University of Minnesota
School of Physics and Astronomy

2026 Spring Physics 8012
Quantum Field Theory II

Assignment Solution

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Homework 5 Due to February 26 8:00 AM

Question 1

Consider quantal one-dimensional problem described by the Lagrangian

$$\mathcal{L} = \frac{1}{2}\dot{X}^2 - V(X), \tag{1}$$

where

$$V(X) = \lambda(X^2 - \eta^2)^2, \tag{2}$$

where η is real and positive. This is so-called double-well potential. Find the classical trajectory in the Euclidean time connecting the point $X = -\eta$ in the distant past with the point $X = \eta$ in the distant future (keeping in mind that T will be set to ∞ at the end).

Why do we need Euclidean time? We will use this trajectory in subsequent lectures.

Answer