8.3 Applying Accumulation and Integrals

CA #1

Calculus Name: ______________________________

1. Mr. Sullivan can paint his tricycles at a rate of $r(t) = 50 - \frac{t}{2}$ square inches per minute, where t is the number of minutes since he started painting.
   a. Find $\int_0^5 r(t)\,dt$

   b. Explain the meaning of your answer to part *a* in the context of this problem.

2. A storm has washed away sand from a beach, causing the edge of the water to get closer to a nearby road. The rate at which the distance between the road and the edge of the water was changing during the storm is modeled by $r(t) = e^{-\cos t}$ feet per hour, t hours after the storm began. The edge of the water was 80 feet from the road when the storm began. If the storm lasted 5 hours, how far is the water from the road after the storm?

3. A store is having a 10-hour sale. The rate at which shoppers enter the store t hours after the sale begins is modeled by the function $E(t)$, which is measured as shoppers per hour. When the sale starts, there are already 30 shoppers in the store. Write, but do not solve, an equation involving an integral to find the time x when the amount of shoppers in the store is 150.

4.

t (minutes)	0	10	20	30	40	50	60
$W(t)$ (°F)	57	63	72	85	90	98	102

The temperature of water in Mr. Brust's hot tub at time t is modeled by a strictly increasing, twice-differentiable function W, where $W(t)$ is measured in degrees Fahrenheit and t is measured in minutes. The water is heated for 60 minutes, beginning at time $t = 0$. Values of $W(t)$ at selected times t are given in the table above.

a. Use the data in the table to evaluate $\int_{10}^{30} W'(t)\,dt$.

b. Using correct units, interpret the meaning of $\int_{10}^{30} W'(t)\,dt$ in the context of this problem.

5.

t (seconds)	0	2	3	7	8	10
$W'(t)$ (ounces per second)	0	4.2	8.3	10.7	13.5	14.1

On a cold winter morning, hot water is pouring into a large container for hot chocolate. The rate $W'(t)$ at which the water is being poured in the container at time t, $0 \leq t \leq 10$, is shown at selected values in the table above. The cup already had 10 ounces of cold water before pouring the hot water in.

a. Using correct units, interpret the meaning of $\int_0^3 W'(t)\,dt$ in the context of this problem.

b. Use a left Riemann sum, with the five subintervals indicated by the data in the table, to approximate $\int_0^{10} W'(t)\,dt$. Use appropriate units.

c. Using your answer from part (b), how much water is in the container after 10 seconds?

6. The rate at which Mr. Kelly eats hot dogs is given by $h(t)$, where h is measured in hot dogs per minute and t is measured in minutes since the start of lunch time. Using correct units, explain the meaning of $\int_0^3 h(t)\,dt$.

Answers to 8.3 CA #1

1a. $\frac{975}{4} = 243.75$ 1b. 243.75 square inches are painted during the first 5 minutes.	2. $80 - \int_0^5 r(t)\,dt = 72.668$ feet	3. $30 + \int_0^x E(t)\,dt = 150$
4a. 22 °F 4b. The temperature of the water has increased by 22 °F from the 10th minute to the 30th minute since the hot tub was turned on.	5a. How much water has been poured into the container during the first three seconds. 5b. 75.1 ounces 5c. 85.1 ounces	6. The number of hot dogs Mr. Kelly eats during the first three minutes of lunch.