Water Tank FRQ Rubric: (Calc Active)

(a) \[ h'(6) \approx \frac{h(7) - h(5)}{7 - 5} = \frac{18.5 - 15.5}{2} = 1.5 \text{ in/min} \]

(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 \( \int_0^{10} h(t) \, dt \).

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

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

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

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

The depth of the water in tank \( B \) is increasing at time \( t = 6 \) because \( g'(6) > 0 \).
Amusement Park Ride FRQ Rubric: (Calc Inactive)

(a) \[ \int_0^3 r(t) \, dt = 2 \left( \frac{1000 + 1200}{2} + \frac{1200 + 800}{2} \right) = 3200 \text{ people} \]

2 : \{ 1 : integral \\
1 : answer \}

(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 \(0 \leq t < 3\), \(r(t) > 800\). For \(3 < t \leq 8\), \(r(t) < 800\).
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 : \{ 1 : identifies \(t = 3\) \\
1 : number of people in line \\
1 : justification \}

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

3 : \{ 1 : 800t \\
1 : integral \\
1 : answer \}