Q1 [8 marks]
Let \( t(n) = n^2 + \frac{n}{2} \). Show that \( t(n) = \Theta(n^2) \) using
a) Basic definition
b) Theorem
c) Limits

Q2. [8 marks]
For each of the following pair of functions, determine which function grows faster.

a) \( f(n) = \log(n^2 + 1) \) and \( g(n) = \log^2(n + 1) \)

b) \( f(n) = n^2 + 2^n \) and \( g(n) = 3^{n-1} \)

Q3. Consider the following algorithm

\[
\begin{align*}
\{1\} & \quad A \leftarrow 0 \\
\{2\} & \quad B \leftarrow 0 \\
\{3\} & \quad \text{For } i \leftarrow 1 \text{ to } n \text{ do} \\
\{4\} & \quad \quad \text{For } j \leftarrow 1 \text{ to } i \text{ do} \\
\{5\} & \quad \quad \quad A \leftarrow A + j^2 \\
\{6\} & \quad \quad \text{if } (i = j) \text{ then} \\
\{7\} & \quad \quad \quad B \leftarrow B + 1 \\
\{8\} & \quad \quad \text{else } B \leftarrow B \times 2 \\
\end{align*}
\]

end for

a) [2 marks] How many times assignment operation will be executed in the statement \{4\}?
b) [4 marks] How many times testing will be done in the statement \{6\}?
c) [4 marks] How many times addition operation will be executed in the statement \{7\}?
d) [2 marks] In which of the statements \{5\} and \{8\}, the number of multiplications will be larger?
e) [4 marks] Find the order of the multiplications.

Q4. [4 marks] Find the efficiency of the function: \( f(n) = \sum_{i=1}^{n} (n-i)^2 \)