



BC.Q404.REVIEW ASSESSMENTS

(Part 2)

RATE IN / RATE OUT

(20 points)

CALCULATORS PERMITTED

[Decimal Answers – Round to Three Decimal Places]

NAME:

DATE:

BLOCK:

I (*print name*) _____ certify that I wrote **all** marks made in this assessment. I did not write **anything** that I do not fully understand. I would now, having completed this assessment, be able to make similar (but equally accurate) responses if asked complete the same exact assessment on my own.

Signature:

1. A 20-gallon kiddie pool has 15 gallons of water at 8:00 am ($t = 0$ hours). A hole in the pool makes the water drain at the rate of $f(t) = 13 \cdot \ln(t + 2)$ gallons per hour.

At 8:00 am, a dad puts a hose into the pool which adds water at the rate

$$r(t) = \begin{cases} e^{-0.05t}; & 0 \leq t \leq 0.5 \\ 25; & t > 0.5 \end{cases} \text{ gallons per hour.}$$

A. Find $f(0.25)$ and $f'(0.25)$. Include the units of measure for each.

B. How much water drained from the pool between 8:00am and 8:30am?

C. How much water is in the pool at 8:30am?

D. Write an equation for the amount of water in the pool at any time t between 8:00am and 8:30am.

E. In the amount of water in the kiddie pool increasing or decreasing at 8:15am ($t = 0.25$)? Justify.

F. In the amount of water in the kiddie pool increasing or decreasing at 9:15am ($t = 1.25$)? Justify.

G. How much water was added to the pool between 8:00am and 9:00am?

H. How much water is in the pool at 9:00am?

I. Set up, but do not solve, an equation used to find the answer to the following question:
If the water hose is not removed from the pool, then when will it begin to overflow?

2. An oil tank contains 200 cubic meters of oil at $t = 0$. Oil is pumped into the tank at a rate $E(t) = 2 + \sin(t) \cdot \tan^{-1}(t)$ m^3 per hour and leaves at the rate $L(t) = \frac{t}{4} + 0.5$ m^3 per hour.

A. What is the average rate of change in the amount of oil in the tank for $0 \leq t \leq 8$ hours? Include units of measure.

B. What is the absolute maximum and absolute minimum amount of oil in the tank on the time interval $0 \leq t \leq 8$ hours? Show the analysis that leads to your conclusion.

3. A tank initially holds 400 cubic feet of water.

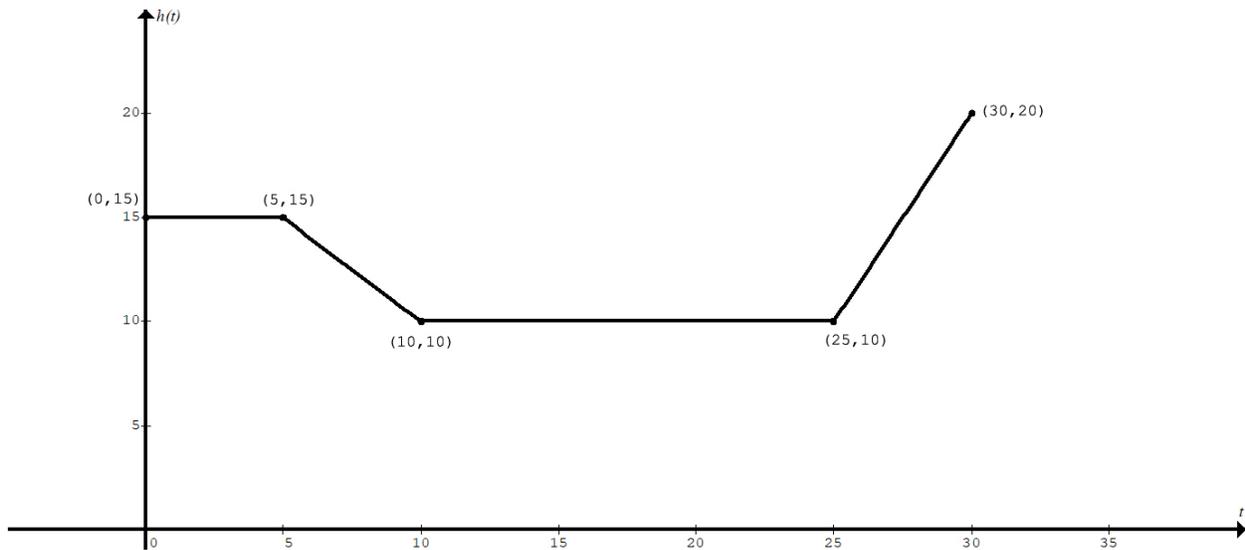
Water enters a tank at the rate $g(t)$ cubic feet per hour for $0 \leq t \leq 30$ hours.

Select values of $g(t)$ are shown in the table below.

t	0	5	10	15	20	25	30
$g(t)$	21	15	16	14	25	35	12

Water drains from the tank at the rate $h(t)$ cubic feet per hour for $0 \leq t \leq 30$ hours.

The graph of $y = h(t)$ is made up of line segments and is shown in the graph below.



A. Approximate the total amount of water that enters the tank between 0 and 30 hours using a **trapezoidal** sum with six equal intervals. Simplify.

B. How much water left the tank over the first 30 hours?

C. Using the estimate in part A, find the amount of water in the tank at time $t = 30$ hours.

D. Is water volume increasing or decreasing at time $t = 10$ hours? Justify.

E. Estimate the value of $g'(27)$ and find the value of $h'(27)$. Include units of measure for each.

F. Using the correct units, find and interpret the value of $\frac{1}{30} \int_0^{30} h(t) dt$ in the context of the problem.

G. Using the correct units, find and interpret the value of $\frac{1}{30} \int_0^{30} g'(t) dt$ in the context of the problem.