5.1) Work out the LSZ reduction formula for the complex scalar field that was introduced in problem 3.5. Note that we must specify the type (a or b) of each incoming and outgoing particle.

As stated in problem 3.5.c, the only difference b/w a and b is $\varphi \to \varphi^\dagger$. φ and $\varphi^\dagger$ satisfy the same equation, so the end result of the LSZ formula will be the same; however, to get there, we will have to use the following:

$$a_1(+\infty) \equiv i\int d^3k\, f_1(\vec{k}) \int d^4x\, e^{-ikx}(-\partial^2+m^2)\varphi(x)$$

$$b_1(+\infty) \equiv i\int d^3k\, f_1(\vec{k}) \int d^4x\, e^{-ikx}(-\partial^2+m^2)\varphi^\dagger(x)$$

$$a_1^\dagger(-\infty) \equiv i\int d^3k\, f_1(\vec{k}) \int d^4x\, e^{ikx}(-\partial^2+m^2)\varphi^\dagger(x)$$

$$b_1^\dagger(-\infty) \equiv i\int d^3k\, f_1(\vec{k}) \int d^4x\, e^{ikx}(-\partial^2+m^2)\varphi(x)$$