# Today's topics and news

- Topics: Sigmas and sums
- Homework: Watch videos 7.3 and 7.4.

# True or False

$\sum_{k=M}^{N}(a_k + b_k) = a_k + \sum_{k=M}^{N} b_k$. False

$\sum_{k=M}^{N}(a)(b_k) = a\sum_{k=M}^{N} b_k$. True

$\sum_{k=M}^{N} a + b_k = a + \sum_{k=M}^{N} b_k$. False

$\sum_{k=M}^{N}(a_k b_k) = (\sum_{k=M}^{N} a_k)(\sum_{k=M}^{N} b_k)$. False

# Finding the formula for sum of squares

Sigmas aren't always the easiest to work with. For example, if I ask you to find $\sum_{k=1}^{1000} k^2$, you don't really want to perform 999 summation operations in order to find the answer. For certain sums, there are nice alternative expressions which are much more computable. For example:

$\sum_{k=1}^{N} 1 = N.$
$\sum_{k=1}^{N} a = aN.$
$\sum_{k=1}^{N} k = \frac{(N+1)(N)}{2}.$

# Finding the formula for sum of squares

We want to do the same thing for $\sum_{k=1}^{N} k^2$. If I told you the formula, it would be easy for you to prove the formula works by induction. However, we are going to try to figure out the formula.

Consider $\sum_{k=1}^{N}[(k+1)^3 - k^3]$. We are going to write it in two different ways.

1. Think of a simple formula which is equal to the above sum.

2. Independently, write the above sum in another way by doing the obvious simplification inside of the sigma.

3. Equate the expressions you found in 1 and 2. Use algebra to find $\sum_{k=1}^{N} k^2$.

Notice the above method also works for finding sums of higher powers if you choose to look at the appropriate expressions.

# Using the formula

Find $\sum_{j=100}^{1000}(200(j+1)^2+3)$