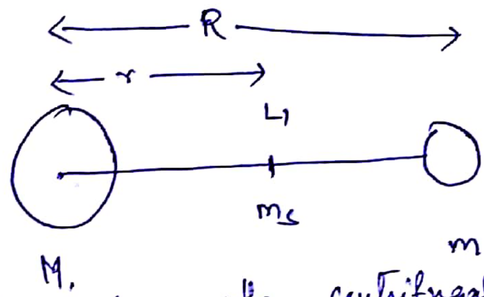
Ans 9) Lagrange's point :



We are assuming ~~the~~ $M >> m$.

and circular orbit.

Now the gravitational force must balance the centrifugal force

$$\therefore \frac{GMm_s}{r^2} - \frac{Gmm_s}{(R-r)^2} = \frac{m_s v_s^2}{r} \quad \text{— (1)}$$

where 'v_s' is the orbital speed of satellite.

$$\Rightarrow \frac{GM}{r^2} - \frac{Gm}{(R-r)^2} = \frac{v_s^2}{r} \quad \text{— (ii)}$$

0.01

Now the ang. velocity of moon must be same as that of the satellite to be always at ~~the same~~ the same line.

$$\omega = \frac{v_s}{r} = \frac{V}{R}$$ where 'V' is the orbital speed of moon.

$$v_s^2 = \frac{V^2 r^2}{R^2} = \frac{GMr^2}{R^3} \quad \text{— (iii)}$$

Using (iii) in (ii) we get

$$\boxed{\cancel{\frac{M}{r^2} = \frac{m}{(R-r)^2} + \frac{Mr}{R^3}}} \Rightarrow \boxed{\frac{M}{r^2} = \frac{m}{(R-r)^2} + \frac{Mr}{R^3}}$$

This gives the eqn for the distance r from the centre of earth to L_1 point.