AP CALCULUS
2007AB5 NAME: PERIOD:
9 POINTS (2,3,2,1 and 1 for units in (b) and (c))

You *MAY NOT* use your calculators.

t (minutes)	0	2	5	7	11	12
$r'(t)$ (feet per minute)	5.7	4.0	2.0	1.2	0.6	0.5

The volume of a spherical hot air balloon expands as the air inside the balloon is heated. The radius of the balloon, in feet, is modeled by a twice-differentiable function r of time t, where t is measured in minutes. For $0 < t < 12$, the graph of r is concave down. The table above gives selected values of the rate of change, $r'(t)$, of the radius of the balloon over the time interval $0 \le t \le 12$. The radius of the balloon is 30 feet when $t = 5$. (Note: The volume of a sphere of radius r is given by $V = \frac{4}{3}\pi r^3$.)

(a) Estimate the radius of the balloon when $t = 5.4$ using the tangent line approximation at $t = 5$. Is your estimate greater tan or less than the true value? Give a reason for your answer.

(b) Find the rate of change of the volume of the balloon with respect to time when $t = 5$. Indicate units of measure.

(c) Use a right Riemann sum with five subintervals indicated by the data in the table to approximate $\int_0^{12} r'(t)\ \mathrm{d}t$. Using correct units, explain the meaning of $\int_0^{12} r'(t)\ \mathrm{d}t$ in terms of the radius of the balloon.

(d) Is your approximation in part (c) greater of less than $\int_0^{12} r'(t)\ \mathrm{d}t$? Give a reason for your answer.