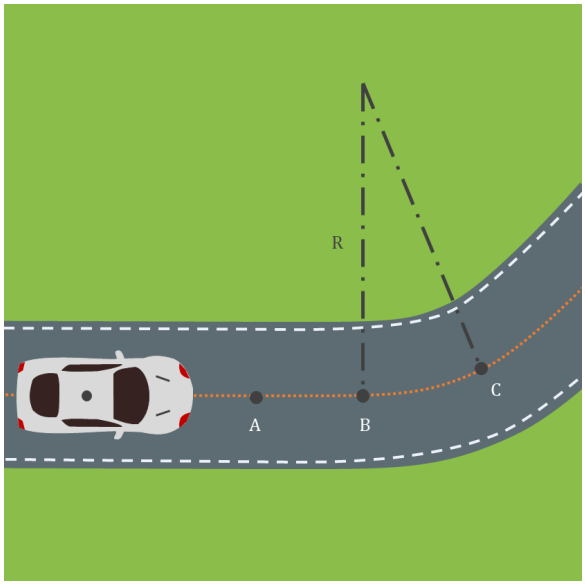
Car Brakes for Corner



A car traveling at a speed of v_A applies his brakes at point A and reduces his speed at a uniform rate to v_C at point C in a distance s_{AC}. Which of the following equations gives a relation for the tangential acceleration of the car between point A and C?

Using known expressions:

$$a = \frac{\mathrm{d}v}{\mathrm{d}t} \quad \Rightarrow \quad \mathrm{d}t = \frac{\mathrm{d}v}{a} \tag{1}$$

$$v = \frac{\mathrm{d}s}{\mathrm{d}t} \quad \Rightarrow \quad \mathrm{d}t = \frac{\mathrm{d}s}{v} \tag{2}$$

Combining both expressions results in:

$$\frac{\mathrm{d}v}{a} = \frac{\mathrm{d}s}{v} \tag{3}$$

$$a\mathrm{d}s = v\mathrm{d}v \tag{4}$$

Finding expressions for $a\mathrm{d}s$ and $v\mathrm{d}v$ gives:

$$a\mathrm{d}s = a\int_0^{s_{AC}} \mathrm{d}s = a \cdot (s_{AC} - 0) = a \cdot s_{AC} \tag{5}$$

$$v\mathrm{d}v = \frac{1}{2}({v_C}^2 - {v_A}^2) \tag{6}$$

Combining Equations 5 and 6 gives:

$$a \cdot s = \frac{1}{2}({v_C}^2 - {v_A}^2) \quad \Rightarrow \quad a = \frac{{v_C}^2 - {v_A}^2}{2 \cdot s_{AC}} \tag{7}$$