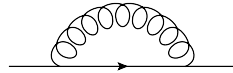
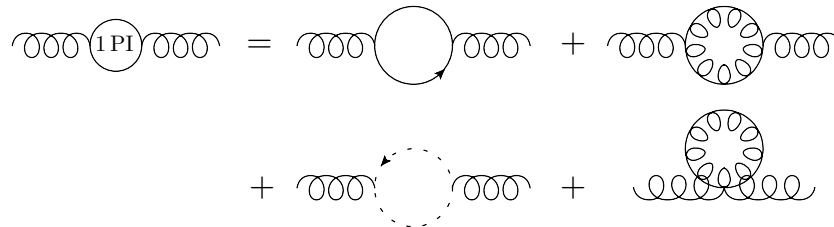


1. Compute the fermion self-energy diagram in QCD using dimensional regularization. Extract the divergent part.



Note: I will explicitly perform the computation of this diagram in the exercise class on September 30.

2. Draw all one-particle irreducible Feynman diagrams for the quark-gluon vertex and for the triple-gluon vertex at one-loop.
3. Determine the symmetry factors of the four gluon self-energy diagrams



4. Compute *one* of the gluon self-energy diagrams shown in the previous exercise and extract its divergent part explicitly. Choose one of the first three, since the last diagram vanishes in dimensional regularization (why?).

Note that the gluon self-energy as a whole is transverse, i.e. it takes the form

$$\Pi_{\mu\nu}(q^2) = (q_\mu q_\nu - g_{\mu\nu} q^2) \Pi(q^2),$$

As it should be, only transverse gluons propagate. The same property holds for the fermion-loop part, but the individual gluon- and ghost-loop diagrams do not have this form.

It would be good to split the class into three teams to get the full result self-energy on October 7.