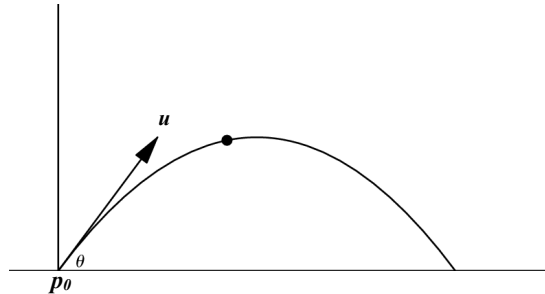


COMP270 Week 5 Exercise Sheet: Newtonian Mechanics

Note: for the following exercises, assume that the acceleration due to gravity, g , is 9.81m/s^2 acting straight downwards, and there is no air resistance or other force acting upon the objects.



1. A projectile is launched with an initial speed of 30m/s , with an angle of inclination of $\theta = 40^\circ$ from the initial position $p_0 = (0\text{m}, 2.5\text{m})$.
 - a. What is the initial velocity u in vector form?
 - b. At what time will the projectile reach its apex (highest point)?
 - c. What are the coordinates of the projectile at the apex?
 - d. How long will it take for projectile to come back to an altitude of $y = 2.5\text{m}$?
 - e. What will the horizontal displacement be at this time?
 - f. For how long is the projectile in the air before it hits the ground?
 - g. Find the values for the projectile's
 - i. final velocity, v , and
 - ii. final horizontal displacement, s_x'when it hits the ground.
2. A ball is thrown from ground level so that it just clears a wall that is 3m high. If the initial speed of the ball is 20m/s , find the angle of projection.
3. A ball is thrown vertically upwards with a speed of 21m/s .
 - a. In which direction is the ball travelling after 3 seconds?
 - b. What is the total distance it has travelled in this time?
4. A stone is thrown vertically upwards with a speed of 7m/s , and one second later, a second stone is thrown vertically upwards from the same point with the same speed. Find the height at which the two stones collide.

Reference

Splitting vectors into components: <https://www.physicsclassroom.com/Class/vectors/u3l1e.cfm>

Aside: proof(s) that $-1 \times -1 = 1$: <http://mathforum.org/dr.math/faq/faq.negxneg.html>