Solution to HW 3

The relevant diagrams (and the momenta flow) are shown in Fig. (1). The corresponding

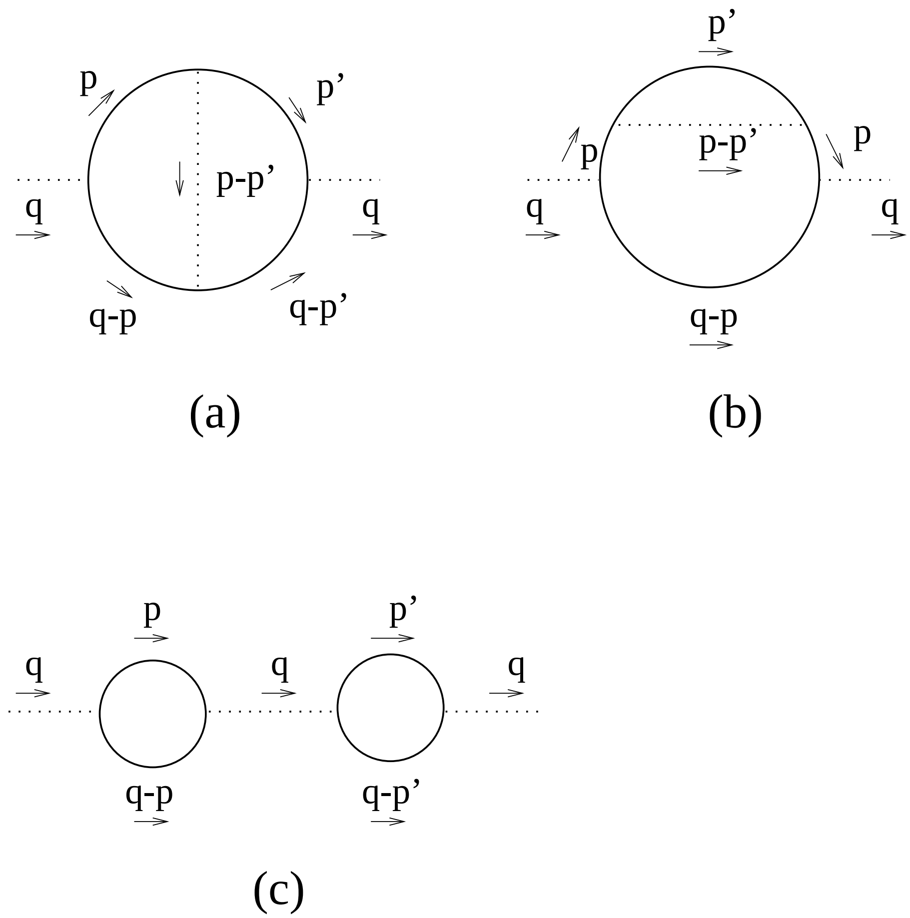

FIG. 1. Feynman diagrams for the two-pion Green function in the λ^2 order.

expressions for the (reduced) Green functions are:

$$\mathcal{G}_a(q) = \frac{1}{2}\frac{\lambda^4}{(m^2-q^2-i\epsilon)^2}\int\frac{dp}{16\pi^4 i}\int\frac{dp'}{16\pi^4 i}\;\frac{1}{M^2-p^2-i\epsilon}\;\frac{1}{M^2-p'^2-i\epsilon}$$
$$\frac{1}{M^2-(q-p)^2-i\epsilon}\;\frac{1}{M^2-(q-p')^2-i\epsilon}\;\frac{1}{m^2-(p-p')^2-i\epsilon} \tag{1}$$

for the diagram in Fig.(1)a ($\frac{1}{2}$ is the symmetry coefficient),

$$\mathcal{G}_b(q) = \frac{\lambda^4}{(m^2-q^2-i\epsilon)^2}\int\frac{dp}{16\pi^4 i}\int\frac{dp'}{16\pi^4 i}\;\frac{1}{(M^2-p^2-i\epsilon)^2}\;\frac{1}{M^2-p'^2-i\epsilon}$$
$$\frac{1}{M^2-(q-p)^2-i\epsilon}\;\frac{1}{m^2-(p-p')^2-i\epsilon} \tag{2}$$

for the diagram in Fig.(1)b (the symmetry coefficient for this diagram is 1), and

$$\mathcal{G}_c(q) = \frac{1}{4}\frac{\lambda^4}{(m^2 - q^2 - i\epsilon)^3}\int \frac{dp}{16\pi^4 i}\ \frac{1}{M^2 - p^2 - i\epsilon}\ \frac{1}{M^2 - (q-p)^2 - i\epsilon}$$
$$\int \frac{dp'}{16\pi^4 i}\ \frac{1}{M^2 - p'^2 - i\epsilon}\ \frac{1}{M^2 - (q-p')^2 - i\epsilon} \tag{3}$$

for the diagram in Fig.(1)c. Here $\frac{1}{4} = \frac{1}{2} \times \frac{1}{2}$ is the symmetry coefficient.