Q 02 A cyclist is riding with a speed of 27 kmh^{-1}. As he approaches a circular turn on the road of radius 80 m, he applies brakes and reduces his speed at the constant rate of 0.5 ms^{-2}. What is the magnitude and direction of the net acceleration of the cyclist on the circular turn?

Sol. Here, v = 27 kmh^{-1} = $27 \times (1000\text{m}) \times (60 \times 60\text{s})^{-1}$ = 7.5 ms^{-1}, r = 80 m

Centripetal acceleration, $a_c = \frac{v^2}{r} = \frac{(7.5)^2}{80} = 0.7 ms^{-2}$

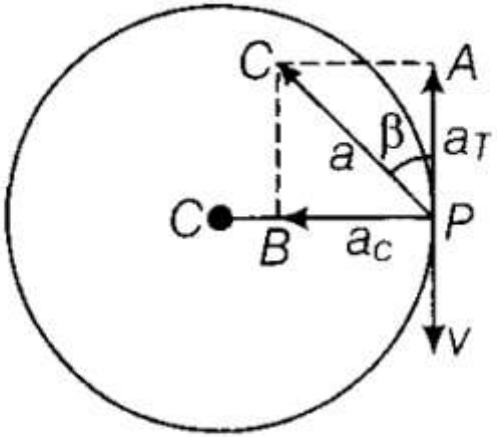
Let the cyclist applies the brakes at the point P of the circular turn, then tangential acceleration a_T will act opposite to velocity. Acceleration along the tangent,

a_T = 0.5 ms^{-2}

Angle between both the accelerations is 90°

Therefore, the magnitude of resultant acceleration,

a = $\sqrt{a_c^2 + a_T^2} = \sqrt{(0.7)^2 + (0.5)^2}$ = 0.86 ms^{-2}



Let the resultant acceleration make an angle β with the tangent i.e, the direction of net acceleration of the cyclist, then

$\tan\beta = \frac{a_c}{a_T} = \frac{0.7}{0.5}$ = 1.4 or $\beta = 54°28'$