1

For circular orbit

$$V_{cir}^2 = \frac{\mu}{r}$$

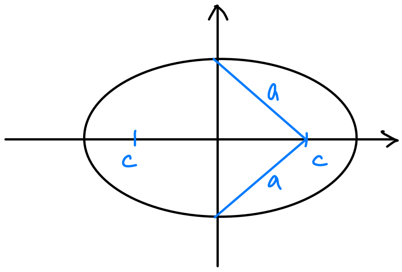
For elliptical orbit

$$V_{elli}^2 = \mu\left(\frac{2}{r} - \frac{1}{a}\right)$$

$$V_{cir}^2 = V_{elli}^2$$

$$\Rightarrow \frac{\cancel{\mu}}{r} = \cancel{\mu}\left(\frac{2}{r} - \frac{1}{a}\right) \Rightarrow 2 - \frac{r}{a} = 1 \Rightarrow \frac{r}{a} = 1$$

$\Rightarrow r = a$ (line between the point pass through the minor axis and forcus) #



2.

From Kepler's third law

$$\frac{r^3}{T^2} = \frac{GM_{sun}}{4\pi^2}$$

$$\Rightarrow M_{sun} = \frac{4\pi^2 r^3}{GT^2}$$

$T = 365$ days $= 3.1536 \times 10^7$ sec

$r = 1.469 \times 10^{11}$

$G = 6.67 \times 10^{-11}$

$$= 1.8866 \times 10^{30}\ kg$$ #

#3.

From Kepler's third law.

$$\frac{r^3}{T^2} = \frac{\mu}{4\pi^2} \Rightarrow T^2 = \frac{4\pi^2 r^3}{\mu}$$

$$= \frac{4\pi^2 \times \left(1.05^{\frac{2}{3}}\right)^3 [ER^3]}{0.00553 \ [ER^3/min^2]}$$

$$= 7870.6972 \ min^2$$

$$\Rightarrow T = 88.7169 \ min$$

For 16 minutes,

$$\Delta\theta = 2\pi \times \frac{16}{88.7169} = 1.10935 \ rad \approx 64.93^\circ \neq 60^\circ$$

$\therefore$ NOT a circular orbit #

#5.

$$\frac{r^3}{T^2} = \frac{\mu}{(2\pi)^2} \Rightarrow \frac{\mu}{r^3} = \left(\frac{2\pi}{T}\right)^2 \Rightarrow \sqrt{\frac{\mu}{r^3}} = \frac{2\pi}{T}$$

$$M = \frac{2\pi}{T} t = E - e\sin E$$

$$\tan\frac{\theta}{2} = \sqrt{\frac{1+e}{1-e}} \tan\frac{E}{2} \Rightarrow \tan\frac{\pi}{4} = \sqrt{\frac{1.5}{0.5}} \tan\frac{E}{2}$$

$$\Rightarrow E = 1.0472 \ rad$$

$$\Rightarrow \frac{2\pi}{270} t = 1.0472 - 0.5\sin 1.0472$$

$$\Rightarrow t = 26.3727 \ min$$ #