Exercise 8: Loop expansion for the $\phi^{3}$-theory
The action for the $\phi^{3}$-theory in $d$-dimensions is given by

$$
\begin{equation*}
S=\int \mathrm{d}^{d} r\left[\frac{1}{2}(\nabla \phi)^{2}+\frac{1}{2} m_{0}^{2} \phi^{2}+\frac{\lambda}{3!} \phi^{3}\right] \tag{1}
\end{equation*}
$$

i) Find the critical dimension of the theory.
ii) Specify the relevant vertex functions to deal with the critical properties.
iii) Find all diagrams that contribute to the relevant vertex functions up to two loop order.
iv) Write down the explicit expression for the diagrams contributing to the relevant vertex functions up to one loop order.

