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Date	18.09.2024
Lab session (Day & time)	Thu, 19.09.2024, 09:00 – 10:50
Lab partner	— (don't know)

M2 Projectile Motion Lab Report

A. Answer the following questions BEFORE the lab session (6 pts each)

1. As a projectile moves in its parabolic path as shown in Fig. 1, at what point along its path are the velocity and acceleration vectors for the projectile perpendicular to each other? (a) nowhere (b) the highest point (c) the launch point

(b) (velocity is tangent to trajectory → horizontal at highest point; acceleration is always vertical)

2. Assume that the ball shown in Fig. 1 is fired at the angle $\theta = 0$. If you plot y as a function of x^2, as defined by Eqs. (3) and (4), is the curve a straight line? What does this tell you about the relationship between y and x?

$x = v_x t$, $y = y_0 + (v_0 \sin\theta)t - \frac{gt^2}{2} = y_0 - \frac{gt^2}{2} = y_0 - \frac{gx^2}{2v_x^2} =$

$= -\frac{g}{2v_x^2} \cdot x^2 + y_0$ — affine function of x^2 → straight line graph

⇒ y is quadratic in x,

$y(x)$ ↓ (y decreases with x increasing),

$y(x)$ is convex downwards (undergraph is convex)

3. Two balls are launched horizontally at the same height, y_0. The initial velocity of the two balls is different. Do the two balls land on the floor at the same time? Why?

They do, since the time of flight is determined only by y_0:

$y(t) = y_0 - \frac{gt^2}{2} = 0 \Rightarrow g\frac{T^2}{2} = y_0$

$T^2 = \frac{2y_0}{g}$ $\quad T = \sqrt{2y_0/g} = T(y_0)$

for horizontal launch