

### Exercise

1. The acceleration  $a$  of a particle following rectilinear translation is defined as  $a = -k\sqrt{v}$  where  $k$  is constant. Knowing that  $x=0$ ,  $v=25$  m/s at  $t=0$ , and that  $v=12$  m/s when  $x=6$  m. Determine
  - (a) The velocity of particle when  $x=8$  m and
  - (b) The time required for the particle to come to rest.
2. The acceleration of a particle at any point is expressed by the relation  $a = 200x(1 + kx^2)$ , where  $a$  and  $x$  are expressed in  $\text{m/s}^2$  and  $\text{m}$  respectively.  $k$  is a constant. If the velocity of the particle at A is  $v_A=2.5$  m/s when  $x=0.15$  m. Find the value of  $k$ .
3. The velocity of a particle having motion in the  $x$ - $y$  plane at time  $t=3.5$  s is  $4.12\mathbf{i} + 3.17\mathbf{j}$  m/s. The average acceleration during next  $0.05$  s becomes  $2\mathbf{i}+2.5\mathbf{j}$   $\text{m/s}^2$ . Determine the velocity at  $t=3.55$  s and angle  $\alpha$  made by average acceleration and velocity vector at  $t=3.55$  s.
4. The velocity  $v$  of a particle with respect to time  $t$  is as shown in figure-1. Draw the  $a$ - $t$  and  $x$ - $t$  graphs for the particle during the period  $0 < x < 40$ , if  $x=-14.6$  m at  $t=0$ . Also determine (a) the maximum value of its position, (b) the values of  $t$  for which  $x=32.6$  m, (c) the total distance travelled by the particle during the period  $t=0$  to  $t=30$  and (d) the two values of  $t$  for which the particle passes through the origin.

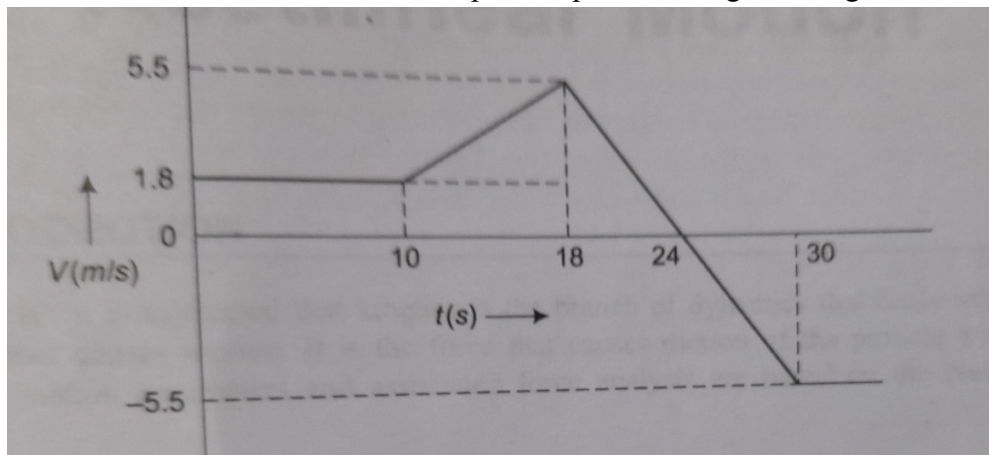


Figure-1

5. A particle moves along a straight line. Its motion is represented by the equation  $s=16t+4t^2-3t^3$  where  $s$  in terms of  $\text{m}$  and  $t$  is in seconds. Determine the followings
  - (a) Displacement, velocity and acceleration 2 seconds after start.
  - (b) Displacement and acceleration when velocity is zero; and
  - (c) Displacement and velocity when acceleration is zero.
6. The acceleration of a particle starting from rest is given by the equation:  $a=12-0.1s$ ; where  $a$  is the acceleration in  $\text{m/s}^2$  and  $s$  is the displacement in  $\text{m}$ . Determine the velocity of the particle when a distance of  $100$  m is covered and the distance at which velocity will be zero again.