```
In[ ]:= FullSimplify[
    TR[a^2*GA[α].GA[β].GA[γ].GA[δ] - (* a^2 is \tilde{q}^2 from \tilde{q}^4 term,
        other terms are proportional to \tilde{q}^2*q^2 *)
    (GA[α].GS[q].GA[β].GS[q].GA[γ].GA[δ] + GA[α].GA[β].GA[γ].GS[q].GA[δ].GS[q] + GA[α].GA[β].GS[q].GA[γ].GA[δ].GS[q] +
        GA[α].GA[β].GS[q].GA[γ].GS[q].GA[δ] + GA[α].GS[q].GA[β].GA[γ].GA[δ].GS[q] +
        GA[α].GS[q].GA[β].GA[γ].GS[q].GA[δ])]]
```

$$\text{Out[ ]= } 4\left(a^2\,\overline{g}^{\,\alpha\,\beta}\,\overline{g}^{\,\gamma\,\delta} - \left(2\,\overline{q}^2 + a^2\right)\overline{g}^{\,\alpha\,\gamma}\,\overline{g}^{\,\beta\,\delta} + \overline{g}^{\,\alpha\,\delta}\left(\left(2\,\overline{q}^2 + a^2\right)\overline{g}^{\,\beta\,\gamma} - 2\,\overline{q}^\beta\,\overline{q}^\gamma\right) - 2\,\overline{q}^\alpha\,\overline{q}^\beta\,\overline{g}^{\,\gamma\,\delta} - 2\,\overline{q}^\alpha\,\overline{q}^\delta\,\overline{g}^{\,\beta\,\gamma} - 2\,\overline{q}^\gamma\,\overline{q}^\delta\,\overline{g}^{\,\alpha\,\beta} + 2\,\overline{q}^2\,\overline{g}^{\,\alpha\,\beta}\,\overline{g}^{\,\gamma\,\delta}\right)$$