(Q) Show that in Sch. metric, there are circular light like orbits at $r = 3r_g/2$

Ans The geodesic for massless particles is:-

$$\frac{d^2u}{d\phi^2} + u = \frac{3r_g}{2}u^2 \quad ; u = \frac{1}{r} \rightarrow (1)$$

For a constant r ; $\frac{du}{d\phi} = 0$.

$\Rightarrow$ (1) reduces to

$$u = \frac{3r_g}{2}u^2 \Rightarrow u = 0 \text{ or } u = \frac{2}{3r_g}.$$

$u = 0 \Rightarrow r \to \infty$ & $u = \frac{2}{3r_g} \Rightarrow r = \frac{3r_g}{2}$

So, for a circular orbit,

$$r = \frac{3r_g}{2}$$