AP Cola Problem Key

The rate of consumption of cola in the United States is given by $S(t) = Ce^{kt}$, where S is measured in billions of gallons per year and t is measured in years from the beginning of 1980.

a) The consumption rate doubles every 5 years and the consumption rate at the beginning of 1980 was 6 billion gallons per year. Find C and k.

$Amount = Ce^{kt}$ $\quad 12 = 6e^{k5}$ $\quad 2 = e^{k5}$ $\quad k = \frac{\ln 2}{5} = 0.138$ or 0.139 **(1 point)**

$C = 6$ **(1 point)**

b) Find the average rate of consumption of cola over the 10-year time period beginning January 1, 1983. Indicate units of measure.

$$\frac{1}{10}\int_3^{13} S(t)\,dt = 19.680 \text{ billion gallons/year}$$ **(3 points)**

c) Use the trapezoidal rule with four equal subdivisions to estimate $\int_5^7 S(t)dt$.

$$\frac{1/2}{2}\left[S(5) + 2S(5.5) + 2S(6) + 2S(6.5) + S(7)\right] = 27.668 \text{ billion gallons}$$ **(2 points)**

d) Using correct units, explain the meaning of $\int_5^7 S(t)dt$ in terms of cola consumption.

The total number of gallons, in billions, of cola consumed in the United States from 1985 to 1987. **(2 points)**