Answer on question #54974, Physics / Astronomy — Astrophysics

Question Neptune's moon Nereid has an orbital period of almost exactly one Earth year. If the mass of Neptune is around 1026 kilograms, what is the semimajor axis of Nereid's orbit?

Solution Period T is related to semi-major axis a as

$$T^2 = \frac{4\pi^2}{GM}a^3$$

where M is Neptune mass. Hence we can find semi-major axis

$$a = \sqrt[3]{\frac{T^2GM}{4\pi^2}} = \sqrt[3]{\frac{(31.6 \cdot 10^6)^2 \cdot 6.67 \cdot 10^{-11} \cdot 10^{26}}{4\pi^2}} \approx 5.53{\cdot}10^9\, m = 5.53{\cdot}10^6\, km$$