2013 F=ma Exam: Problem 13

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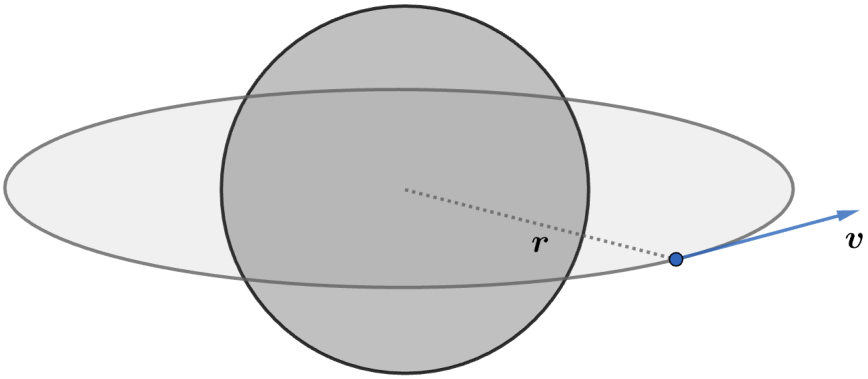

If the ring is part of Saturn, then it rotates together with the planet i.e. has the same angular velocity ω. From angular kinematics,

$$\omega = \frac{v}{r}$$
$$v \propto r$$

If the ring is a satellite of Saturn, then it moves at the velocity of a circular orbit which is

$$v = \sqrt{\frac{GM}{r}}$$
$$v^2 \propto \frac{1}{r}$$

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