We now look at a free energy on the form:

$$F = \alpha \partial_x M_x + \beta \partial_y M_y + \gamma \partial_x M_y + \Delta \partial_y M_x + \zeta (\partial_x M_x)^2 + \eta (\partial_y M_y)^2$$
$$+ \Theta (\partial_x M_y)^2 + \iota (\partial_y M_x)^2 + K \partial_y M_x \partial_x M_y$$

Looking at the symmetry of I get:

$$\alpha = \beta = \gamma = \Delta = 0$$

Adding gives me:

$$\varepsilon = K \quad , \quad \zeta = \iota \quad \text{and} \quad \eta = \Theta$$

Giving me the expression:

$$F = \varepsilon \left(\partial_x M_x \partial_y M_y + \partial_y M_x \partial_x M_y \right) + \iota \left[(\partial_x M_x)^2 + (\partial_y M_x)^2 \right]$$
$$+ \eta \left[(\partial_x M_y)^2 + (\partial_y M_y)^2 \right]$$

Now going back and adding a magnetic field parameter to equation (27) with $M_y = 0$:

$$F = aM_x^2 + bM_x^4 - HM_x$$

I can now use the hint $\left(\chi = \left| \frac{\partial M_x}{\partial H} \right| \right)$ and the product rule:

$$\frac{\partial F}{\partial H} = \frac{\partial F}{\partial M} \frac{\partial M}{\partial H} = \frac{\partial F}{\partial M} \chi \Leftrightarrow \chi = \left(\frac{\partial F}{\partial H} \right) \left(\frac{\partial F}{\partial M} \right)^{-1} = (-M_x) \left(2aM_x + 4bM_x^3 - H \right)^{-1}$$

For $H = 0$ and small values of M_x, the susceptibility is:

$$\chi \approx \frac{1}{2a} = \frac{1}{2a_0(t - t_c)}$$ which is Curie-Weiss for $C = (2a_0)^{-1}$