Here are some problems for Monday, 1 May, 2023.

1. Prove the following proposition. For all $n \in \mathbb{N}_0$, $1 + 2 + 4 + \cdots + 2^n = 2^{n+1} - 1$.

2. Prove that:
$$\frac{1}{2!} + \frac{2}{3!} + \frac{3}{4!} + \cdots + \frac{n}{(n+1)!} = 1 - \frac{1}{(n+1)!} \, . \tag{1}$$

3. Prove that for all $n \in \mathbb{N}$, $n^2 - n$ is even. Do this proof three ways:
   (a) Consider two cases: n is odd and n is even.
   (b) Use induction.
   (c) Use Proposition 4.2.

4. Find a formula for the sum:
$$2 + 4 + 6 + \cdots + 2n \, . \tag{2}$$
   Prove that your formula is correct two ways:
   (a) Use Proposition 4.2.
   (b) Use induction.