An object is approaching a thin convex lens of focal length 0.3m with a speed of 0.01m/s.The magnitude of the rate of change of position of image when the object is at a distance of 0.4m from the lens is

A   0.09 m/sec

B   0.01 m/sec

C   0.04 m/sec

D   0.02 m/sec

Solution

Correct option is A)

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \quad .....\{1\}$$

$f = 0.3$

at given point of time given u = −0.4

$$\therefore \frac{1}{v} = \frac{1}{0.3} - \frac{1}{0.4} = \frac{1}{1.2}$$

v = 1.2

differentiating 1 with respect to time

$$\frac{-1}{v^2} \times \frac{dv}{dt} + \frac{1}{u^2} \times \frac{du}{dt} = 0....2$$

given $\frac{du}{dt} = 0.01 \frac{m}{s}$

putting the values of u, v, $\frac{du}{dt}$ in equation 2

$$\frac{dv}{dt} = 0.09 \frac{m}{s}$$