$$\mathcal{F}^{*1} = -W^1 = \frac{\partial W}{\partial \phi_1} = g(\phi_3^2 - m^2)$$

$$\mathcal{F}^{*2} = -W^2 = \frac{\partial W}{\partial \phi_2} = M\phi_3$$

$$\mathcal{F}^{*3} = -W^3 = \frac{\partial W}{\partial \phi_3} = 2g\phi_1\phi_3 + M\phi_2$$