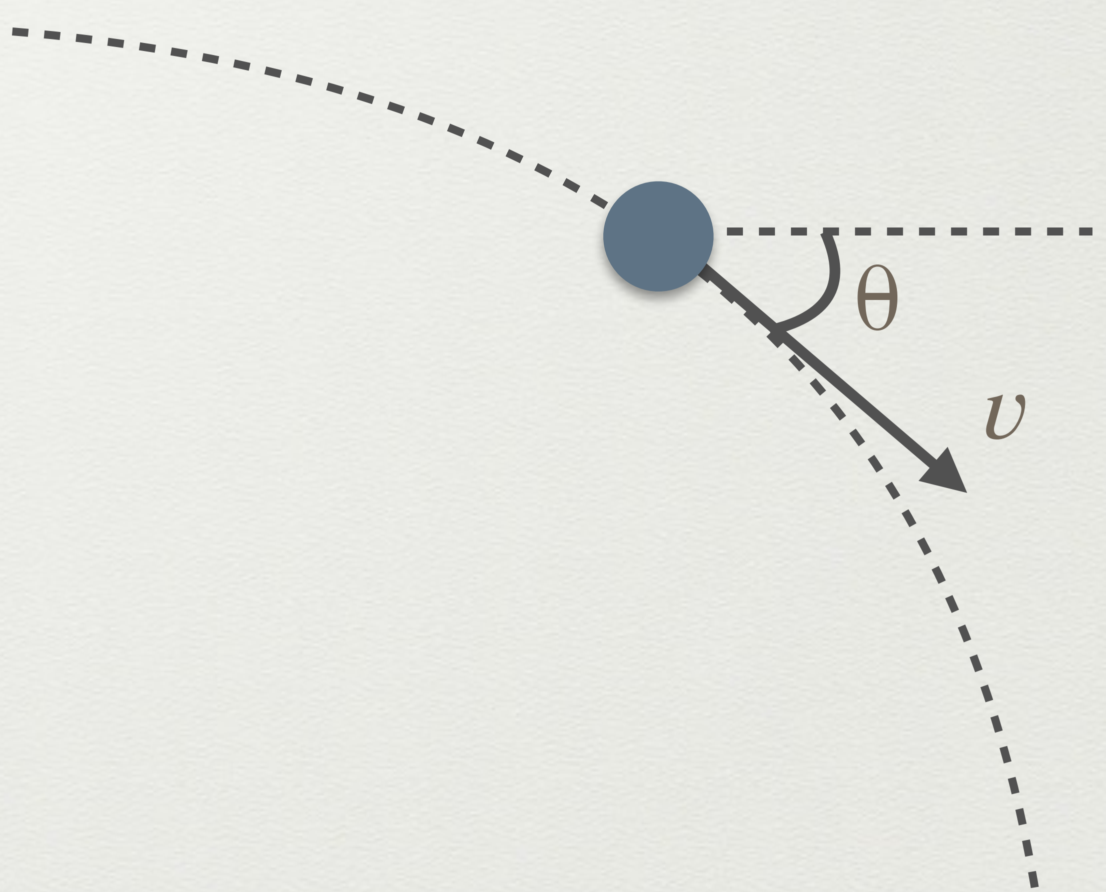
PROJECTILE MOTION REVIEW

Honors Physics

Question 1

- A lacrosse ball is thrown horizontally with an initial velocity v_0 (at $t = 0$). At any moment, its direction of motion makes an angle θ to the horizontal that changes with time. Derive a formula for θ as a function of time as the ball follows a projectile's path.



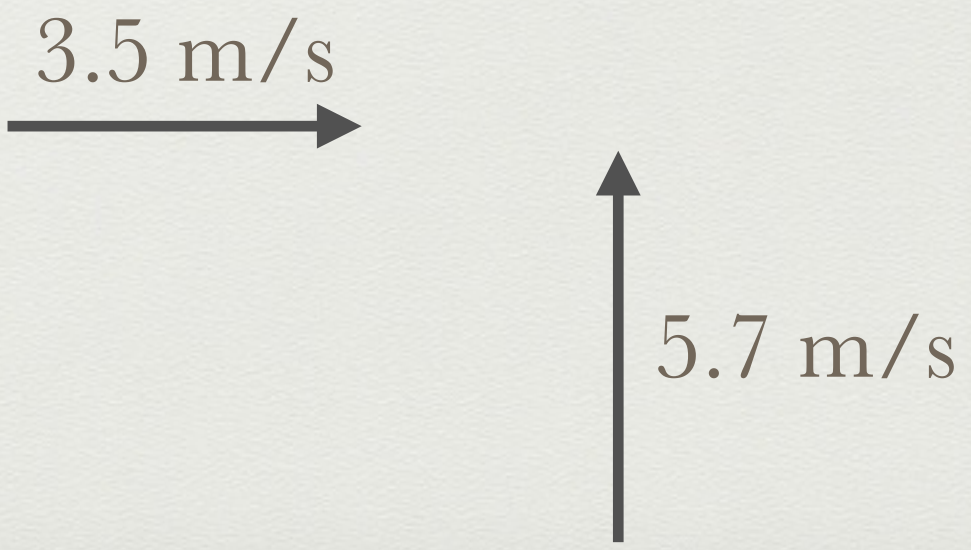
- *Ans.* $\theta(t) = \tan^{-1}\left(\dfrac{gt}{v_0}\right)$

Question 2

- Two lacrosse players run at right angles to each other. Player 1 runs at 3.5 m/s and player 2 runs 5.7 m/s. What is the relative velocity of of player 1 as seen by player 2? What is the velocity of player 2 relative to player 1?

- *Ans. 6.7 m/s @ 122º*

- *Ans. 6.7 m/s @ -58º*



Question 3

- Paul Rabil (major league lacrosse offensive player of the year 2012, 2011, and 2009) runs at 7.3 m/s towards attacker Vito DeMola for a pass. Rabil hurls the ball at 40. m/s from a height of 2.8 m and at an angle 18º above the horizontal. What is the maximum distance from DeMola that Rabil can be when releasing the ball in order for his teammate to complete the pass?

- *Ans. 120 m*

Question 4

- Casey Powell (attack for Florida Launch) runs at 5.9 m/s after defender for the New York Lizards, Tim Henderson, who flees at 4.3 m/s. When Powell is 20. m behind Henderson, Powell accelerates uniformly and passes Henderson 2.1 s later. What was Powell's acceleration?

- *Ans.* $a = 7.5\ m/s^2$

Question 5

- When Mark Millon played for the Boston Cannons, he once threw a lacrosse ball over a 12-m-high fence 95 m from where he stood. Roughly what was the minimum initial speed of the ball when it left the head of the crosse? Assume the ball was launched 1.0 m above the ground and its path initially made a 40° angle with the ground.

- *Ans.* $v_i = 83\ m/s$

Question 6

- A flying lacrosse ball has an instantaneous velocity of 90.0 kph at -37.7°
- Assuming the lacrosse ball has a tiny rocket attached, what velocity vector would the rocket need to add to the ball for it to move at 80.0 kph entirely in the -*x* direction?
- *Ans. 161 kph @ 160.°*

Question 7

- It's the Rochester Rattlers' biggest game of the season. The boys are in the heat of the game when a disruptive spook leaps straight up from the field (at 35 m/s)! John Ortolanii hurls the lacrosse ball with all his might the moment the specter reaches his maximum height. If he stands 20. m away and can throw the ball at 49 m/s from a height of 2.0 m, at what angle should he aim in order to hit the intruder in his spooky phantom face?

- *Ans.* $\theta = 72^o$

Question 8

- #2 Kevin Crowley is running late for practice with the Chesapeake Bayhawks! He speeds along the freeway at 140. km/h and doesn't notice the unmarked police car traveling at a constant 90.0 km/h. If precisely 1.00 s after Crowley passes the police car, the police officer accelerates the car at 2.00 m/s^2 and Crowley maintains a constant speed, will Crowley make it to the Navy-Marine Corps Memorial Stadium 650. m away?

- *Ans.* $t_{ot} = 15.8$ *s* , $t_p = 16.7$ *s ; nope!*

Question 9

- Assume Crowley's speed was not know. The police car, traveling at 90.0 km/h, accelerates at 2.00 m/s^2 1.00 s after being passed. If the police officer overtakes Crowley after 7.00 s, what was the former Cascade MLL Rookie of the Week's speed?

- *Ans.* $v_{kc} = 109$ *km/h*

Question 10

- In 1971, Tom Cafaro was the first lacrosse player to go to the Moon. While there, he was said to have goosed a ball 180 m! Assuming that the swing, angle, and so on, were the same as on Earth where Cafaro could only goose a ball 30 m, estimate the acceleration due to gravity on the surface of the Moon.

- *Ans.* $g_m = 1.6\ m/s^2$