$$\sum_{i=1}^{n} i = 1 + 2 + 3 + ... + n \tag{1}$$

$$S = 1 + 2 + 3 + ... + n \tag{2}$$

$$S = n + (n-1) + (n-2) + ... + 1 \tag{3}$$

$$2S = (1+n) + (2+(n-1)) + (3+(n-2)) + ... + (n+1) \tag{4}$$

$$= (1+n) + (1+n) + (1+n) + ... + (1+n) \tag{5}$$

$$= n(1+n) \tag{6}$$

$$2S = n(n+1) \tag{7}$$

$$S = \frac{n(n+1)}{2} \tag{8}$$

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2} \tag{9}$$