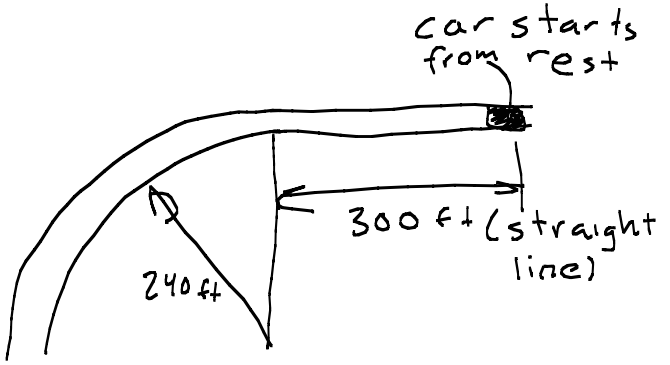
Problem 3

Given: $\dot{v} = 0.05t^2$

Determine: The magnitude of the velocity and the acceleration when $s = 550$ ft



If $s = 550$ ft, then the car is on the curved path

$$\dot{v} = 0.05t^2 = \frac{a_t}{t} = \frac{dv}{dt}$$

$$\int_0^v dv = \int_0^t 0.05t^2 dt$$

$$v = 0.0167t^3 \qquad v = \frac{ds}{dt}$$

$$\frac{ds}{dt} = 0.0167t^3$$

$$\int_0^s ds = \int_0^t 0.0167t^3 dt$$

$$s = (4.167\times10^{-3})t^4$$

when $s = 550\text{ ft}$ $\Rightarrow$ $\boxed{t = 19.06\text{ sec}}$

From before $v = 0.0167t^3$

$$v|_{550\text{ft}} = 0.0167(19.06\text{ sec})^3$$

$$\boxed{v = 115\text{ ft/sec}}$$

$$a_t = 0.05t^2$$

$$= (0.05)(19.06)^2 = \boxed{18.16\text{ ft/sec}^2}$$

$$a_n = \frac{v^2|_{s=550\text{ft}}}{\rho} = \frac{(115\text{ ft/sec})^2}{240\text{ ft}} = \boxed{55.48\text{ ft/sec}^2}$$

$$a = \sqrt{(18.16)^2 + (55.48)^2} = \boxed{58.4\text{ ft/sec}^2}$$