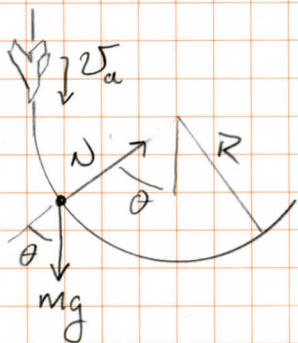


TMS 2-5 A JET FIGHTER CAN WITHSTAND 9g. HE IS FLYING DOWN AT MACH 3 AND INTENDS TO PULL UP IN A CIRCULAR PATH.

- a) WHERE DOES THE PILOT SENSE THE MAX ACCEL?
 b) WHAT'S THE RADIUS OF THE MINIMUM CIRCLE?



a) THE PILOT SENSES N AS ACCELERATION

$$\sum F_r = ma_r$$

$$N - mg \cos \theta = m \frac{v^2}{R}$$

$$\Rightarrow N = m \left(\frac{v^2}{R} + g \cos \theta \right)$$

$$\Rightarrow N \text{ IS MAXIMUM AT } \theta = 0$$

\Rightarrow BOTTOM OF THE CIRCLE

b) FOR MAXIMUM CIRCLE N AT $\theta = 0$ IS $9mg$

$$N - mg = m \frac{v^2}{r} \quad (\theta = 0)$$

$$9mg - mg = m \frac{v^2}{R}$$

$$8g = \frac{v^2}{R}$$

$$\text{MACH 1} = 343 \text{ m/s} \Rightarrow \text{MACH 3} = 1,029 \frac{\text{m}}{\text{s}}$$

$$\Rightarrow R = \frac{v^2}{8g} = \frac{(1021)^2}{8(9.8)}$$

$$R = 13,505 \text{ m} = 13.5 \text{ km}$$

(TO GET TMS'S ANSWER USE $v_{\text{SOUND}} = 330 \frac{\text{m}}{\text{s}}$)