2014 F=ma Exam: Problem 20

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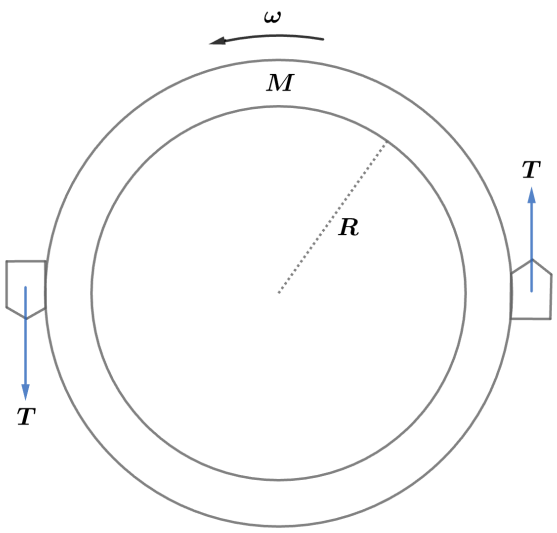

Setting the centripetal acceleration equal to g, we have

$$a_c = \omega^2 R = g$$

so the space station needs to be rotating at angular velocity

$$\omega = \sqrt{\frac{g}{R}}$$

By Newton's 2nd law,

$$\tau = 2TR = I\alpha$$

Since we have a ring, $I = MR^2$ so

$$2TR = MR^2\alpha$$
$$\alpha = \frac{2T}{MR}$$

From kinematics,

$$\omega = \alpha t$$

The rockets need to fired for time

$$t = \frac{\omega}{\alpha} = \frac{MR}{2T}\sqrt{\frac{g}{R}} = \frac{M}{2T}\sqrt{gR}$$

so the answer is $\boxed{\text{B}}$.