

2016 BC 1

Water is pumped into a tank at a rate modeled by $W(t) = 2000e^{-t^2/20}$ liters per hour for $0 \leq t \leq 8$, where t is measured in hours. Water is removed from the tank at a rate modeled by $R(t)$ liters per hour, where R is differentiable and decreasing on $0 \leq t \leq 8$. Selected values of $R(t)$ are shown in the table below. At time $t = 0$, there are 50,000 liters of water in the tank.

t (hours)	0	1	3	6	8
$R(t)$ (liters / hour)	1340	1190	950	740	700

- a) Estimate $R'(2)$. Show the work that leads to your answer. Indicate units of measure.
- b) Use a left Riemann sum with four subintervals indicated by the table to estimate the total amount of water removed during the 8-hour time interval $0 \leq t \leq 8$. Is this an overestimate or underestimate of the total amount of water removed. Give a reason for your answer.
- c) Use your answer in part (b) to find an estimate of the total amount of water in the tank, to the nearest liter at the end of 8 hours.
- d) For $0 \leq t \leq 8$ is there a time, t , when the rate at which water is pumped into the tank is the same as the rate at which the water is removed from the tank. Explain why or why not?