conditions

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Solution to 3.

3(a) $\tilde{A} = \hat{x}\, 50\, e^{-j\pi/2} + \hat{y}\, 10\, e^{-j\pi/2}$

$\underline{A} = Re\left[\tilde{A}\, e^{j\omega t}\right]$

$= \hat{x}\, 50 \cos(\omega t - \pi/2) + \hat{y}\, 10 \cos(\omega t - \pi/2)$

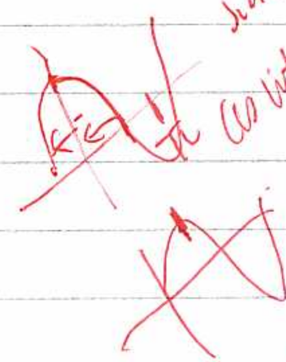
3 $= \hat{x}\, 50 \sin \omega t + \hat{y}\, 10 \sin \omega t.$

3(b) $\tilde{B} = \hat{\phi}\, \frac{20}{r}\, e^{j\pi/2}\, e^{-j\pi z/6}$

$\underline{B} = Re\left[\tilde{B}\, e^{j\omega t}\right]$

$= \hat{\phi}\, \frac{20}{r} \cos\left(\omega t + \frac{\pi}{2} - \frac{\pi z}{6}\right)$

3 $= -\frac{20}{r} \sin\left(\omega t - \frac{\pi z}{6}\right) \hat{\phi}$



3(c) $\tilde{C} = \frac{30}{r^2}(1+j)\, e^{-j3\phi} \cos\phi\ \hat{\phi}$

$(1+j) = \sqrt{2}\, e^{j\pi/4}$

$\tilde{C} = \frac{30}{r^2} \sqrt{2}\, e^{j\pi/4}\, e^{-j3\phi} \cos\theta\ \hat{\phi}$

$\underline{C} = Re\left[\tilde{C}\, e^{j\omega t}\right]$

4 $= \frac{30\sqrt{2}}{r^2} \cos\left(\omega t + \frac{\pi}{4} - 3\phi\right) \cos\theta\ \hat{\phi}.$

$\sin(\omega t = \ldots$

$\cos(\omega t = \sin\ldots$

$\cos(\omega t - 3\phi) + \cos(\omega t - 3\phi + \frac{\pi}{2})$

$+ \sin(\omega t \ldots$