2007 AB5/BC5

A. $r(5)=30$ and $r'(5)=2$ so the tangent line at $t = 5$ is $y=2(t-5)+30$.

$y(5.4) = 2(5.4-5)+30$ or 30.8. Since r is concave down, $r''(x) < 0$ for all x so the tangent line approximation is greater than the real value.

B.

$$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$$

$$\left.\frac{dV}{dt}\right|_{t=5} = 4\pi(r(5))^2 \bullet 2$$

$$= 4\pi(30)^2 \bullet 2$$

$$7200\pi \text{ cu. ft/min}$$

C.

$$\int_0^{12} r'(t)dt \approx (2)(4) + 3(2) + 2(1.2) + 4(.6) + 1(.5)$$

$$\approx 19.3 \textit{ feet}$$

$\int_0^{12} r'(t)dt$ is the change in the radius in feet during the time period 0 to 12 minutes.

D. Since the graph of r is concave down this means that r' is decreasing. Therefore the approximation in part C is an underestimate of the change in the radius.