Order of Growth Assignment

Big-O

1) $32(n^2) + 17n + 1 <= c * n^2$

$n >= 1$
So…
$n^2 >= n >= 1$
$32n^2 >= 32n >= 32$
$17n^2 >= 17n >= 17$

So…
$32(n^2) + 17n + 1 <= 32(n^2) + 17(n^2) + (n ^ 2)$:
This holds true because everything on right hand side is greater than each corresponding term on the left hand side.

So...
$32(n^2) + 17n + 1 <= 50 (n^2)$ while $n >= 1$

So…
Being that $32(n^2) + 17n + 1$ is bound on top by a constant * n^2, we say it's $O(n^2)$

2) $32(n^2) + 17n + 1 <= c * n$

Pick a counterexample of $n >= 1$:
$32(2^2) + 17(2) + 1 <= 50(2)$
163 is is greater 100

So…
A counterexample has been found, and thus $32(n^2) + 17n + 1$ is not $O(n)$

3) $32(n^2) + 17n + 1 <= c * nlogn$

Pick a counterexample of $n >= 1$:
$32(1^2) + 17(1) + 1 <= 50(log1)$
50 is greater than 0

So…

A counterexample has been found, and thus 32(n^2) + 17n + 1 is not O(nlogn)

Ω

1) 32(n^2) + 17n + 1 >= c * n^2

n >= 1
So…
32(n^2) + 17n + 1 >= 17(n^2) :
This holds true because 32(n^2) is greater than 17(n^2), and because n is always positive here, 32(n^2) is only adding positive terms and therefore is always > 17(n^2)

So...
32(n^2) + 17n + 1 >= 17 (n^2) while n >= 1

So…
Being that 32(n^2) + 17n + 1 is bounded from below by a constant * n^2, we say it's Ω(n^2)

2) 32(n^2) + 17n + 1 >= c * n

n >= 1
So…
32(n^2) + 17n + 1 >= 17n :
This holds true because 17n is >= 17n, and 17n is only adding positive terms and therefore the left hand side is always >= right hand side

So…
32(n^2) + 17n + 1 >= 17n while n >= 1

So…
Being that 32(n^2) + 17n + 1 is bounded from below by a constant * n, we say it's Ω(n)

3) 32(n^2) + 17n + 1 >= c * n^3

Pick a counterexample of n >= 1:
32(3^2) + 17(3) + 1 >= 17(3^3)
340 is less than 459

So…

A counterexample has been found, and thus 32(n^2) + 17n + 1 is not Ω(n^3)

Θ

1) <u>c1 * n^2 <= 32(n^2) + 17n + 1 <= c2 * n^2</u>

Already proved above the following:
32(n^2) + 17n + 1 >= 17(n^2)
32(n^2) + 17n + 1 <= 50(n^2)

So…
17(n^2) <= 32(n^2) + 17n + 1 <= 50(n^2) while n >=1

So…
Being that 32(n^2) + 17n + 1 is bounded from below and above each by a constant * n^2, we say it's Θ(n^2)

2) <u>c1 * n <= 32(n^2) + 17n + 1 <= c2 * n</u>

Pick a counterexample of n >= 1:
17(2) <= 32(2^2) + 17(2) + 1 <= 50(2)
34 is less than 163, but 163 is greater than 100

So…
A counterexample has been found, and thus 32(n^2) + 17n + 1 is not Θ(n)

3) <u>c1 * n^3 <= 32(n^2) + 17n + 1 <= c2 * n^3</u>

Pick a counterexample of n >= 1:
17(3^3) <= 32(3^2) + 17(3) + 1 <= 50(3^3)
459 is greater than 340

So…
A counterexample has been found, and thus 32(n^2) + 17n + 1 is not Θ(n^3)