SI 7: Finite Calculus

1 Proofs

Prove the Following:

1. $\Delta x^{\underline{n}} = n x^{\underline{n-1}}$
2. $\sum u(x)\Delta v(x)\delta x = u(x)v(x) - \sum v(x+1)\Delta u(x)\delta x$

2 Computations

Compute the following, you are allowed these identities without proof:

$$\binom{n}{k} - \binom{n-1}{k} = \binom{n-1}{k-1} \tag{1}$$

$$\Delta H_x = x^{\underline{-1}} \tag{2}$$

You are also allowed anything proven up until now, and standard algebraic operations.

3. $\sum_{n=1}^{N} \ln(n)$
4. $\sum_{x=1}^{N} \binom{x}{k}$
5. $\sum_{x=1}^{N} \sum_{y=1}^{N} (x+y)^2$
6. $\sum_{x=1}^{N} (H_x \binom{x}{m-1} + \binom{x+1}{m} x^{\underline{-1}})$