Solve any three problems out of four:

1. A star has a planet on a circular orbit of radius 2 au (astronomical units). The planetary year is 4 Earth's years long. What is the mass of the star compared to the Sun's mass? (In other words, calculate the ratio $M_{\text{star}}^{\text{other}}/M_{\text{Sun}}$.)

2. A 1000 kg car and a 5000 kg truck collide on a very icy road. Before the collision, the car goes North at 60 MPH (miles per hour) while the truck goes South at 30 MPH. After the collision, the two entangled wrecks skid together on the frictionless ice. What is the velocity of this skid?

3. A meter-stick is balanced in the air on two vertical strings. One string — attached at the 40 cm mark — is suspended from the ceiling, and the other string — attached at the 10 cm mark — hangs down and supports a 50 g weight. Calculate the meter-stick's mass.
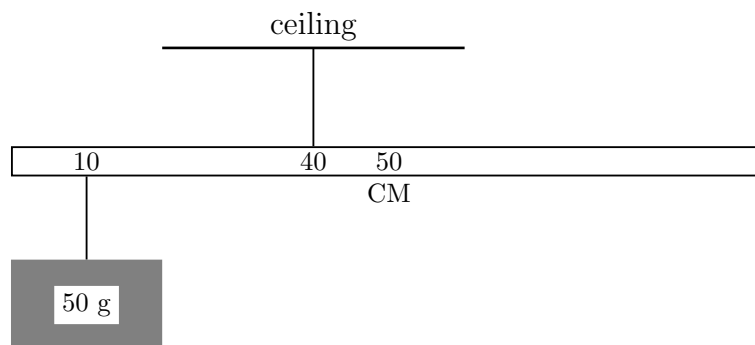
Note: Meter-stick's center of mass is in its middle, at the 50 cm mark.

Hint: Think of the upper string as the pivot point.

4. A 75 kg man walks up a steep hill at speed 1 m/s. The hill's elevation is 20%: for every 100 meters that the man walks, his elevation increases by 20 meters. How much mechanical power does the man expend on this uphill walk?