Location of Synchronous Orbit.

\[ F_c = F_g \]

\[ m a w^2 = \frac{GMU}{a^2} \]  
**circular orbit**

\[ w^2 = \frac{2\pi}{P_{\text{orbit}}} \]

For the Synchronous Orbit

\[ P_{\text{orbit}} = P_{\text{rotation}} \]

and

\[ w = \frac{2\pi}{P_{\text{rotation}}} \]

Now solve for \( a \) where this is true.

\[ a \left( \frac{(2\pi)^2}{P_{\text{rot}}^2} \right) = \frac{GM}{a^2} \]

\[ a^3 = \frac{GM P_{\text{rot}}^2}{(2\pi)^2} \]

\[ a = \left( \frac{GM P_{\text{rot}}^2}{(2\pi)^2} \right)^{1/3} \]