(1) Label each statement below True or False (1 point each)

a. false $3^n = O(2^n)$

b. false $n^2 = O(n \log n)$

c. true $n^2 + 3n + 1 = O(n^3)$

d. false $n \log n = O(\log^2 n)$

e. true $\log \log n = O(\log n)$

f. false $n^3 - 2n - 3 = o(n^3)$

g. false $\log^2 n = o(\log \log n)$

h. true $2^n = o(3^n)$

i. false $\log n = o(\log n)$

j. true $n \log n = o(n^2)$
(2) Define the following:

a. The class P (2 points)
   The class of languages decidable in polynomial time using a deterministic, single-tape Turing machine. (Must use reasonable encoding for storing numbers).

b. The class NP (1 point)
   The class of languages that can be verified in polynomial time. Alternatively, the class of languages that can be decided in polynomial time on a non-deterministic Turing machine.

c. Verifier (1 point)
   A Turing machine that take as input an input string \( w \) and a certificate \( c \). In polynomial time, the verifier uses \( c \) to test if \( w \) is in the language \( L \). The certificate is used to prove \( w \) is in \( L \). If the verifier accepts, then \( w \) is in \( L \). If it rejects, the membership of \( w \) in \( L \) is unknown.

d. Certificate (1 point)
   The extra string provided to a verifier to prove \( w \) is in \( L \).