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.

PLEASE SHOW ALL WORKING.

1. (**15 marks**) Prove by mathematical induction that, for every $n \in \mathbb{N}$,

$$1 \cdot 2 + 2 \cdot 3 + \ldots n(n+1) = \frac{1}{3}n(n+1)(n+2).$$

2. (**10 marks**) Let $n \in \mathbb{N}$ and $W(n) = \{-(n-1), -(n-2) \ldots, -1, 0\} \cup \mathbb{N}$. Prove by mathematical induction on n that $W(n)$ is a well-ordered set.

3. (**15 marks**) Prove by mathematical induction that, for every $n \in \mathbb{N}$, $3^{4n+1} + 4^{n+1}$ is divisible by 7.

4. (**10 marks**) Use the Euclidean algorithm to find the greatest common divisor of 3598 and 1603, and find integers x and y such that

$$\gcd(3598, 1603) = 3598x + 1603y.$$