(2) Homework p 223 #2

↙ volume not velocity

$$V(t) = 4000\left(1 - \frac{t}{60}\right)^2$$

a) $V(0) = 4000\left(1 - \frac{0}{60}\right)^2$

$V(0) = 4000(1)^2$

$V(0) = 4000$

$V(20) = 4000\left(1 - \frac{20}{60}\right)^2$

$V(20) = 4000\left(\frac{2}{3}\right)^2$

$V(20) = \frac{16000}{9} \approx 1780$ (3sf)

b) Average rate of change in volume $= \frac{\text{change in volume}}{\text{time}}$

$= \frac{V(20) - V(0)}{20 - 0}$

"use un-rounded from" →

$= \frac{1777.78 - 4000}{20}$

$\approx \boxed{-111 \text{ (3sf)}}$

c) Instantaneous → derivative

$V'(t) = 4000(2)\left(1 - \frac{t}{60}\right)^1 \cdot \left(-\frac{1}{60}\right)$

$V'(t) = -\frac{8000}{60}\left(1 - \frac{t}{60}\right)$

$V'(t) = -\frac{400}{3}\left(1 - \frac{t}{60}\right)$

$V'(t) = -\frac{400}{3} + \frac{20}{9}t$

$V'(20) = -\frac{400}{3} + \frac{20}{9}(20)$

$V'(20) = -\frac{800}{9} \approx \boxed{-88.9 \text{ (3sf)}}$

d) If the amount of water in the tank is never increasing then the derivative must be negative in that time-frame.

$V'(t) = -\frac{400}{3} + \frac{20}{9}t$