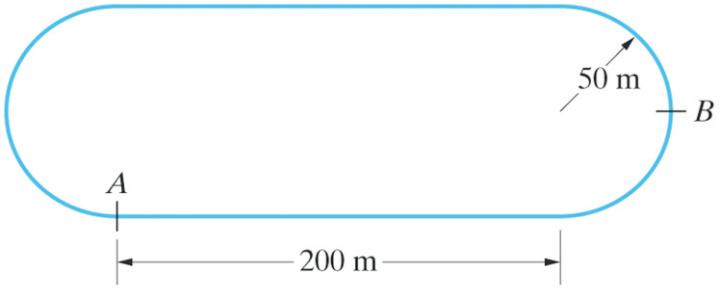
Name

Date

**Week:** _____ **Problem:** _____

## Given:

After subjecting the car design described in Problem 13.116 to wind tunnel testing, the students estimate that the tangential component of the car's acceleration will be $a_t = 0.6 - 0.002v^2$ m/s$^2$, where $v$ is the car's velocity in m/s. If the car starts from rest at $A$, what are its velocity and acceleration in terms of normal and tangential components when it reaches $B$?




## Required:

## Solution:

**Solution:** At point $B$ $s_B = \left(200 + \frac{50\pi}{2}\right)$ m

$$a_t = v\frac{dv}{ds} = 0.6 - 0.002v^2 \Rightarrow \int_0^{v_B} \frac{v\,dv}{0.6 - 0.002v^2} = \int_0^{s_B} ds$$

$$v_B = 14.20 \text{ m/s}, \quad a_{Bn} = \frac{v_B^2}{50 \text{ m}} = 4.03 \text{ m/s}^2$$

$$a_t = 0.6 - 0.002(14.20 \text{ m/s})^2 = 0.197 \text{ m/s}^2$$

Thus

$$\mathbf{v}_B = (14.20\mathbf{e}_t) \text{ m/s}$$
$$\mathbf{a}_B = (0.197\mathbf{e}_t + 4.03\mathbf{e}_n) \text{ m/s}^2$$