**Self-assessment: 25 Mathematical induction**

**1.** Prove by induction that 1 × 3 + 2 × 4 + ⋯ + *n*(*n* + 2) = .

*(accessible to students on the path to grade 3 or 4) [6 marks]*

**2.** Use the principle of mathematical induction to show that 15*n* – 2*n* is a multiple of 13 for all *n* ∈ ℕ.

*(accessible to students on the path to grade 5 or 6) [6 marks]*

**3.** Prove by induction that 3*n* > *n* +17 for all integers *n* ≥ 3.

*(accessible to students on the path to grade 5 or 6) [6 marks]*

**4.** (a) Use mathematical induction to prove that (cos *θ* + i sin *θ*)*n* = cos(*nθ*) + i sin(*nθ*) for *n* ∈ ℕ.

(b) By expanding (cos *θ* + i sin *θ*)5, find an expression for sin(5*θ*) in terms of sin *θ*.

*(accessible to students on the path to grade 5 or 6) [12 marks]*