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 :

(1) $2\sqrt{\dfrac{k}{p}}$

(2) $2\sqrt{\dfrac{p}{k}}$

(3) $\sqrt{\dfrac{2p}{k}}$

(4) $\sqrt{\dfrac{2k}{p}}$

1

Correct option (2)

Explanation:

$$\frac{dp}{dt} = f = kt$$

$$\int_{p}^{3p} dp = \int_{0}^{T} kt\, dt$$

$$2p = \frac{kT^2}{2}$$

$$T = 2\sqrt{\frac{p}{k}}$$