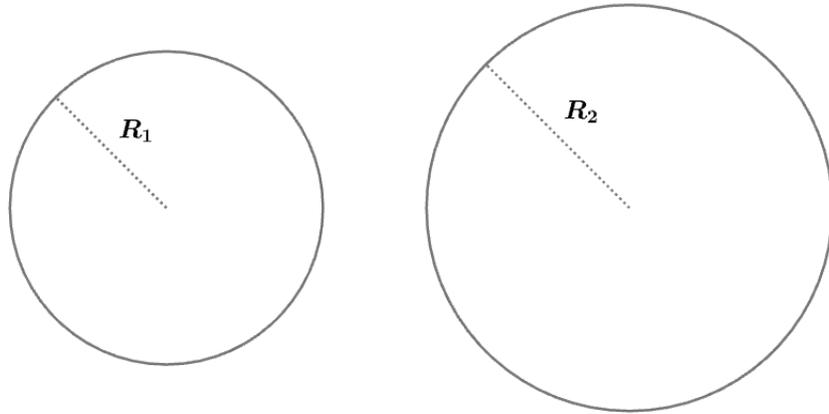# 2008 F=ma Exam: Problem 23

Kevin S. Huang

- (a) Recall the escape velocity is given by

$$v_{\text{esc}} = \sqrt{\frac{2GM}{R}} \propto \sqrt{\frac{R^3}{R}} = R$$

which would depend on radius.

- (b) Recall the acceleration due to gravity is given by

$$g = \frac{GM}{R^2} \propto \frac{R^3}{R^2} = R$$

which would depend on radius.

- (c) Recall from Kepler's 3rd law

$$T \propto \sqrt{\frac{r^3}{M}}$$

For $r = R$,

$$T \propto \sqrt{\frac{R^3}{R^3}} = 1$$

which is independent of radius.

- (d) Recall from Kepler's 3rd law

$$T \propto \sqrt{\frac{r^3}{M}} \propto \frac{1}{\sqrt{R^3}}$$

which would depend on radius.

- (e) Not applicable.

Thus, the answer is $\boxed{\text{C}}$.