Question

When a rubber-band is stretched by a distance x, it exerts a restoring force of magnitude $F = ax + bx^2$ where a and b are constants. The work done in stretching the unstretched rubber band by L is

A $\frac{aL^2}{2} + \frac{bL^3}{3}$

B $\frac{1}{2}\left(\frac{aL^2}{2} + \frac{bL^3}{3}\right)$

C $aL^2 + bL^3$

D $\frac{1}{2}(aL^2 + bL^3)$

Solution

Correct option is A)

$F = ax + bx^2$

$dw = F\,dx$

$$W = \int_0^L (ax + bx^2)dx$$

$$W = \frac{aL^2}{2} + \frac{bL^3}{3}$$