Worksheet 3.2 & 3.3 - The Growth of Functions and Complexity of Algorithms

1. How can big-O notation be used to estimate the sum of the first n positive integers?
2. Show that $3x^2 + 8x\log(x)$ is $\Theta(x^2)$.
3. Is the sum of the first n positive integers $\Theta(n^2)$?
4. Give a big-O estimate for the number of of additions used in this segnment of an algorithm:

   $t := 0$

   for $i := 1$ **to** n

   for $j := 1$ **to** n

   $t := t + i + j$

5. Give a big-O estimate for the number of operations, where an operation is an addition or a multiplication, used in this segment of an algorithm (ignoring comparisons used to test the conditions in the while loop).

   $i := 1$

   $t := 0$

   while $i \leq n$

   $t := t + i$

   $i := 2i$

6. Determine the least number of comparisons, or best-case performance,

   (a) required to find the maximum of a sequence of n integers, using Algorithm 1 of Section 3.1.

   (b) used to locate an element in a list of n terms with a linear search.