1. Four pairs of initial and final positions of a body along an x axis are given. Which pair gives a positive displacment of the body?
   (a) – 10m, + 15 m   (b) – 5 m, – 12 m
   (c) 2m, – 5 m   (d) 2m, 1m
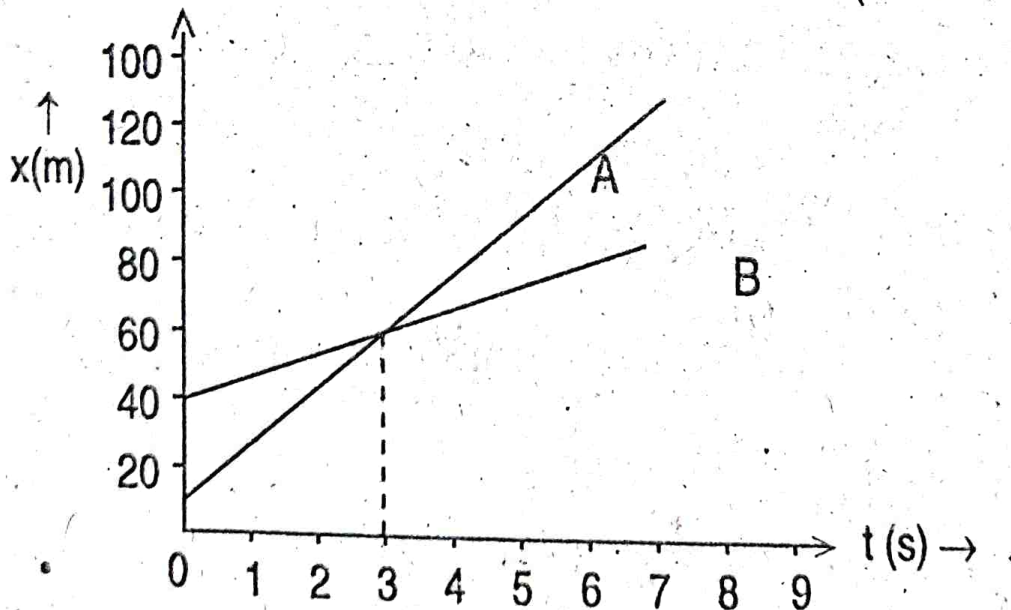
Ans: (a)

2. Position (x) – time (t) graphs of two objects A and B are shown below. At what time the objects meet?

Ans: 3 sec.

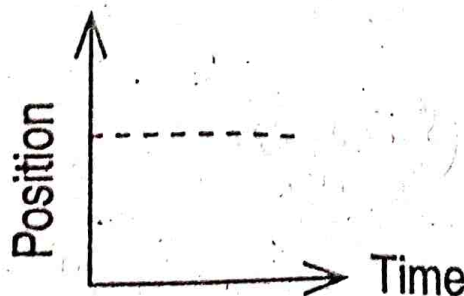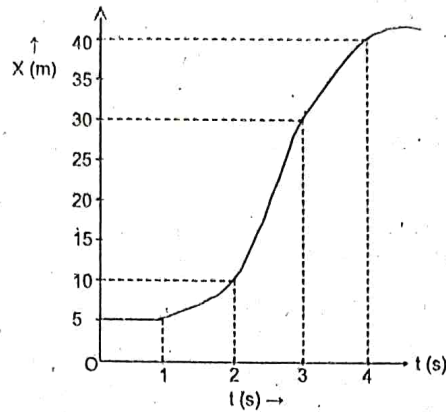3. Draw the position - time graph of a stationary object.

4. Position - time graph of a body is given.

(a) Estimate the velocity during the time interval $t = 2s$ to $t = 3s$.

(b) Displacement of an object is proportional to t^3. Show that its acceleration is increasing with time.

(Model 2015)

(a) Velocity during the time interval

$t = 2s$ to $t = 3s$

$$\frac{dx}{dt} = \frac{x_2 - x_1}{t_2 - t_1} = \frac{30 - 10}{3 - 2} = 20 \text{m/s}$$

(b) Displacement $x \propto t^3$ or $x = kt^3$

Velocity of the body $v = \dfrac{dx}{dt} = \dfrac{d}{dt}(kt^3) = 3kt^2$

Acceleration $= a = \dfrac{dv}{dt} = \dfrac{d}{dt}(3kt^2) = 3k \times 2 \times t = 6kt$

Here 6 and k are constants

$\therefore$ acceleration $a \propto t$ or as 't' increases 'a' increases.

5. Velocity is defined as the rate of change of displacement.

(a) Distinguish between average velocity and instantaneous velocity.

(b) When does the average velocity become equal to the instantaneous velocity?

(c) A car travels from A to B at 60 km/hr and returns to A at 90 km/hr. What is its average velocity and average speed? *(SAY 2014)*

(a) Average velocity is the ratio of total displacement to total time taken. Instantaneous velocity is velocity of the particle at any instant of time.

(b) Uniform velocity

(c) Average velocity = zero

$$\text{Average speed} = \frac{2v_1 v_2}{v_1 + v_2} = \frac{2 \times 60 \times 90}{60 + 90} = 72 \text{ km/hr.}$$