Chapter 6   Problem 75 [†]

Given

$$F = \begin{cases} 100x^2 & 0 \le x < 1 \\ 100(4x - x^2 - 2) & 1 \le x \le 2 \end{cases}$$

Solution

a) Find the work done between $x = 0\ m$ and $x = 1.0\ m$.

Using the definition of work we get

$$W = \int F dx = \int_0^1 100x^2 dx$$

$$W = \frac{100x^3}{3}\Big|_0^1 = 33.3\ J$$

b) Find the work done between $x = 1.0\ m$ and $2.0\ m$.

Using the definition of work we get

$$W = \int F dx = \int_1^2 100(4x - x^2 - 2) dx$$

$$W = 100\left(\frac{4x^2}{2} - \frac{x^3}{3} - 2x\right)\Big|_1^2$$

$$W = 100\left(\frac{4(2)^2}{2} - \frac{(2)^3}{3} - 2(2)\right) - 100\left(\frac{4(1)^2}{2} - \frac{(1)^3}{3} - 2(1)\right)$$

$$W = 167\ J$$