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Set 9. Exercises for 20 October 2017

Problem 51: A body is falling freely in the gravitational field of the Earth at a point of latitude λ (polar angle, or co-latitude, $\theta = \pi/2 - \lambda$). The angular rotation velocity of the Earth is $\omega = 7.292 \cdot 10^{-5}\,\mathrm{s}^{-1}$.

a) Show that the body is deflected toward east by the Coriolis effect on the northern hemisphere. What about the southern hemisphere?

The body is falling from rest from a height $h = 100\,\mathrm{m}$ at the equator. Choose a coordinate system with z-axis in the local vertical direction and the x-axis toward the east. Neglect air resistance.

b) Find the deflection of the particle falling at the equator, assuming it to be small enough to be neglected in calculating the fall velocity. [Hint: See *Goldstein* p. 179].

Problem 52: *Goldstein*, exercise 4.21.

Problem 53: *Goldstein*, exercise 4.24.

Problem 54: *Goldstein*, exercise 4.22. The *first approximation* here means for short enough times.

Problem 55: *Goldstein*, exercise 4.23. Assume that the pendulum is released from rest at the point $x = a$, $y = 0$, with the origin at the rest position of the pendulum. [Hint: The equations of motions are much simpler to solve by introducing complex coordinates, $w = x + \mathrm{i}y$].