

## Series 3

### I. Propagation over spacelike separation

Verify that the propagator  $D(x)$  of the massive scalar (in 4d) vanishes for spacelike separation.

### II. Propagator of the massless free scalar field in 2d

Calculate the propagator for the massless free scalar field in 2d by solving the differential equation

$$-\partial_x^2 D(\vec{x} - \vec{y}) = \delta(\vec{x} - \vec{y}). \quad (1)$$

### III. Potential energy between two static sources

Calculate the integral

$$E = - \int \frac{d^3k}{(2\pi)^2} \frac{e^{i\vec{k}\cdot(\vec{x}_1 - \vec{x}_2)}}{\vec{k}^2 + m^2}. \quad (2)$$