Math 118 – Homework #12 SOLUTION (4 points)

CiC, p. 306-7, #7, p. 307-8 #10

CiC, p. 306-7, # 7.

a. Total energy consumption is (1000 watts · 2 hours) + (1500 watts · 3 hours) + (500 watts · 9 hours) = 11000 watt-hours = 11 kw-hrs.

b.

$$E(T) = \begin{cases} 0 & T < 0 \\ 1000T & 0 \le T < 2 \\ 1500(T-2) + 2000 & 3 \le T < 5 \\ 500(T-5) + 6500 & 5 \le T < 14 \\ 11000 & 14 \le T \end{cases}$$

c. The average power demand is $11/14 = 0.786$ kw-hrs. If the heater were set at 0.786 kw for 14 hours, the energy consumption would be equal to that in part (a.).

CiC, p. 307-8, # 10.

a. If x is the distance that the anchor has been lifted, then the combined weight W of the chain and anchor is $W(x) = 2000 + 40\cdot$ (length of chain) $= 2000 + 40(30 - x) = 3200 - 40x$.

b. For the first 10 feet, the weight at the bottom of that section is $W(0) = 3200$ pounds. So the work estimate on this section is $3200 \times 10 = 32{,}000$ ft-lbs.

For the second 10 feet, the weight at the bottom of that section is $W(10) = 2800$ pounds. So the work estimate on this section is $2800 \times 10 = 28{,}000$ ft-lbs.

For the third 10 feet, the weight at the bottom of that section is $W(20) = 2400$ pounds. So the work estimate on this section is $2400 \times 10 = 24{,}000$ ft-lbs.

The total work estimate is the sum of these three estimates: 84,000 ft-lbs.

c. The total work estimate is the sum of the work estimates on each of the thirty one-foot intervals. On each interval, we have

$$\text{work} = \text{weight} \times \text{distance} = W(x) \cdot 1 = 3200 - 40x.$$

So

$$\text{total work} = \sum_{x=0}^{29} 3200 - 40x = 78{,}600 \text{ ft-lbs.}$$

This is a more accurate estimate of the work done because we adjust the weight more often in this calculation which better fits with the continuous change of weight.