1. CORIOLIS BULLET
   (Taylor 9.9)
   A bullet of mass $m$ is fired with muzzle speed $v_0$ horizontally and due north from a position at colatitude $\theta$.

   (a) Find the direction and magnitude of the Coriolis force in terms of $m$, $v_0$, $\theta$, and the angular velocity of the earth, $\vec{\Omega}$.

   (b) How does the Coriolis force compare with the bullet’s weight if $v_0 = 1000$ m/s and $\theta = 40^\circ$?

2. CORIOLIS DRIFT
   In McDonald’s article (see course schedule), it is stated that, in the absence of friction, a car moving at 60 mph would undergo a Coriolis drift to the right of roughly 15 feet after traveling 1 mile, and that a person walking at 4 mph would similarly undergo a Coriolis drift of roughly 250 feet after 1 mile.

   You do not actually need to read McDonald’s article in order to do this problem.

   (a) Verify these claims are the correct order of magnitude, assuming a latitude of 45°.

   (b) Explain briefly why the effect is larger for the pedestrian than for the car.

3. I FEEL THE EARTH MOVE UNDER MY FEET ...
   (adapted from Taylor 9.26 and 9.29)
   The first-order approximation for the deflection due to the Coriolis force of an object falling “straight down” is derived in Taylor Section 9.8.

   (a) Use the same method to show that the first-order approximation for the deflection due to the Coriolis force on an object thrown “straight up” from the ground is

   $$\frac{4\Omega v_0^3 \sin \theta}{3g^2}.$$  

   Note: You can reasonably assume that $\dot{x}$ and $\dot{y}$ are small compared to $\dot{z}$.

   (b) The object dropped from a height winds up to the East of where it starts, whereas the object thrown up from the ground winds up to the West.

   Briefly explain why (1–2 sentences; no equations).

   Note: Make sure your calculations support this sign difference!