**NB:** Please deposit your solutions in the appropriate box **by 4 p.m. on the due date**. Late assignments or assignments placed into incorrect boxes will not be marked. Use a mathematics department cover sheet: these are available from outside the Resource Centre.

**1.** Prove by induction that for all $n \in N$,

$$\sum_{i=1}^{n} \frac{1}{i(i+1)} = \frac{n}{n+1}.$$

**2.** Prove by induction that for all $n \in N$,

$$\sum_{i=1}^{n} \frac{i}{2^i} = 2 - \frac{n+2}{2^n}.$$

**3.** Prove that if $A, B$ are sets with $n, m$ elements respectively, then there are exactly $m^n$ distinct possible functions $f : A \to B$. [Hint: Use induction on $n$.]

**4.** Suppose that in a pile of 2 or more coins it is known that one is heavier than the rest but all the others are the same weight. Prove that four weighings with a balance are sufficient to discover which coin is heavier. [Hint: Set one coin aside and consider the possibilities for the rest.]