Asymptotics Introduction

Give the runtime of the following functions in Θ notation. Your answer should be as simple as possible with no unnecessary leading constants or lower order terms.

```java
private void f1(int N) {
    for (int i = 1; i < N; i++) {
        for (int j = 1; j < i; j++) {
            System.out.println("hello tony");
        }
    }
}
```
$\Theta(\_\_\_)$

Solution: $\Theta(N^2)$

Explanation: The inner loop does up to i work each time, and the outer loop increments i each time. Summing over each loop, we get that $1+2+3+4+\ldots+N = \Theta(N^2)$.

```java
private void f2(int N) {
    for (int i = 1; i < N; i *= 2) {
        for (int j = 1; j < i; j++) {
            System.out.println("hello hannah");
        }
    }
}
```
$\Theta(\_\_\_)$

Solution: $\Theta(N)$

Explanation: The inner loop does i work each time, and we double i each time until reaching N. $1+2+4+8+\ldots+N = \Theta(N)$