Q- A lift starts ascending with a constant acceleration of $4m/s^2$, then with a constant velocity v and finally stops under a constant retardation of $4m/s^2$. If the total height ascended is 40 m and the total time taken is 7 s then what is the time during which the lift moves with constant velocity and what is the constant velocity v?

Let the time during which the lift accelerates is t seconds.

As the acceleration is 4 m/s^2, the constant velocity [v = u + at]

$v = 0 + 4*t = 4t$

And the distance covered during acceleration will be given by [$s = ut + ½ at^2$]

$x_1 = 0 + ½*4*t^2 = 2t^2$

As the deceleration is same as acceleration the time and distance covered will be same for stopping as well and thus the time for which lift moves with constant velocity will be (7 -2t)s

The distance covered during motion with constant velocity will be

X_2 = velocity*time = 4t*(7 – 2t)

Thus the total distance covered will be

$x_1 + x_2 + x_3 = 40$

Or $2t^2 + 4t*(7 – 2t) + 2t^2 = 40$

Or $28t – 4t^2 = 40$

Or $t^2 – 7t + 10 = 0$

Gives t = 2 s or t = 5s

The time for acceleration cannot be 5 second otherwise total time will be more than 7 s, thus the possible value for t is 2s only.

Thus the time for which the lift moves with constant velocity is 7-4 = **3s**

And the constant velocity is 4t = **8 m/s**.