

# Statistical Mechanics 2011–12

## Exercise on series expansions

This exercise sheet is for anyone who would like to practice expanding functions into power series.

Derive the following expansions for  $x \ll 1$ :

1.  $\frac{2 \sinh x}{1 + 2 \cosh x} = \frac{2}{3}x - \frac{1}{9}x^3 + O(x^5) .$
2.  $\log(1 + 2 \cosh x) = \log 3 + \frac{x^2}{3} - \frac{x^4}{36} + O(x^6) .$
3.  $2e^{x+2x^2} - e^{2x+2x^2} = 1 + x^2 + O(x^4) .$

Derive the following expansion for  $x \gg 1$ :

1.  $\sqrt{1 - 2e^{-x} + 11e^{-2x}} = 1 - e^{-x} + 5e^{-2x} + O(e^{-3x}) .$