PHY3063 Spring 2018

HOMEWORK A

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Due: January 25, 2018

1. CH25 Q-27.
What is the difference between the stable and unstable mechanical equilibrium? In either case, when an object is placed at the equilibrium position, there is no net force on the object. However, when the object is moved away from the equilibrium by an infinitesimal amount ($\vec{\delta}$), a non-zero net force appears in $\vec{\delta}$ for unstable equilibrium (runaway) and in $-\vec{\delta}$ for stable equilibrium to restore the stable equilibrium.

2. CH25 E-16.

3. CH25 P-3.

4. CH25 P-4 (a) only.
Conduct Taylor expansion to show $\tan\theta \approx \theta$ *for* $\theta \ll 1$. *What is the next term?* θ^2 *or* θ^3*?*

5. CH25 P-8.

6. Ch25 E-13.
Carry out the vector calculation to the end. If you can do this calculation, you can do any vector summations! Consider the symmetry first to simplify the calculation.

7. Repeat the calculation for a uniform line charge (p.577 of RHK). The difference is that the line is split into two sections with the line charge density $+\lambda$ for $0 \le z \le +L/2$ and $-\lambda$ for $-L/2 \le z \le 0$. What is the force for a limiting case of $y \to \infty$.

8. Calculate the Coulomb force on a unit charge (1 C) located above an infinite flat sheet of charge by a distance z. The sheet is uniformly charged with a surface charge density σ. We calculated the force from a ring of charge (p.577 of RHK).
Hint: Make a small modification from this. Set up a ring of charge of radius r *and thickness* dr. *This is the differential element of charge* $\sigma(2\pi r dr)$. *And you can proceed to integrate* $d\vec{F}$ *in terms of* r *from 0 to* ∞.