Water Tank FRQ Rubric: (Calc Active)

(a) $h'(6) \approx \dfrac{h(7) - h(5)}{7 - 5} = \dfrac{18.5 - 15.5}{2} = 1.5$ in/min

1 : answer with units

(b) $\int_0^{10} h(t)\,dt \approx (2-0)\cdot h(2) + (5-2)\cdot h(5) + (7-5)\cdot h(7) + (10-7)\cdot h(10)$

$= 2(10.0) + 3(15.5) + 2(18.5) + 3(20.0) = 163.5$

Because h is an increasing function, the right Riemann sum approximation is greater than $\int_0^{10} h(t)\,dt$.

3 :
- 1 : right Riemann sum
- 1 : approximation
- 1 : overestimate with reason

(c) Average depth in tank $B = \dfrac{1}{10}\int_0^{10} g(t)\,dt = 16.624$ in

Average depth in tank $A = \dfrac{1}{10}\int_0^{10} h(t)\,dt < \dfrac{1}{10}(163.5) = 16.35 \text{ in} < 16.624$ in

Therefore, the average depth of the water in tank B is greater than the average depth of the water in tank A.

3 :
- 1 : integral
- 1 : average depth in tank B
- 1 : answer with reason

(d) $g'(6) = 0.887$

The depth of the water in tank B is increasing at time $t = 6$ because $g'(6) > 0$.

2 :
- 1 : uses $g'(6)$
- 1 : answer with reason

Amusement Park Ride FRQ Rubric: (Calc Inactive)

(a) $\int_0^3 r(t)\,dt = 2\cdot\frac{1000+1200}{2} + \frac{1200+800}{2} = 3200$ people

$2 : \begin{cases} 1 : \text{integral} \\ 1 : \text{answer} \end{cases}$

(b) The number of people waiting in line is increasing because people move onto the ride at a rate of 800 people per hour and for $2 < t < 3$, $r(t) > 800$.

1 : answer with reason

(c) $r(t) = 800$ only at $t = 3$
For $0 \le t < 3$, $r(t) > 800$. For $3 < t \le 8$, $r(t) < 800$.
Therefore, the line is longest at time $t = 3$.
There are $700 + 3200 - 800\cdot 3 = 1500$ people waiting in line at time $t = 3$.

$3 : \begin{cases} 1 : \text{identifies } t = 3 \\ 1 : \text{number of people in line} \\ 1 : \text{justification} \end{cases}$

(d) $0 = 700 + \int_0^t r(s)\,ds - 800t$

$3 : \begin{cases} 1 : 800t \\ 1 : \text{integral} \\ 1 : \text{answer} \end{cases}$