

# Induction Lecture 2

Prove: For  $n \geq 1$

$$1 \times 2 + 2 \times 3 + 3 \times 4 + \dots + n(n+1) = (n)(n+1)(n+2)/3$$

Basis:  $n=1$

$$\begin{aligned} (1)(2) &= (1)(2)(3)/3 \\ 2 &= 6/3 \quad \checkmark \end{aligned}$$

Assume true for  $k$ :

$$1 \times 2 + 2 \times 3 + \dots + k(k+1) = (k)(k+1)(k+2)/3$$

Induction step:

$$\begin{aligned} & \underbrace{1 \times 2 + 2 \times 3 + \dots + k(k+1)}_{(k)(k+1)(k+2)/3} + (k+1)(k+2) \\ &= (k)(k+1)(k+2)/3 + (k+1)(k+2) \\ &= (k)(k+1)(k+2)/3 + 3(k+1)(k+2)/3 \\ &= \left[ (k)(k+1)(k+2) + 3(k+1)(k+2) \right] / 3 \\ &= (k+3)(k+1)(k+2) / 3 \\ &= (k+1)(k+2)(k+3) / 3 \\ &= (\underline{k+1})(\underline{k+1+1})(\underline{k+1+2}) / 3 \quad \checkmark \end{aligned}$$