(14) Kinematics

1) The velocity, \( v \) m/s, of a particle moving in a straight line, \( t \) seconds after leaving a fixed point \( O \) is given by \( v = t^2 + kt + 12 \), where \( k \) is a constant. At \( t = 3 \) s the particle rests momentarily at point \( M \).
   a) Find the other value of \( t \) where the particle is momentarily at rest.
   b) Calculate the average speed of the particle for the first 6 seconds.
   c) Calculate the time at which the particle passes point \( M \) again.

2) A particle moves in a straight line. After time \( t \) seconds, the velocity of the particle (in m/s) is \( v = 16 + 4t - kt^2 \), where \( k \) is a constant.
   a) If the maximum velocity is 20 m/s, find the value of \( k \).
   b) Find the time when the particle is moving at its initial velocity again.

3) Two cyclists, Alvin and Bryan, are moving in the same direction on the same straight track. At a certain point \( O \), Alvin is travelling at a speed of 20 m/s and decelerate uniformly at 4 m/s\(^2 \), overtakes Bryan who is travelling at 4 m/s and accelerating uniformly at 2 m/s\(^2 \).
   a) Find the distance between Alvin and Bryan three seconds after passing \( O \).
   b) Calculate the velocity of Bryan when he overtakes Alvin.