Homework9 for GP1

1. KK 8.1 (9.1）
2. KK 8.2 (9.2)
3. KK 8.5 (9.5)
4. KK 8.9 (9.9)
5. KK 8.11 (9.11)
6. KK 8.12 (9.12)
7. Given the fact that the tidal force (felt on earth) by the moon is twice as large as the tidal force due to Sun. Please estimate the average density ratio of the Moon and Sun, i.e.: ρ_{moon} / ρ_{sun}=? (Assuming spherical shapes with radius r_m, r_s, and distance from earth and moon and sun are R_{E-M}, R_{E-S}.if you need hint, see the footnote[1])
8. For a battleship at the equator of the earth, it is firing a cannon ball towards a target to its north. The target is 20km away to the north, and the gun is firing at 45 degree angle. The cannon will hit the target if no spin of earth. However due to the spin of earth, the cannon ball will miss the target and land west to it, calculate the distance of missing. (Neglect wind and air resistance, and neglect the curvature of earth surface, taking g=10)
9. In a fictitious 2-D plane which rotates with some unknown angular velocity ω, the rotational axis is through the center of the plane and perpendicular to the plane. Suppose you are standing on such plane and know nothing about outside of the plane. The plane is also frictionless for simplicity (or you can create such experimental condition). Could you tell you are in a rotating plane by doing experiment on the plane only, without referring to the outside world, and can you measure the angular velocity of the frame and determine the center of rotation (assume the plane is large and it is impractical for you to walk to the center of plane). If the answers are yes, please describe the experiment you carried out.

---

[1] The ration r_m / R_{E-M} is the angle spanned by the moon to the observer on earth, so will be in the case for Sun. For this question, we can treat the angles spanned by Moon and Sun are approximately same.