Answer on Question#40189 – Physics – Mechanics

Figure 2 A new car is tested on a 150 m radius track. If the car speeds up at an acceleration of 1.5 m/s2, how long after starting is the magnitude of its centripetal acceleration equal to the tangential acceleration?

Solution:

Tangential acceleration of the car is equal to

$$a_t = 1.5\frac{m}{s^2}$$

Formula for the centripetal acceleration:

$$a_c = \frac{V^2}{R}$$

Centripetal acceleration = tangential acceleration:

$$\frac{V^2}{R} = a_t$$

$$V^2 = a_t \cdot R$$

$$V = \sqrt{a_t \cdot R} \quad (1)$$

Rate equation for the car:

$$V = a_t t \Longrightarrow$$

$$t = \frac{V}{a_t} \quad (2)$$

$$(1)\text{in}(2):$$

$$t = \frac{\sqrt{a_t \cdot R}}{a_t} = \sqrt{\frac{R}{a_t}} = \sqrt{\frac{150m}{1.5\frac{m}{s^2}}} = 10s$$

Answer: magnitude of its centripetal acceleration will be equal to the tangential acceleration after $10s$ starting.