Salzman

10/10

Problem 5

Demonstrate that the 2 operators $O_1(x) = \bar{\psi}(x)\Gamma^1\psi(x)$ and $O_2(y) = \bar{\psi}(y)\Gamma^2\psi(y)$ (where Γ^1 and Γ^2 are any of the 16 matrices considered in our bilinears discussion) commute for $(x-y)^2<0$ provided that the fields anticommute, $\{\psi(x),\bar{\psi}(y)\} = \{\psi(x),\psi(y)\} = \{\bar{\psi}(x),\psi(y)\} = \{\bar{\psi}(x),\bar{\psi}(y)\} = 0$ for $(x-y)^2<0$.

$$[O_1(x), O_2(y)] = [\bar{\psi}(x)\Gamma^1\psi(x), \bar{\psi}(y)\Gamma^2\psi(y)]$$

$$= \bar{\psi}(x)\Gamma^1\psi(x)\bar{\psi}(y)\Gamma^2\psi(y) - \bar{\psi}(y)\Gamma^2\underbrace{\psi(y)\bar{\psi}(x)}_{-1}\Gamma^1\psi(x)$$

$$= \bar{\psi}(x)\Gamma^1\psi(x)\bar{\psi}(y)\Gamma^2\psi(y) + \bar{\psi}(y)\Gamma^2\bar{\psi}(x)\psi(y)\Gamma^1\psi(x)$$

This is a component equa
so Γ^1, Γ^2 are simply n
and commute with everyth

$$= \bar{\psi}(x)\Gamma^1\psi(x)\bar{\psi}(y)\Gamma^2\psi(y) + \bar{\psi}(y)\Gamma^1\Gamma^2\bar{\psi}(x)\underbrace{\psi(y)\psi(x)}_{-1}$$

$$= \bar{\psi}(x)\Gamma^1\psi(x)\bar{\psi}(y)\Gamma^2\psi(y) - \underbrace{\bar{\psi}(y)\Gamma^1\Gamma^2\bar{\psi}(x)}_{-1}\psi(x)\psi(y)$$

Γ^1, Γ^2 are simply num

$$= \bar{\psi}(x)\Gamma^1\psi(x)\bar{\psi}(y)\Gamma^2\psi(y) + \bar{\psi}(x)\Gamma^1\Gamma^2\underbrace{\bar{\psi}(y)\psi(x)}_{-1}\psi(y)$$

$$= \bar{\psi}(x)\Gamma^1\psi(x)\bar{\psi}(y)\Gamma^2\psi(y) - \bar{\psi}(x)\Gamma^1\Gamma^2\psi(x)\bar{\psi}(y)\psi(y)$$

Γ^1, Γ^2 are simp
numbers

$$= \bar{\psi}(x)\Gamma^1\psi(x)\bar{\psi}(y)\Gamma^2\psi(y) - \bar{\psi}(x)\Gamma^1\psi(x)\bar{\psi}(y)\Gamma^2\psi(y)$$