Particle Physics HW 8 Quiz Name Key

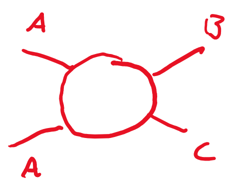
You can try both problems below, but you will only receive credit for the most correct solution.

1. Consider the ABC theory with $m_A > m_B + m_C$ and Lagrangian:

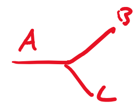
$$\mathcal{L} = \frac{1}{2}\partial_\mu\phi_A\partial^\mu\phi_A - \frac{1}{2}\left(\frac{m_A c}{\hbar}\right)^2\phi_A^2 + \frac{1}{2}\partial_\mu\phi_B\partial^\mu\phi_B - \frac{1}{2}\left(\frac{m_B c}{\hbar}\right)^2\phi_B^2 + \frac{1}{2}\partial_\mu\phi_C\partial^\mu\phi_C - \frac{1}{2}\left(\frac{m_C c}{\hbar}\right)^2\phi_C^2 - g\phi_A\phi_B\phi_C$$

Is the scattering event $A + A \to B + C$ possible? If so, what is the lowest order contribution to the amplitude M?

It is not possible since



cannot be completed by any number of vertices of the form



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Turn over for second problem!!

2. Consider the momentum space Dirac equation for anti-particle spinors, i.e. $(\gamma^\mu P_\mu + mc)v^{(i)} = 0$. Find an expression for the inverse of the operator in parentheses.

We know from the HW that $(\gamma^\mu P_\mu - mc)\dfrac{(\gamma^\mu P_\mu + mc)}{p^2 - m^2c^2} = \underline{I}$.

But this means $\underbrace{\dfrac{(\gamma^\mu P_\mu - mc)}{p^2 - m^2c^2}}_{M^{-1}} \underbrace{(\gamma^\mu P_\mu + mc)}_{M} = \underline{I}$