**Problem 4**

* According to the definition of big O, a function, f(n) is in O(g(n)) if there exists positive real number c and a real number k such that for all n > k, 0 < f(n) < c∙g(n)

1)

5n3 ϵ O (n3)

This is true because it is apparent that for c ≥ 5, and n ≥ 1

5n3 ≤ c ∙ n3

2)

100n2 ϵ O (n4)

100n2 ≤ c ∙ n4

This is true because a quadratic function is always an upper bound over a constant, so this holds true for any c ≥ 0

3)

log n2 ϵ O (log n)

2log n ϵ O (log n)

2log n ≤ c ∙ log n

2 ≤ c

Hence, this is true because for c ≥ 2 and n ≥ 1

4)

This is true because for c ≥ 3 and n ≥ 1,

5)

This is false because, after applying L’hopital rule we get the results below implying that it is incorrect