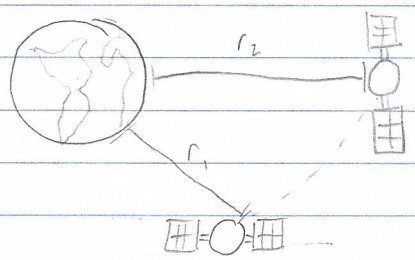
20-P-MOM-DY-30

A satellite orbiting the earth wants to increase the radius of its orbital path. To do this, the satellite powers on its engines for a period of $t = 10s$. As a result, the orbital radius increases from $r_1 = 400km$ to $r_2 = 550$ km. Determine the average force that the engine applies to the satellite. The radius of the earth is 6371 km. $m = 1000kg$. The angular velocity of the satellite is maintained. $v_1 = 7$ km/s



Solution: $H_1 + \int_{t_1}^{t_2} M_o dt = H_2$

$$r_1 m v_1 + M_o t \Big|_0^{10} = r_2 m v_2 \qquad M_o = F(r_2 - r_1)$$

$$r_1 m v_1 + F(r_2 - r_1)(10) = r_2 m v_2$$

$$F = \frac{r_2 m v_2 - r m v_1}{(10)(r_2 - r_1)} = \frac{r_2^2 m\omega - r^2 m\omega}{(10)(r_2 - r_1)} \qquad \omega = \frac{v}{r} = 0.001$$

$$F = 1.42 \text{ MN}$$