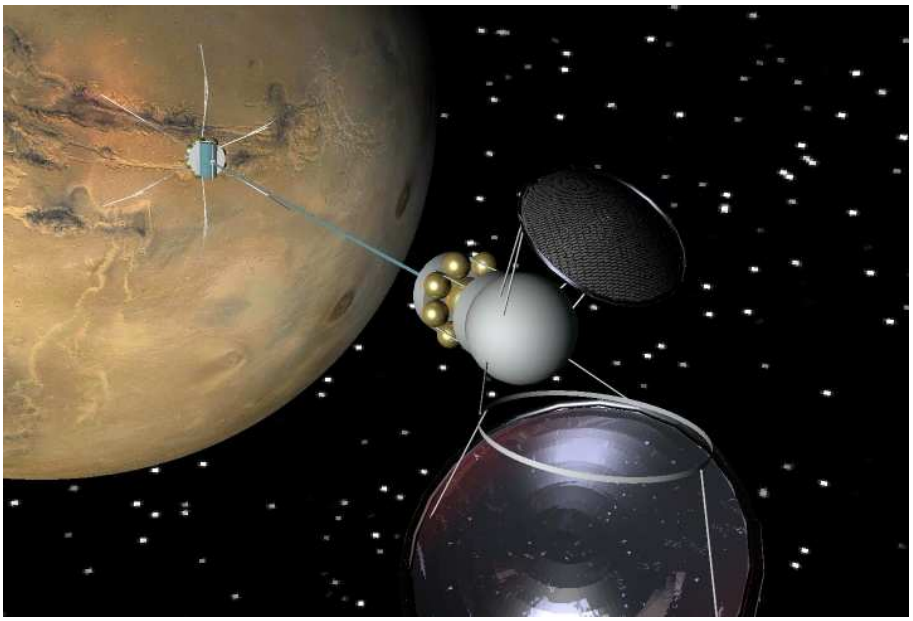

Space elevator

In the book "Red Mars" the construction of a space elevator is described. A big asteroid is brought to the proximity of the planet, and mining machines harvest the asteroid and churn out what is essentially a rope that drags down towards the planet. The elevator is placed at the equator such that it rotates with the planet.

Mars info:
radius: $R_m \approx 3400km$.
Mass: $M_m \approx 6.4185 \times 10^{23} kg$
Day: $24.62296h$

The mass density of the asteroid used is $\rho = 5000kg/m^3$, and it is roughly spherical, with diameter $d = 5km$. which in the end is the total mass of the rope and the remains of the asteroid which serves as a ballast. Assume that the width of the rope is $10m$ and that its cross section is perfectly circular.

1. What is the mass of the rope portion of the asteroid, roughly?

2. At what radius is the top of the elevator placed?

The answer is hard to get exactly, so approximations (especially as the ones we did in class) are very kosher. Also, make the following assumptions (and confirm after the fact): (a) The tether mass is much smaller than the asteroid mass, (b) the ballast asteroid is rather close to the Mars-synchronous orbit. For the radius of the ballast orbit, therefore, a linear expansion relative to the Mars-synchronous orbit is useful.

Info on the book "Red Mars", and another useful diagram is found at:
http://martianchronicles.wordpress.com/2009/07/14/book-review-red-mars/
or the space elevator wikipedia page.