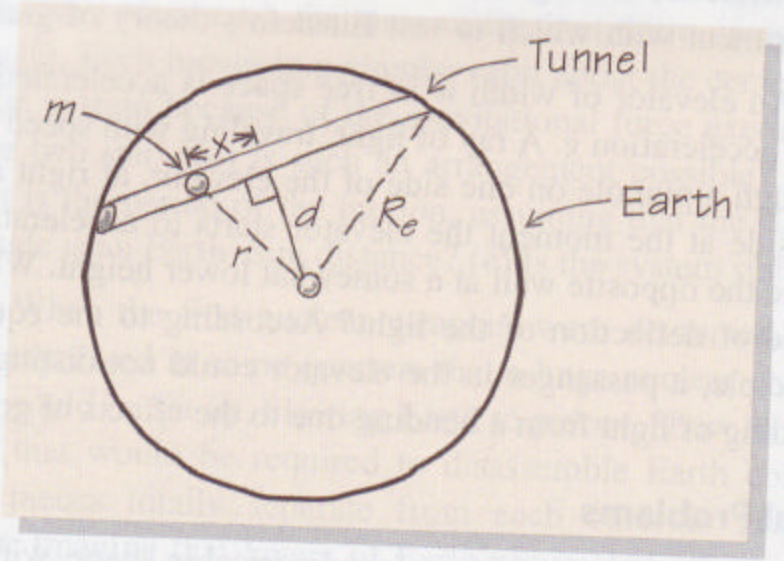
15. (II) The height achieved in a jump is determined by the initial vertical velocity that the jumper is able to achieve. Assuming that this is a fixed number, how high can an athlete jump on Mars if she can clear 1.85 m on Earth?

22. (I) The radius of a neutron star is 750 times smaller than Earth's radius, and its mass is 1.8×10^5 times larger than Earth's mass. What is the escape velocity from the surface of a neutron star? (Ignore the fact that, at high speeds, one should not really use $mv^2/2$ for the kinetic energy.)

52. (III) Rather than a tunnel through Earth's center, as in Example 12–9, consider a tunnel drilled along a chord of Earth, meaning that it passes a perpendicular distance d away from the center of Earth (Fig. 12–33). Find the potential energy of a mass placed in such a tunnel as a function of (a) its distance r from the center of Earth and (b) its distance x from the midpoint of the tunnel.



▲ **FIGURE 12–33** Problem 52.

57. (II) A binary star system consists of two stars, each of mass M, orbiting around their common center of mass with radii R from the center of mass. Determine the period of revolution.