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(Total for question 4 is 4 marks)

5 A particle P travels in a straight line from A to D, passing through the points B and C. For the section AB the velocity of the particle is $(0.5t - 0.01t^2)$ m s⁻¹, where t s is the time after leaving A.

- (a) Given that the acceleration of P at B is 0.1 m s⁻², find the time taken for P to travel from A to B.

The acceleration of P from B to C is constant and equal to 0.1 m s⁻².

- (b) Given that P reaches C with speed 14 m s⁻¹, find the time taken for P to travel from B to C.

P travels with constant deceleration 0.3 m s⁻² from C to D. Given that the distance CD is 300 m, find

- (c) The speed with which P reaches D
- (d) The distance AD.

(Total for question 5 is 4 marks)

6 A particle P starts from rest at the point A at time $t = 0$, where t is in seconds, and moves in a straight line with constant acceleration a m s⁻² for 10 s. For $10 \leq t \leq 20$, P continues to move along the line with velocity v m s⁻¹, where

$$v = \frac{800}{t^2} - 2. \text{ Find}$$

- (a) The speed of P when $t = 10$, and the value of a
- (b) The value of t for which the acceleration of P is $-a$ m s⁻²
- (c) The displacement of P from A when $t = 20$.

(Total for question 6 is 4 marks)

- 7 A vehicle is moving in a straight line. The velocity v m s⁻¹ at time t s after the vehicle starts is given by

$$v = A(t - 0.05t^2) \quad \text{for } 0 \leq t \leq 15,$$

$$v = \frac{B}{t^2} \quad \text{for } t \geq 15,$$

where A and B are constants. The distance travelled by the vehicle between $t = 0$ and $t = 15$ is 225 m.

- (a) Find the value of A and show that $B = 3375$.
(b) Find an expression in terms of t for the total distance travelled by the vehicle when $t \geq 15$.
(c) Find the speed of the vehicle when it has travelled a total distance of 315 m.

(Total for question 7 is 4 marks)

- 8 The distance travelled by a cyclist is modelled by

$$s = 4t + 0.5t^2 \text{ in S.I. units}$$

Find expressions for the velocity and the acceleration of the cyclist at time t .

(Total for question 8 is 4 marks)