

Topic 19A: Exercises on Harder 3 Unit Induction
Level 1, Part 1

1. Show that for $n \geq 1$, $1+2+\dots+n = \frac{n(n+1)}{2}$.

2. Show that for $n \geq 1$ $1+3+5+\dots+(2n-1) = n^2$.

3. Show that for $n \geq 1$ $1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \dots + n(n+1) = \frac{n(n+1)(n+2)}{3}$.

4. Show that $n \geq 1 \quad \frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \dots + \frac{1}{n(n+1)} = \frac{n}{(n+1)}$.

5. Using the product rule for differentiation show that for $n \geq 1$ $\frac{d}{dx} x^n = n \cdot x^{n-1}$.

6. Using integration by parts, show that for $n \geq 1$ $\int x^n dx = \frac{x^{n+1}}{n+1} + c$.

7. Show that for $n \geq 1$ $\frac{d^n}{dx^n} \ln(1-x) = -\frac{(n-1)!}{(1-x)^n}$.

8. Show that for $n \geq 3$, $2^n > 2n+1$.