

## PAST YEARS EXAMINATION QUESTIONS

- 1 A particle moves in a straight line so that,  $t$  seconds after leaving a point  $O$ , its velocity,  $v$  m/s, is given by  $v = 4t^2 - 12t + 5$ . Find
- an expression for the displacement of the particle from  $O$ ,  $t$  seconds after leaving  $O$ ,
  - the values of  $t$  when the particle is at rest,
  - the minimum velocity of the particle,
  - the displacement of the particle from  $O$  when the velocity of the particle is a minimum.

N2002/II/15 (AO Maths)

- 2 A car moves on a straight road. As the driver passes a point  $A$  on the road with a speed of  $20 \text{ ms}^{-1}$ , he notices an accident ahead at a point  $B$ . He immediately applies the brakes and the car moves with an acceleration of  $a \text{ ms}^{-2}$ , where  $a = \frac{3t}{2} - 6$  and  $t$  s is the time after passing  $A$ . When  $t = 4$ , the car passes the accident at  $B$ . The car then moves with a constant acceleration of  $2 \text{ ms}^{-2}$  until the original speed of  $20 \text{ ms}^{-1}$  is regained at a point  $C$ . Find

- the speed of the car at  $B$ , [4]
- the distance  $AB$ , [3]
- the time taken for the car to travel from  $B$  to  $C$ . [2]

Sketch the velocity-time graph for the journey from  $A$  to  $C$ . [2]

N2002/II/11

- 3 A car starts from rest and moves in a straight line. After  $t$  s, its acceleration,  $a \text{ m/s}^2$  is given by  $a = 0.2(18 - t)$ . Find

- the speed of the car when  $t = 30$ ,
- the distance travelled by the car in the first 30 s.

N2003/II/14(a) (AO Maths)

- 4 A particle travels in a straight line so that,  $t$  s after passing a fixed point  $A$ , its speed,  $v \text{ ms}^{-1}$ , is given by  $v = 40(e^{-t} - 0.1)$ .

The particle comes to instantaneous rest at  $B$ . Calculate the distance  $AB$ . [6]

N2003/II/6

- 5 A particle moves in a straight line so that, at time  $t$  s after leaving a fixed point  $O$ , its displacement from  $O$  is  $s$  m and its velocity is  $v$  m/s, where  $v = 3e^t - 40e^{-2t}$ . Find

- the initial velocity of the particle,
- the value of  $t$  when the particle is instantaneously at rest,
- the acceleration of the particle when  $t = \ln 2$ ,
- the value of  $t$  when the acceleration is a minimum,
- an expression for  $s$  in terms of  $t$ .

N2003/II/6 (AO Maths)

- 6 A particle, travelling in a straight line, passes a fixed point  $O$  on the line with a speed of  $0.5 \text{ ms}^{-1}$ . The acceleration,  $a \text{ ms}^{-2}$ , of the particle,  $t$  s after passing  $O$ , is given by  $a = 1.4 - 0.6t$ .

- Show that the particle comes instantaneously to rest when  $t = 5$ . [4]
- Find the total distance travelled by the particle between  $t = 0$  and  $t = 10$ . [6]

N2004/III/12 (EITHER)

- 7 A particle starts from rest at a fixed point  $O$  and moves in a straight line towards a point  $A$ . The velocity,  $v \text{ ms}^{-1}$ , of the particle,  $t$  seconds after leaving  $O$ , is given by  $v = 6 - 6e^{-3t}$ . Given that the particle reaches  $A$  when  $t = \ln 2$ , find

- the acceleration of the particle at  $A$ , [3]
- the distance  $OA$ . [4]

N2005/II/6

- 8 A particle starts from a fixed point  $A$  and travels in a straight line. The velocity,  $v \text{ ms}^{-1}$ , of the particle,  $t$  s after leaving  $A$ , is given by  $v = 1 + t - \sqrt{4t + 9}$ .

- Find the acceleration of the particle when it is at instantaneous rest. [7]
- Obtain an expression, in terms of  $t$ , for the displacement, from  $A$ , of the particle  $t$  s after leaving  $A$ . [5]

N2007/II/12 (EITHER)

- 9 A particle travels in a straight line so that,  $t$  s after passing through a fixed point  $O$ , its acceleration,  $a \text{ ms}^{-2}$ , is given by  $a = -e^{\frac{1}{2}t}$ . The speed of the particle at  $O$  is  $20 \text{ ms}^{-1}$ .

- Obtain an expression for the speed,  $v \text{ ms}^{-1}$ , of the particle  $t$  s after passing through  $O$ . [4]

(ii) Find the value of  $t$  at the point  $P$  where the particle is at instantaneous rest. [2]

(iii) Find the distance  $OP$ . [4]

N2008/II/9 (Syll. 4018)

10 A cyclist starts from rest from a point  $A$  and travels in a straight line until he comes to rest at a point  $B$ . During the motion, his velocity,  $v \text{ ms}^{-1}$ , is given by  $v = 6t - \frac{1}{2}t^2$ , where  $t$  is the time in seconds after leaving  $A$ .

Find

(i) the time taken for the cyclist to travel from  $A$  to  $B$ , [1]

(ii) the distance  $AB$ , [3]

(iii) the acceleration of the cyclist when  $t = 8$ . [2]

N2008/II/6

11 A motorcycle is driven along a straight horizontal road. As it passes a point  $A$  the brakes are applied and the motorcycle slows down, coming to rest at a point  $B$ . For the journey from  $A$  to  $B$ , the distance,  $s$  metres, of the motorcycle from  $A$ ,  $t$  seconds after passing  $A$ , is given by

$$s = 400 \left( 1 - e^{-\frac{t}{10}} \right) - 16t.$$

(i) Find an expression, in terms of  $t$ , for the velocity of the motorcycle during the journey from  $A$  to  $B$ . [2]

(ii) Find an expression, in terms of  $t$ , for the acceleration of the motorcycle during the journey from  $A$  to  $B$ . [2]

(iii) Find the velocity of the motorcycle at  $A$ . [1]

(iv) Show that the time taken for the journey from  $A$  to  $B$  is approximately 9.163 seconds. [2]

(v) Find the average speed of the motorcycle for the journey from  $A$  to  $B$ . [3]

N2009/II/8