AP Calculus AB

8.1 Day 2

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1. A cylindrical can of radius 10 millimeters is used to measure rainfall in Stormville. The can is initially empty, and rain enters the can during a 60-day period. The height of water in the can is modeled by the function S, where $S(t)$ is measured in millimeters and t is measured in days for $0 \le t \le 60$. The rate at which the height of the water is rising in the can is given by $S'(t) = 2\sin(0.03t) + 1.5$.

(a) According to the model, what is the height of the water in the can at the end of the 60-day period?

$S(0)=0$

$$S(60) = \int_0^{60} S'(t)\,dt \approx \boxed{171.813\text{ mm}}$$

2. At a certain height, a tree trunk has a circular cross section. The radius $R(t)$ of that cross section grows at a rate modeled by the function

$$\frac{dR}{dt} = \frac{1}{16}\left(3 + \sin\left(t^2\right)\right) \text{ centimeters per year} \quad = R'(t)$$

for $0 \le t \le 3$, where time t is measured in years. At time $t = 0$, the radius is 6 centimeters. The area of the cross section at time t is denoted by $A(t)$. $R(0)=6$

(a) Write an expression, involving an integral, for the radius $R(t)$ for $0 \le t \le 3$. Use your expression to find $R(3)$.

$$\int_0^3 R'(t)\,dt = R(3) - R(0)$$

$$R(3) = R(0) + \int_0^3 R'(t)\,dt$$

$$\approx 6 + .611$$

$$\approx \boxed{6.611\text{ cm}}$$

3. A storm 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 $\boxed{f(t) = \sqrt{t} + \cos t - 3 \text{ meters per hour,}}$ t hours after the storm began. The edge of the water was 35 meters from the road when the storm began, and the storm lasted 5 hours. The derivative of $f(t)$ is $f'(t) = \frac{1}{2\sqrt{t}} - \sin t$. $F(0)=35$

not needed

(a) What was the distance between the road and the edge of the water at the end of the storm?

$$\int_0^5 f(t)\,dt = F(5) - F(0)$$

$$F(5) = F(0) + \int_0^5 f(t)\,dt \approx 35 + (-8.505) \approx \boxed{26.495\text{ meters}}$$