MTH 231 LECTURE 1

## Summation Notation

$\sum_{K=a}^{b} f(K)$ || Sum everything from $K=a$ to $K=b$ while applying the rule $f(K)$

EX: $\sum_{K=10}^{K=12} 2K \quad \underset{10}{\underline{20}} + \underset{11}{\underline{22}} + \underset{12}{\underline{24}} = \boxed{66}$

EX: $\sum_{K=1}^{3} (K^3 + 2K) = \underset{1}{\underline{(1+2)}} + \underset{2}{\underline{(8+4)}} + \underset{3}{\underline{(27+6)}}$

EX: $\sum_{K=a}^{K=b} (c) = (b-a+1)c$

## Linearity Property

1] $\sum_{K=a}^{b} c f(K) = c \cdot \sum_{K=a}^{b} f(K)$

2] $\sum_{K=a}^{b} f(K) + g(K) = \sum_{K=a}^{b} f(K) + \sum_{K=a}^{b} g(K)$

## Index Shifting on Summations

1] $\sum_{K=a}^{b} f(K) = \sum_{K=a-c}^{b-c} f(K+c)$

2] $\sum_{K=a}^{b} f(K) = \sum_{K=a+c}^{b+c} f(K-c)$

## SET Summation Notation

Let $A = \{1,7,3\}$; $\sum_{K \in A} K^2 = 1^2 + 7^2 + 3^2$

NOTE: useful when the set of K= values arent part of an incrementing series (i.e. 1,2,3...).

## Double Sums

$$\sum_{i=1}^{2} \sum_{K=2}^{3} i \cdot K \underset{\text{linearity}}{=} \sum_{i=1}^{2} i \cdot \sum_{K=2}^{3} K = \boxed{15}$$

## "Popping Terms off the top"

"Popping the 6 off the top"

Consider... $\sum_{K=3}^{6} K^3 = \underset{3}{\underline{3^3}} + \underset{4}{\underline{4^3}} + \underset{5}{\underline{5^3}} + \underset{6}{\underline{6^3}} \Longrightarrow \left(\sum_{K=3}^{5} K^3\right) + 6^3$

NOTE: can also be taken off bottom

## Factorials

$n! = n \cdot (n-1) \cdot (n-2) \cdot \ldots \cdot 3 \cdot 2 \cdot 1$

$7! = 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$