Work on these with your partner(s) at the board

For each problem,

- First check that the claim is reasonable by plugging in several different values of n.
- Then prove the claim using mathematical induction.

1. Prove that $\forall n \in \mathbb{Z}, n \geq 1, \quad 1 + 2 + 3 + \cdots + n = \dfrac{n(n+1)}{2}$

2. Prove that $\forall n \in \mathbb{N}, \quad 5 \mid (6^n - 1)$

   This notation means that 5 divides $6^n - 1$ evenly, with no remainder

3. Prove that $\forall n \in \mathbb{Z}, n > 1, \quad n! < n^n$