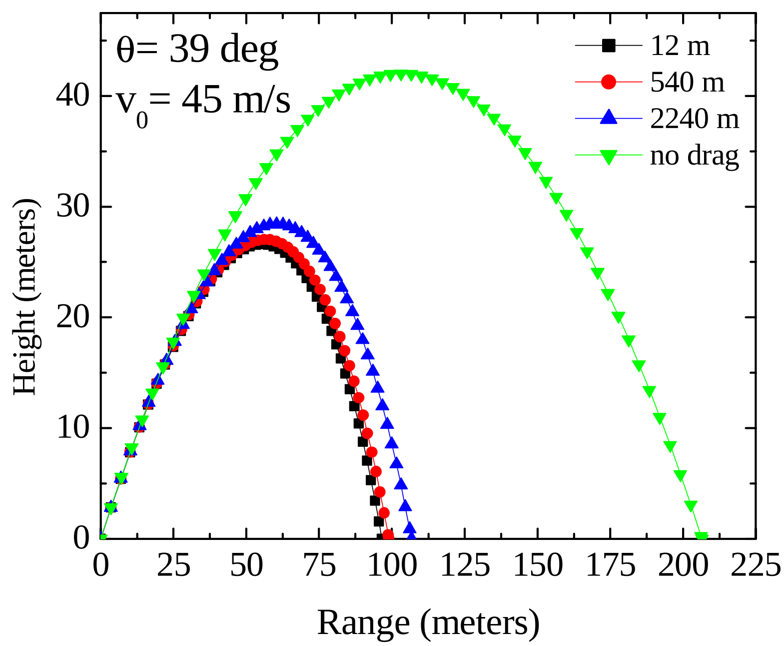
Solution Notes

Part 2

(note: the time step for all computations was 0.1 s)

1. For a 100 mph baseball, I found the optimal angle to be ~ 39 deg. at sea level and ~ 40 deg. at Mexico City. Of course, the optimal angle is 45 deg. when there is no drag force.
2. A baseball always travels a longer distance when hit at higher altitude. Here's an example of a set of trajectories at various altitudes and one for the case of no air drag.

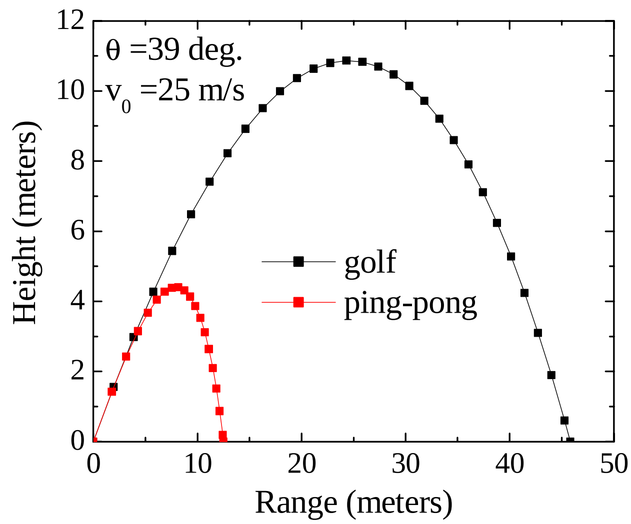


There is some variation in the percentage increase of range with the post-impact velocity of the ball. Below is a table showing results for a baseball hit at an angle of 39 degrees.

	25 m/s	% change	35 m/s	% change	45 m/s	% change
12 m	46.11	-	72.58	-	96.60 m	-
540 m	46.72	1.3%	74.00	2.0%	98.94 m	2.4%
2240 m	48.66	5.5%	78.60	8.3%	106.73 m	10.5%

Additional activities

a. The asymmetrical trajectory results from the ball continuously losing horizontal speed, and so it travels more slowly in the horizontal direction (covers less ground) on the way down than it did on the way up.
b. Optimal angle without air resistance is 45 deg.; it is reduced to ~ 39 deg. for typical atmospheric conditions.
c. The larger mass of the golf ball allows it to travel significantly further than the ping-pong ball. For initial conditions: speed = 25 m/s, angle = 39 deg. the golf ball travels 45.8 m whereas the ping-pong ball goes only 12.5 m. Note: results are for a golf ball without dimples.



d. This is a trial and error exercise. For the case of the Phillies' new ballpark, I found that a baseball hit at 58 m/s or 130 mph and at an angle of 39 deg. will just clear the 6 foot wall in straightaway centerfield.