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Set 6. Exercises for 29 September 2017

Problem 32: *Goldstein*, derivation 3.1

Problem 33: Halley's comet follows a very eccentric elliptical orbit with eccentricity $e = 0.967$. Its perihelion distance is 0.59 AU (*astronomical unit*, $1\,\text{AU} = 149.6 \cdot 10^6\,\text{km}$). What is its greatest distance from the Sun (its *aphelion* distance)? What is the period of the orbit?

Problem 34: Solve the transformed equation of the orbit, Eq. (3.34) in *Goldstein*, for a free particle ($V = 0$). Show that the solution is a straight line, using either a geometrical or an analytical method.

Problem 35: Exam problem 2, 2014 fall.

Problem 36: Exam problem 1, 2014 spring, except part i.

Problem 37: Show that the equation (the symbols are the same as in section 3.7 of *Goldstein*):

$$r = \frac{a(1-e^2)}{1+e\cos\theta}\,,$$

with $0 \leq e < 1$ describes an ellipse which satisfies the equation:

$$\frac{(x+ea)^2}{a^2} + \frac{y^2}{b^2} = 1\,,$$

and find b. As usual, $x = r\cos\theta$ and $y = r\sin\theta$.

Problem 38: *Goldstein*, exercise 3.11.