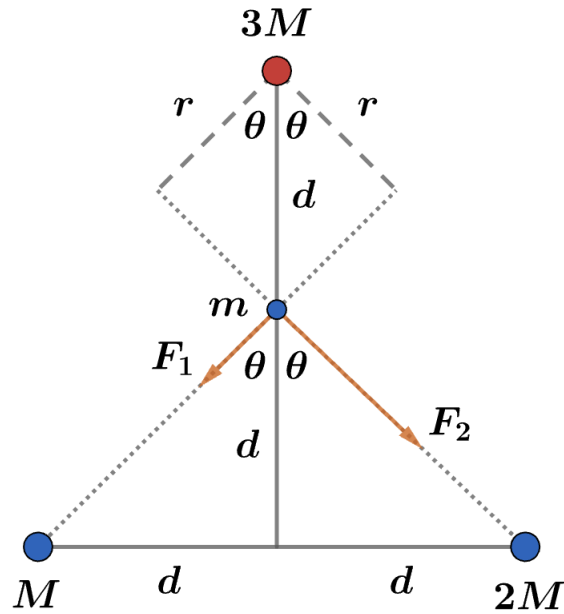


2024 F=ma Exam: Problem 12

Kevin S. Huang



Since the location of the $3M$ asteroid is chosen as the pivot point, its gravitational force on the space probe doesn't contribute to the torque. The net torque is then

$$\begin{aligned}\tau &= \tau_2 - \tau_1 = (F_2 - F_1)r = \left[\frac{G(2M)m}{(d\sqrt{2})^2} - \frac{GMm}{(d\sqrt{2})^2} \right] (d \cos \theta) = \frac{GMm}{(d\sqrt{2})^2} d \cos(\pi/4) \\ &= \frac{GMm}{2d^2} \frac{d}{\sqrt{2}} = \frac{1}{2\sqrt{2}} \frac{GMm}{d}\end{aligned}$$

so the answer is A.