A particle of mass m is moving in a straight line with momentum p. Starting at time $t = 0$, a force $F = kt$ acts in the same direction on the moving particle during time interval T, so that its momentum changes from p to $3p$. Here, k is a constant. The value of T is **(JEE Main 2019, 11 Jan Shift II)**

(a) $\sqrt{\frac{2p}{k}}$ (b) $2\sqrt{\frac{p}{k}}$ (c) $\sqrt{\frac{2k}{p}}$ (d) $2\sqrt{\frac{k}{p}}$

Sol

$$F(t) = \frac{d\,P(t)}{dt}$$

$$\int d\,P(t) = \int F(t)\,dt$$

$$P(t)\Big|_0^T = \int_0^T K t\,dt$$

$$(3P - P) = \frac{K t^2}{2}\Big|_0^T$$

$$2P = \frac{K T^2}{2}$$

$$T = \sqrt{\frac{4P}{K}}$$

$$T = 2\sqrt{\frac{P}{K}}$$

B option