6-1 Soln)

A) Find the resistivity of copper: $1.7\times10^{-8}\ \Omega$ m.
Find the area of the loop: $A = \pi(R_{Loop})^2$.
Find the *emf*:

$$\mathcal{E} = (-)N\frac{d\Phi_M}{dt} = (1)\frac{d(B_\perp A)}{dt} = A\frac{dB}{dt} = \pi R_{Loop}^2\frac{dB}{dt} \quad .$$

Find the resistance, R:

$$R = \frac{\rho L}{A_X} = \frac{\rho 2\pi R_{Loop}}{\pi r_{Wire}^2} \quad .$$

We're assuming that the radius of the loop is so much greater than the radius of the wire than we can consider it to be a 'Playdoh' shape.

Find the current:

$$I = \frac{\mathcal{E}}{R} = \frac{\pi R_{Loop}^2\frac{dB}{dt}}{\frac{\rho 2\pi R_{Loop}}{\pi r_{Wire}^2}} = \frac{\pi R_{Loop} r_{Wire}^2\frac{dB}{dt}}{2\rho} = \frac{\pi(2)(0.0005^2)(0.3)}{2(1.7\times10^{-8})} = 13.9\ A$$

B) We find the direction from Lenz's law. The magnetic field is pointing into the page, so that's like having a magnetic north pole just above the loop. The field is getting stronger, so that's like moving the north pole closer to the loop. Then, another north pole will form just above the loop due to the induced current in the loop so as to repel the magnet. The RHR then says that the current in the loop is going CCW.