Big O notation

(1 point each, 9 points in total)

1. You can find in Table 2 in Section 2.4 a closed form formula for $1^2 + 2^2 + 3^2 + \cdot\cdot\cdot + n^2$ (i.e. $\sum_{1 \leq k \leq n} k^2$) in terms of *n*. Based on the definition of big-O, do you think $1^2 + 2^2 + 3^2 + \cdot\cdot\cdot + n^2$ is $O(n^2)$. In other words, given $f(n) = \sum_{1 \leq k \leq n} k^2$ and $g(n) = n^3$, do you think *f(n)* is *O(g(n))*? Briefly explain why or why not.

2. Continue with #1 above, do you think $1^2 + 2^2 + 3^2 + \cdot\cdot\cdot + n^2$ is $O(n^3)$?

3. Continue with #1 above, do you think $1^2 + 2^2 + 3^2 + \cdot\cdot\cdot + n^2$ is $O(n^4)$?

4. Based on the definition of big-O, do you think $(8+6n+4n^3)/(2n+1)$ is $O(n^2)$. In other words, given $f(n) = (8+6n+4n^3)/(2n+1)$ and $g(n) = n^2$, do you think *f(n)* is *O(g(n)))*? Briefly explain why or why not.
5. Continue with #4 above, do you think $(8+6n+4n^3)/(2n+1)$ is $O(n^3)$?

6. Continue with #4 above, do you think $(8+6n+4n^3)/(2n+1)$ is $O(n^4)$?

7. Based on the definition of big-O, do you think $0 \cdot 1 + 1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \cdot\cdot\cdot + (n-1) \cdot n$ is $O(n^2)$. In other words, given $f(n) = \sum_{1 \leq i \leq n} (i-1) \cdot i$ and $g(n) = n^3$, do you think *f(n)* is *O(g(n))*? Briefly explain why or why not.
   Note that $f(n) = \sum_{1 \leq k \leq n} (k-1) \cdot k = \sum_{1 \leq k \leq n} k^2 - k = \sum_{1 \leq k \leq n} k^2 - \sum_{1 \leq i \leq n} k$. There are closed form formulas for both $\sum_{1 \leq k \leq n} k^2$ and $\sum_{1 \leq k \leq n} k$. Check chapter 2 about the summation of series.

8. Continue with #4 above, do you think $0 \cdot 1 + 1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \cdot\cdot\cdot + (n-1) \cdot n$ is $O(n^3)$?

9. Continue with #4 above, do you think $0 \cdot 1 + 1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \cdot\cdot\cdot + (n-1) \cdot n$ is $O(n^4)$?