1. The sun exerts a force on a drop of water on earth. The drop is somewhere along the line between the centers of earth and the sun. The distance of the drop from the sun is $R_{es} + r$. The force is

$$-(GM_s{R_{es}}^{-2})(1 - 2\left(\frac{r}{R_{es}}\right)).$$

   a. (3 pts.) "The first term pulls the drop toward earth." Explain how to determine that this statement is incorrect.

   b. (3 pts.) Using only the force exerted by the sun, explain why there are two high tides every day.

2. The sun exerts a force on a drop of water on earth. The drop may be anywhere. The distance of the drop from the sun is the magnitude $|\overrightarrow{R_{es}} + \vec{r}|$. (The arrows indicate vectors.) The force is

$$-(GM_s{R_{es}}^{-2})(1 - 2\,\vec{r} \cdot \overrightarrow{R_{es}}/R_{es}^2).$$

The dot indicates dot product.

   a. (3 pts.) Sketch the tidal force on the entire earth. Be certain to indicate direction.

   b. (3 pts.) Where is the tidal force zero? Where is it maximum in magnitude?

3. (3 pts.) For moons having the same density as Jupiter, the Roche limit is 169Mm. Suppose a new moon is discovered with an orbital radius of 150Mm. It is spherical in shape. Explain how such a moon can exists so close to Jupiter.