

$$+ \left\{ \begin{aligned} S &= 1 + 2 + 3 + \dots + n \\ S &= n + (n-1) + (n-2) + \dots + 1 \end{aligned} \right.$$

$$2S = \underbrace{(n+1) + (n+1) + (n+1) + \dots + (n+1)}_{n \text{ times}}$$

$$= n \times (n+1)$$

$$\therefore S = \frac{n(n+1)}{2}$$

$$\underline{1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2} \quad (n \geq 1)}$$

$$n=1 \quad / \quad 1 = \frac{1 \cdot 2}{2} = 1 \quad \text{holds}$$

$$\text{assume } n=k \quad / \quad 1 + 2 + \dots + k = \frac{k(k+1)}{2}$$

$$n=k+1$$

$$1 + 2 + \dots + k + (k+1) = \frac{k(k+1)}{2} + (k+1) = \frac{k(k+1) + 2(k+1)}{2}$$

$$= \frac{(k+1)(k+2)}{2} \quad !!$$