

Mathematics Questions by Topic

Motion and Force

Answer 35

Source: K10SM2Q17

Question 35

A body of mass m kg moves in a straight line. When its displacement is x m from the origin, its velocity is v ms⁻¹ at a time t seconds. The force acting on the body is $mf(x)$ newtons. Given that $v = v_0$ when $x = x_0$ and $v = v_1$ when $x = x_1$, it follows that

A. $\frac{1}{2}mv_1^2 - \frac{1}{2}mv_0^2 = m[f(x_1) - f(x_0)]$

B. $\frac{1}{2}mv_1^2 - \frac{1}{2}mv_0^2 = m \int_{x_0}^{x_1} f(x) dx$

C. $v_1 - v_0 = [f(x_1) - f(x_0)]$

D. $v_1 - v_0 = \int_{x_0}^{x_1} f(x) dx$

E. $v_1 = \sqrt{v_0^2 + m \int_{x_0}^{x_1} f(x) dx}$

ANSWER B

$$m\ddot{x} = mf(x)$$

$$m \frac{d}{dx} \left(\frac{1}{2} v^2 \right) = mf(x)$$

$$m \left[\frac{1}{2} v^2 \right]_{v_0}^{v_1} = m \int_{x_0}^{x_1} f(x) dx$$

$$\frac{1}{2}mv_1^2 - \frac{1}{2}mv_0^2 = m \int_{x_0}^{x_1} f(x) dx$$