Kinematics Overview (12/6/23)

Q1 [Problem/M]

Given that the velocity of a particle as a function of its displacement is $v(x) = 10e^{-x}$ and that $x = 0$ when $t = 0$, find:

(i) the acceleration as a function of x

(ii) x as a function of t

(iii) v as a function of t

(iv) the acceleration as a function of t

Q2 [10 marks]

(i) Show that $\int a(x)dx = \frac{1}{2}v^2$ (*) [3 marks]

(ii) Given that the acceleration of a particle as a function of its displacement is $a(x) = x + 1$, and that $x = 0$ and $v = 1$ when $t = 0$, find x in terms of t for $x > 0$ [The result (*) can be used.]

[7 marks]

Q3 [Problem/M]

Two cars on a test track travel in adjacent lanes, in the same direction. At a particular point when the cars are level with each other, car A is travelling at $30mph$ whilst car B is travelling at $35mph$. Given that the two cars start braking at this point, and experience the same constant deceleration as each other throughout, at what speed will car B be travelling when car A comes to rest?