Homework 4

Due on: Tuesday, March 03

Problem 1

Work out the OPE between $T^{(X)}(z, \bar{z}) = \left(-\frac{1}{2l^2}\partial_z X(z, \bar{z}) \cdot \partial_z X(z, \bar{z})\right)$ and $\left(e^{ik \cdot X(w, \bar{w})}\right)$. What is the conformal dimension of $e^{ik \cdot X}$?

Problem 2

Evaluate the OPE for $T^{(\psi)}(z, \bar{z}) = \left(-\frac{1}{2l^2}\psi(z, \bar{z}) \cdot \partial_{\bar{z}}\psi(z, \bar{z})\right)$ and $T^{(\psi)}(w, \bar{w})$.

Problem 3

Evaluate the OPE between $T^{(bc)}(z, \bar{z})$ and $T^{(bc)}(w, \bar{w})$. Is there a value of the dimension of spacetime such that the anomaly (central charge) cancels **for the bosonic string**?

Problem 4

Evaluate the OPE between $T^{(\beta\gamma)}(z, \bar{z})$ and $T^{(\beta\gamma)}(w, \bar{w})$. Is there a value of the dimension of spacetime such that the anomaly cancels **for the spinning string**?