7.36 $\vec{A} = (3y - z)\hat{a}_x + 2xz\hat{a}_y$ Wb/m

$\frac{d}{dx}(3y - z) = 0$

$\frac{d}{dy}(2xz) = 0$

a) $0 + 0$

$P(2, -1, 3)$

$\vec{A} = (3(-1) - (3))\hat{a}_x + 2(2)(3)\hat{a}_y$

b) $\vec{A} = -6\hat{a}_x + 12\hat{a}_y$

$\vec{B} = \nabla \times \vec{A} = -4\hat{a}_x - \hat{a}_y + 3\hat{a}_z$ Wb/m²

$\vec{H} = \vec{B}/\mu_0 = \frac{1}{\mu_0}(-4\hat{a}_x - \hat{a}_y + 3\hat{a}_z)$ A/m

$\vec{J} = \nabla \times H = \frac{1}{\mu_0} \nabla \times B = 0$

7.37 $N = 1000$ $I = 0.8$ A $\rho_0 = 0.02$ m

$a = 0.008$ m $V_m = 0$ @ $\rho = 0.025$ m

$\vec{H} = \frac{NI}{2\pi\rho}\hat{a}_\phi = -\nabla V_m = -\frac{1}{\rho}\frac{dV_m}{d\phi}\hat{a}_\phi$ $\phi = 0.3\pi$

$V_m = -\frac{NI\phi}{2\pi} + C$ $0 = \frac{(1000)(0.8)(0.3\pi)}{2\pi} + C$

$C = 120$

$V_m = -\frac{400\pi}{\pi} + 120$ A

8.3 a) $Q = 2E^{-16}$ C $m = 5E^{-26}$ kg

$E = 100\hat{a}_x - 200\hat{a}_y + 300\hat{a}_z$ V/m

$B = -3\hat{a}_x + 2\hat{a}_y - \hat{a}_z$ mT

$t=0 \rightarrow V(0) = (2\hat{a}_x - 3\hat{a}_y - 4\hat{a}_z)E^5$ m/s

$F(0) = Q(E + (V(0) \times B))$

$= 1100\hat{a}_x + 1400\hat{a}_y - 500\hat{a}_z$

$F(0) = 4E^{-14}(6\hat{a}_x + 6\hat{a}_y - \hat{a}_z)$

$a_F = \frac{6\hat{a}_x + 6\hat{a}_y - \hat{a}_z}{\sqrt{73}} = 0.7\hat{a}_x + 0.7\hat{a}_y - 0.12\hat{a}_z$

8.5 $A(1,0,1) \rightarrow B(3,0,1) \rightarrow C(3,0,4) \rightarrow D(1,0,4) \rightarrow A$

$I_w = 0.006$ A B → C $I_f = 15$ A $\hat{a}_z$

a) $F_{BC} = \int_B^C I_w \vec{dL} \times \vec{B} = \int_1^4 6E^{-3}\,dx\,\hat{a}_x \times \frac{15\mu_0}{2\pi}\hat{a}_y = -18\hat{a}_z$ nN

b) $F_{AB} = \int_1^3 6E^{-3}\,dz\,\hat{a}_x \times \frac{15\mu_0}{2\pi}\hat{a}_y = 19.8\hat{a}_z$ nN

c) $F_{DA} = \int_1^4 -6E^{-3}\,dz\,\hat{a}_z \times \frac{15\mu_0}{2\pi(1)}\hat{a}_y = 54\hat{a}_x$ nN

$F_{total} = F_{DA} + F_{BC} = 36\hat{a}_x$ nN

8.26 $\rho_0 = 0.03\ m$ $n = 5000\ t/m$ $I = 0.25A$

$\mu_r = 5 \rightarrow 0 < \rho < a$

$\mu_r = 1 \rightarrow a < \rho < 0.03$

$$\phi_m = \int_S \vec{B} \cdot d\vec{S} = \int_0^{2\pi} \int_0^a 5\mu_0 n I \rho d\rho d\phi$$

$$+ \int_0^{2\pi} \int_a^b \mu_0 n I \rho d\rho d\phi = \Phi = \mu_0 n I (4a^2 - b^2)$$

$\phi_m = 0.00001\ Wb$ $\boxed{a = 0.027\ m}$

a) $\frac{\Phi}{\mu_0 n I} = 4a^2 - b^2 \rightarrow \boxed{\frac{1}{4}\left(\frac{\Phi}{\mu_0 n I} + b^2\right) = a^2}$

$5a^2 = b^2 - a^2$

b) $a = b/\sqrt{6} = \boxed{0.0122\ m}$

8.38 $\rho_a = 0.02\ m$, $\rho_b = 0.03\ m$, $z_a = 0.04$, $z_b = 0.045\ m$

$\mu_r = 80$ $n = 8000$

$$H_\phi = \frac{nI}{2\pi\rho} \qquad \phi = \int\int \vec{B} \cdot d\vec{L} =$$

$$= \int_{0.040}^{0.045} \int_{0.02}^{0.03} \frac{\mu_r \mu_0 n I}{2\pi\rho} d\rho\, dz$$

$$= (0.005) \frac{\mu_0 \mu_r n I}{2\pi} \ln(1.5)$$

$$L = \frac{n\Phi}{I} = \boxed{2.08\ H}$$