

38. (a) The mass of the portion of the galaxy within the radius  $r$  from its center is given by  $M' = (r/R)^3 M$ . Thus, from  $GM'm/r^2 = mv^2/r$  (where  $m$  is the mass of the star) we get

$$v = \sqrt{\frac{GM'}{r}} = \sqrt{\frac{GM}{r} \left(\frac{r}{R}\right)^3} = r\sqrt{\frac{GM}{R^3}} .$$

- (b) In the case where  $M' = M$ , we have

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