

ES:

What are the properties of Summation? How do we use it?

Constant Rule

$$\sum_{i=1}^n k a_i = k \sum_{i=1}^n a_i \quad (\text{ex}) \quad \sum_{i=1}^4 5i = 5 \sum_{i=1}^4 i$$

Sum and difference Rules

$$\sum_{i=1}^n (a_i \pm b_i) = \sum_{i=1}^n a_i \pm \sum_{i=1}^n b_i$$

Power Rule

$$\textcircled{1} \quad \sum_{i=1}^n c = c \cdot n, \quad c \text{ is a constant}$$

only when $i=1$

$$\textcircled{\text{ex}} \quad \sum_{i=1}^3 8 = 8(3) = \textcircled{24}$$

$$\textcircled{2} \quad \sum_{i=1}^n i = \frac{n(n+1)}{2}$$

$$\textcircled{3} \quad \sum_{i=1}^n i^2 = \frac{n(n+1)(2n+1)}{6}$$

$$\textcircled{4} \quad \sum_{i=1}^n i^3 = \frac{n^2(n+1)^2}{4}$$

why power
rule (2), (3) and
(4)?

They are shortcuts to evaluate
the sum when n is a large number.

(ex)

$$\sum_{i=1}^5 i = 1 + 2 + 3 + 4 + 5 = \boxed{15}$$

$$\sum_{i=1}^5 i = \frac{n(n+1)}{2} = \frac{5(5+1)}{2} = \frac{5(6)}{2} = \frac{30}{2} = \boxed{15}$$

Summary