Need to show $\underbrace{(i_1-avg)^2+(i_2-avg)^2+\ldots+(i_n-avg)^2}=(i_1^2+i_2^2+\ldots+i_n^2)-(n\cdot avg^2)$

$= (i_1-avg)(i_1-avg)+(i_2-avg)(i_2-avg)+\ldots+(i_n-avg)(i_n-avg)$

$= (i_1)^2-2(i_1\cdot avg)+(i_2)^2-2(i_2\cdot avg)+\ldots+(i_n^2)-2(i_n\cdot avg)+(n\cdot avg^2)$

$= i_1^2+i_2^2+i_3^2+\ldots+i_n^2+(n\cdot avg^2)-\underbrace{avg\,(2i_1+2i_2+2i_3+\ldots+2i_n)}$

let's change this
start by declaring

$avg = \dfrac{\sum n \text{ numbers}}{n}$

$n\cdot avg = \sum n \text{ numbers}$

$n\cdot avg^2 = avg\cdot \sum n \text{ numbers}$

$2n\, avg^2 = 2\, avg\cdot \sum n \text{ numbers}$

$2n\cdot(avg)^2 = avg\cdot(2i_1+2i_2+\ldots+2i_n)$

thus $= i_1^2+i_2^2+\ldots+i_n^2+n\,avg^2-2n\,avg^2$

$= (i_1^2+i_2^2+i_3^2+\ldots+i_n^2)-(n\cdot avg^2)$

$\square$