Exercise Sheet 7 (String Theory, LVA Nr. 136.005) due 16th of may

Exercise 11: The Virasoro Anomaly

In the quantum theory, the Virasoro algebra may receive an anomalous contribution

$$[L_m, L_n] = (m - n)L_{m+n} + A(m)\delta_{m+n} \,. \tag{1}$$

Use the Jacobi identity to show the recursion relation

$$(m - n)A(l) + (n - l)A(m) + (l - m)A(n) = 0 \,, \tag{2}$$

for $l + m + n = 0$. Now use this to show that $A(m)$ has the form

$$A(m) = am^3 + bm \,. \tag{3}$$

The remaining constants can be obtained by computing two independent expectation values.