Discussion Instructor: Abbott, Allen, Brumbaugh, Bruno, (DeSisto)
Ho, Koster, Mabud, Sedaghati, Stone, Younger
Graded by: John DeSisto
cfr. 307-C South Physics.

PROBLEM 3A

The speed of a racing car is increased at a constant rate from 90 km/h to 126 km/h over a distance of 150 m along a curve of 250 m radius. Determine the magnitude of the total acceleration of the car after it has traveled 100 m along the curve.

\[ V_0 = 90 \text{ km/h} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{1 \text{ hr}}{3600 \text{ s}} = 25.0 \text{ m/s} \]

\[ V_f = 35.0 \text{ m/s} \]

\[
\begin{align*}
V_f^2 - V_0^2 &= 2a_{\parallel} (x - x_0) \\
a_{\parallel} &= \frac{V_f^2 - V_0^2}{2L} \\
a_{\parallel} &= \frac{(35)^2 - (25)^2}{2(150)} = 2.00 \text{ m/s}^2 \\
&= 2.59 \times 10^4 \text{ km/hr}^2
\end{align*}
\]

\[
\begin{align*}
a_{\perp} &= a_{\perp} \sin \theta \\
a_{\perp} &= \frac{V^2}{r} \\
V^2 - V_0^2 &= 2a_{\perp} l \\
V &= \sqrt{(2a_{\perp} + V_0^2)^{1/2}} \\
V &= \sqrt{(2(2.00)(100) + (25)^2)^{1/2}} \\
V &= 32.0 \text{ m/s} \\
&= 115 \text{ km/hr.}
\end{align*}
\]

\[
\begin{align*}
|a_{\text{total}}| &= \sqrt{(a_{\parallel})^2 + (a_{\perp})^2} \\
&= \sqrt{(4.10)^2 + (2.00)^2} \\
|a_{\text{total}}| &= 4.6 \text{ m/s}^2 = 5.9 \times 10^4 \text{ km/hr}^2
\end{align*}
\]

7 pts. breakdown: Units 1 pt.

sig figs: 5 pts.

method 5 pts.