0.1 Dirac Equation

0.1.1 Conplex Conjugate

0.1.2 γ^5

$$\{\gamma^\mu, \gamma^\nu\} = \gamma^\mu\gamma^\nu + \gamma^\nu\gamma^\mu = 2\eta^{\mu\nu}$$

0.2 Slashed

- $$\not{p}\gamma^\nu = p_\mu\gamma^\mu\gamma^\nu = p_\mu(2\eta^{\mu\nu} - \gamma^\nu\gamma^\mu) = 2p^\nu - \gamma^\nu\not{p}$$
$$\Downarrow$$
$$\not{p}\gamma^\nu + \gamma^\nu\not{p} = 2p^\nu \cdot \mathcal{I}$$

- $$\not{p}\not{q} = p_\mu q_\nu\gamma^\mu\gamma^\nu = 2pq - \not{q}\not{p}$$
$$\Downarrow$$
$$\not{p}\not{q} + \not{q}\not{p} = 2pq \cdot \mathcal{I}$$

- $$\gamma^\mu\not{p}\gamma_\mu = \gamma^\mu\gamma^\nu p_\nu\gamma_\mu = (2\eta^{\mu\nu} - \gamma^\nu\gamma^\mu)p_\nu\gamma_\mu = 2\not{p} - \not{p}\gamma^\mu\gamma_\mu = -2\not{p}$$

- $$\gamma^\mu\not{p}\gamma^\nu\gamma_\mu = (2p^\mu - \not{p}\gamma^\mu)\gamma^\nu\gamma_\mu = 2\gamma^\nu\not{p} + 2\not{p}\gamma^\nu = 2p^\nu \cdot \mathcal{I}$$

- $$\gamma^\mu\not{p}\not{q}\gamma_\mu = (2p^\mu - \not{p}\gamma^\mu)(2q_\mu - \gamma_\mu\not{q}) = 4pq - 2\not{p}\not{q} - 2\not{p}\not{q} + 4\not{p}\not{q} = 4pq \cdot \mathcal{I}$$

- $$\begin{aligned}\gamma^\mu\not{p}\gamma_\nu\not{q}\gamma_\mu &= (2p^\mu - \not{p}\gamma^\mu)\gamma_\nu(2q_\mu - \gamma_\mu\not{q}) = 4pq\gamma_\nu - 2\gamma_\nu\not{p}\not{q} - 2\not{p}\not{q}\gamma_\nu + \not{p}\gamma^\mu\gamma_\nu\gamma_\mu\not{q} \\ &= 4pq\gamma_\nu - 2\gamma_\nu\not{p}\not{q} - 2\not{p}\not{q}\gamma_\nu - 2\not{p}\gamma_\nu\not{q} \\ &= 2\gamma_\nu(2pq - \not{p}\not{q}) - 2\not{p}(\not{q}\gamma_\nu + \gamma_\nu\not{q}) \\ &= \gamma_\nu 2\not{q}\not{p} - 4\not{p}q_\nu \\ &= 2(\gamma_\nu\not{q} - 2q_\nu)\not{p} \\ &= -2\not{q}\gamma_\nu\not{p}\end{aligned}$$

0.3 Trace