

The orbital period of a large mass near an asteroid is observed to be 21 days. If the radius of orbit is estimated to be 7102 km, determine the mass of the ~~star~~ asteroid.

$$T = \frac{2\pi}{\sqrt{GM}} r^{3/2}$$

$$\sqrt{GM} = \frac{2\pi}{T} r^{3/2}$$

$$M = \frac{\left(\frac{2\pi}{T} r^{3/2}\right)^2}{G} = \frac{4\pi^2 r^3}{T^2 G}$$

$$= \frac{4\pi^2 (7102 \times 10^3 \text{ m})}{(1.81 \times 10^6 \text{ s})^2 (6.67 \times 10^{-11} \frac{\text{Nm}^2}{\text{kg}^2})}$$

$$= \boxed{9.11 \times 10^{12} \text{ kg}}$$