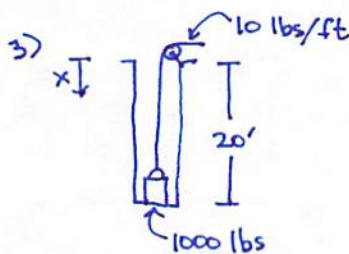


Homework 25 Solutions

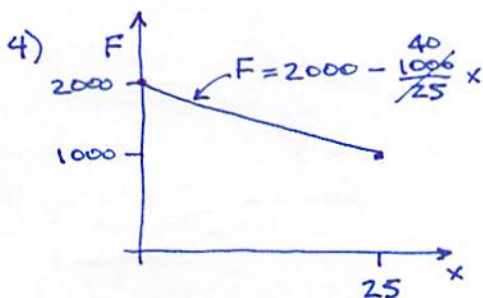
1) $F = kx \Rightarrow 5 \text{ N} = k \cdot 0.01 \text{ m} \Rightarrow k = 5/0.01 = 500 \text{ N/m}$

$$W = \int_{0.01}^{0.03} 500x \, dx = 500 \left[\frac{x^2}{2} \right]_{0.01}^{0.03} = 250 [0.03^2 - 0.01^2] = 0.2 \text{ J}$$

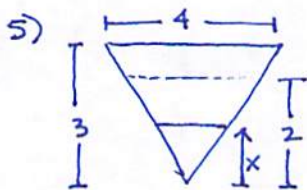
2) $F(x) = 18x^3 \Rightarrow W = \int_0^4 18x^3 \, dx = 18 \left[\frac{x^4}{4} \right]_0^4 = \frac{9}{2} [4^4 - 0^4] = 1152 \text{ N} \cdot \text{cm}$



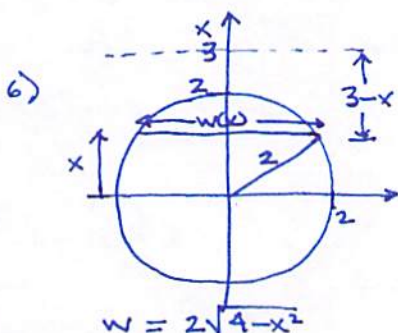
$$F = 1000 + 10x \Rightarrow W = \int_0^{20} 1000 + 10x \, dx = 1000x + 5x^2 \Big|_0^{20} = [(20000 + 5 \cdot 20^2) - 0] = 22,000 \text{ ft} \cdot \text{lbs}$$



$$W = \int_0^{25} (2000 - 40x) \, dx = 2000x - 20x^2 \Big|_0^{25} = [(2000 \cdot 25 - 20 \cdot 25^2) - 0] = 37,500 \text{ ft} \cdot \text{lbs}$$



$$W = \int F \cdot d = \int_0^2 \overbrace{9810}^{P_w} \cdot \overbrace{\frac{w}{3}x}^w \cdot \overbrace{6}^d \cdot \overbrace{dx}^d \cdot (3-x) = 78480 \int_0^2 (3x - x^2) \, dx = 261,600 \text{ J}$$



$$\begin{aligned} W &= \int_{-2}^2 50 \cdot 2\sqrt{4-x^2} \cdot 10 \cdot dx \cdot (3-x) \\ &= 3000 \int_{-2}^2 \sqrt{4-x^2} \, dx - 1000 \int_{-2}^2 x\sqrt{4-x^2} \, dx \\ &= 3000 \frac{\pi \cdot 2^2}{2} - 0 \quad \leftarrow \text{let } u = 4-x^2 \text{ then limits are both 0 so } \int u \, du = 0. \\ &= 6000\pi \text{ ft} \cdot \text{lb} \end{aligned}$$