PROBLEMS FOR QUANTUM FIELD THEORY 1
5. Tutorial

PROBLEM 1: *Feynman propagator*

Consider the Feynman propagator for a scalar field

$$D_F(x - y) = \int \frac{d^4p}{(2\pi)^4} \frac{i}{p^2 - m^2 + i\epsilon} e^{-ip(x-y)}$$

Assuming $x_0 - y_0 > 0$ and using the residue theorem, show that this can be written as

$$D_F(x - y) = \int \frac{d^3p}{(2\pi)^3} \frac{1}{2E_p} e^{-iE_p(x_0-y_0)+i\vec{p}(\vec{x}-\vec{y})}.$$

How does this change for $x_0 - y_0 < 0$?