

FullSimplify[
TR[a^2 * GA[a].GA[b].GA[g].GA[d] - (* a^2 is \tilde{q}^2 from \tilde{q}^4 term, other terms are proportional to \tilde{q}^2*q^2 *)
(GA[a].GS[q].GA[b].GS[q].GA[g].GA[d] + GA[a].GA[b].GA[g].GS[q].GA[d].GS[q] + GA[a].GA[b].GS[q].GA[g].GA[d].GS[q] + GA[a].GS[q].GA[b].GA[g].GA[d].GS[q] + GA[a].GS[q].GA[b].GA[g].GS[q].GA[d])]]