QUIZ 3 – PHYSICS 271 – SOLUTION

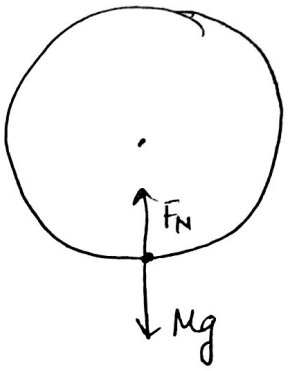
Q) A test pilot is flying an aircraft at a constant speed of 170 m/s in a vertical circle of radius 300 m. If the mass of the pilot is 80 kg , find the force that the seat exerts on the pilot

$v = 170\ m/s$, $r = 300\ m$, $m = 80kg$

a) When the aircraft is at the bottom of the circle

$ma = F_{net}$ ⟶ Newton's 2nd Law

Here, $a = \frac{v^2}{r}$ (Pointing towards the center of the circle)



$\Rightarrow \frac{mv^2}{r} = F_{net}$

$\Rightarrow \frac{mv^2}{r} = F_N - Mg$

$\Rightarrow F_N = \frac{mv^2}{r} + mg = \frac{80 \times 170^2}{300} + 80 \times 9.8 \simeq 8490.8\ N$

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b) When it is upside down, at the highest point of the circle.

$\frac{mv^2}{r} = F_N + Mg$

$\Rightarrow F_N = \frac{mv^2}{r} - mg$

$\approx 6922.6\ N$