8.18 ⋆⋆ An earth satellite is observed at perigee to be 250 km above the earth's surface and traveling at about 8500 m/s. Find the eccentricity of its orbit and its height above the earth at apogee. [*Hint:* The earth's radius is $R_e \approx 6.4 \times 10^6$ m. You will also need to know GM_e, but you can find this if you remember that $GM_e/R_e^2 = g$.]

8-9. A communications satellite is in a circular orbit around Earth at radius R and velocity v. A rocket accidentally fires quite suddenly, giving the rocket an outward radial velocity v in addition to its original velocity.
(a) Calculate the ratio of the new energy and angular momentum to the old.
(b) Describe the subsequent motion of the satellite and plot $T(r)$, $V(r)$, $U(r)$, and $E(r)$ after the rocket fires.

8-14. Find the force law for a central-force field that allows a particle to move in a spiral orbit given by $r = k\theta^2$, where k is a constant.

8-19. Calculate the missing entries denoted by c in Table 8-1. in Marion/Thornton

8-27. A spacecraft in an orbit about Earth has the speed of 10,160 m/s at a perigee of 6,680 km from Earth's center. What speed does the spacecraft have at apogee of 42,200 km?

8-35. An almost circular orbit (i.e., $\varepsilon \ll 1$) can be considered to be a circular orbit to which a small perturbation has been applied. Then, the frequency of the radial motion is given by Equation 8.89. Consider a case in which the force law is $F(r) = -k/r^n$ (where n is an integer), and show that the apsidal angle is $\pi/\sqrt{3-n}$. Thus, show that a closed orbit generally results only for the harmonic oscillator force and the inverse-square-law force (if values of n equal to or smaller than -6 are excluded).