Important sums to know in IADS

1. Sum

$\sum_{i=0}^{n} 2^i = 1 + 2 + 4 + 8 + ... + 2^n = 2^{n+1}\text{-}1 = O(2^n)$

an important instance

$\sum_{i=0}^{\lceil \lg n \rceil} 2^i = 1+2+4+8+16+...+2^{\lceil \lg n \rceil} = 2^{\lceil \lg n \rceil + 1} - 1 = O(n)$

this is also the case if you replace $\lceil \lg n \rceil$ by $\lfloor \lg n \rfloor$

2. Sum

$\sum_{i=0}^{n} \left(1/2\right)^i = 1+1/2+1/4+1/8+...+1/2^n = 2-1/2^n = O(1)$

3. Sum

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

These sums can often appear in the opposite direction:

Example: $2^n + 2^{n-1} + ... + 1 = 2^{n+1}\text{-}1 = O(2^n)$

They can also appear multiplied or divided by a constant:

For instance is the 2. sum just the first rule divided by 2^n and written in the opposite direction.