AP Calculus HW 2/3/15 Solutions

17a) $\int_0^{20} 62.4(120)(20-y)\,dy = 1{,}497{,}600 \text{ ft-lb}$

17b) $\dfrac{1{,}497{,}600 \text{ ft-lb}}{250 \text{ ft-lb/sec}} = 5{,}990.4 \text{ sec} \approx 100 \text{ min}$

17c)

$25 \text{ min} = 1500 \text{ sec} \qquad 250 \text{ ft-lb/sec}(1500 \text{ sec}) = 375{,}000 \text{ft-lb}$

$\int_{10}^{20} 62.4(120)(20-y)\,dy = 374{,}400 \text{ ft-lb of work needed}$

17d)

$\int_0^{20} 62.26(120)(20-y)\,dy = 1{,}494{,}240 \text{ ft-lb}$

$\dfrac{1{,}494{,}240 \text{ ft-lb}}{250 \text{ ft-lb/sec}} = 5{,}976.96 \text{ sec} \approx 100 \text{ min}$

$\int_0^{20} 62.5(120)(20-y)\,dy = 1{,}500{,}000 \text{ ft-lb}$

$\dfrac{1{,}500{,}000 \text{ ft-lb}}{250 \text{ ft-lb/sec}} = 6000 \text{ sec} = 100 \text{ min}$

18) $\int_0^{30} 51.2\left(\pi 10^2\right)(30-y)\,dy \approx 7{,}238{,}229 \text{ ft-lb}$

19) Filling from the top: $62.4\left(\pi\left(2^2\right)(6)\right)(21) = 98{,}801.8 \text{ ft-lb}$

Filling to the valve: $62.4\left(\pi\left(2^2\right)(6)\right)(15) + \int_0^6 62.4(4\pi)(y)\,dy \approx 84{,}687.3 \text{ ft-lb}$

22) $\int_0^8 \dfrac{64.5\pi}{4}(10-y)\,y^2\,dy \approx 34{,}582.652 \text{ ft-lb}$

25a) $\int_0^{11/6} 62.4(2)\left(\dfrac{11}{6}-y\right)dy \approx 209.733 \text{ lb}$

25b) 2x4 bottom: $\int_0^{11/6} 62.4(4)\left(\dfrac{11}{6}-y\right)dy \approx 419.467 \text{ lb}$

2x2 bottom: $\int_0^{11/3} 62.4(2)\left(\dfrac{11}{3}-y\right)dy \approx 838.933 \text{ lb}$ The force doubles.