

Chapter 7Problem 40

$$F(x) = k_1 x + k_2 x^3 \quad k_1 = 204 \text{ N/m}$$

$$k_2 = -0.233 \text{ N/m}^3$$

How much work must be done
to stretch the bungee cord, $x_f = 16.7 \text{ m}$

Since the force is changing with stretch, the
force is constantly changing.
∴ to find work we must take the integral!

$$W = \int_{0}^{x_f} F_x \cdot dx = \int_{0}^{16.7 \text{ m}} (k_1 x + k_2 x^3) dx$$

$$= \int_{0}^{x_f} (k_1 x + k_2 x^3) dx = \left. \frac{k_1 x^2}{2} + \frac{k_2 x^4}{4} \right|_0^{x_f}$$

$$W = \frac{k_1 x_f^2}{2} + \frac{k_2 x_f^4}{4} = \frac{(204 \frac{\text{N}}{\text{m}})(16.7 \text{ m})^2}{2} + \frac{(-0.233 \frac{\text{N}}{\text{m}^3})(16.7 \text{ m})^4}{4}$$

$$= 28,450 - 4530$$

$$= 23,920 \text{ J}$$

to 3 sig. figs.

$$W = 23,900 \text{ J}$$