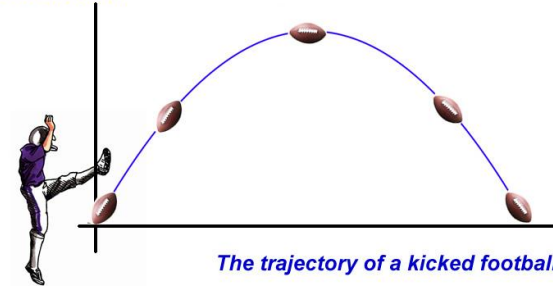




PROJECTILE MOTION

BY LAUREN, MANUEL, EMIN, AND JOSH

Projectile Motion



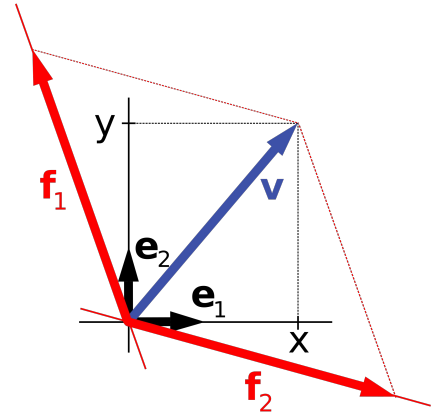
The trajectory of a kicked football

VECTORS

- Arrows show direction
- Length corresponds to the magnitude
- Used to understand physical situations

ADDING VECTORS

- One dimensional:
 - Add and subtract values
 - Net displacement is the end value



VECTOR DECOMPOSITION AND RESOLUTION

- Two methods of Vector resolution is the **Parallelogram** and **Trigonometric** Method
- **The Parallelogram method** involves drawing the vector to scale in the indicated direction, sketching a parallelogram around the vector such that the vector is the diagonal of the parallelogram, and determining the magnitude of the components (the sides of the parallelogram) using the scale.
- **The trigonometric method** involves using trigonometric functions to determine the components of the vector.

VECTOR DECOMPOSITION STEPS

1. Break vectors into x and y components
2. Add all horizontal and vertical components
3. Use pythagorean theorem
4. Make sure to pay attention to direction

DISTANCE VS. DISPLACEMENT

- Distance: total path traveled, all components are added up, may not be a straight line
- Displacement: shortest path from the starting point to the end point, a straight line

WHAT IS PROJECTILE MOTION?

Projectile Motion is a form of motion in which an object is thrown and follows a curved path under the action of gravity.

HELPFUL EQUATIONS

- Gravity: 9.8 m/s^2
- $V_f^2 = v_i^2 + 2a(\Delta x)$
- $\Delta x = (v_i)t + \frac{1}{2}at^2$
- $V_f = v_i + at$

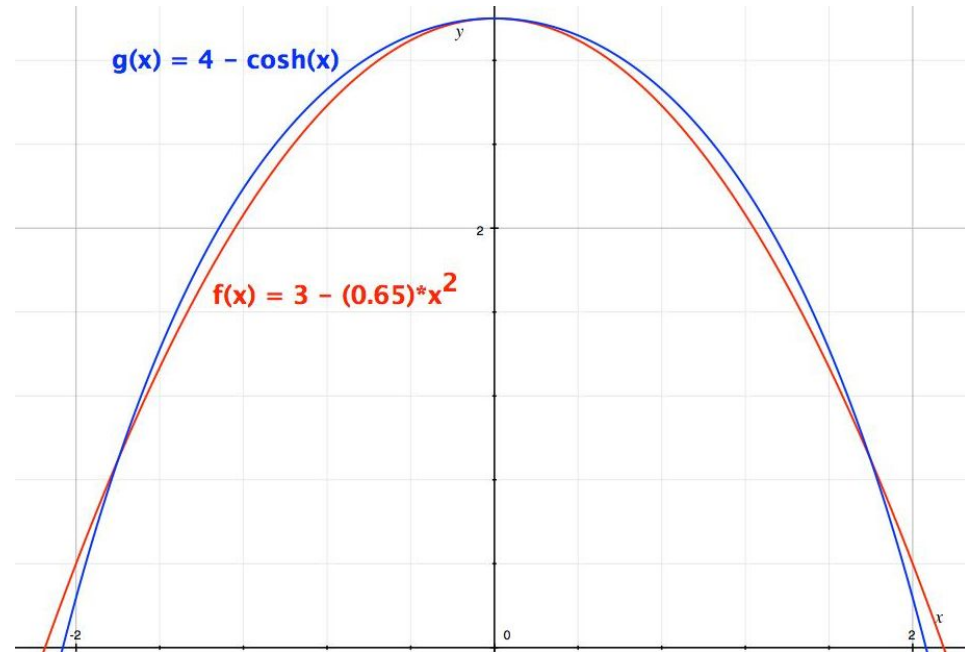
RELATION TO FREE-FALL

- Object now has a horizontal component that must be taken into consideration when calculating the motion
 - Horizontal velocity is a constant value
- Air resistance is still ignored
- Gravity causes vertical acceleration
- However, vertical and horizontal motion are completely independent



PATH OF THE PROJECTILE

- The motion is parabolic
 - $Y = ax + bx^2$



COMMON MISTAKES OR MISUNDERSTANDINGS

- Horizontal speed affects the time in which the ball takes to hit the ground
 - However, horizontal speed does not influence the time since vertical and horizontal motion are independent of one another
- When ignoring air resistance, remember that the horizontal component of velocity remains constant
 - However, when ignoring air resistance, remember that the vertical component of velocity is continuously decreasing

Strategies for FRQs

- Answer questions concisely, don't add unnecessary fluff.
- Even if you don't know what to do for a question, always try your best. You can still receive some credit.
- ***ALWAYS READ THE QUESTION*** There may be something you miss if you do not read the question completely and thoroughly.
- Make sure you do not find the launching or impact angles using triangles with distance information. The right way would be to use trigonometry.

Multiple Choice Practice

1. A ball falls off a building. If horizontal velocity is applied, is the time in which it takes to hit the ground affected?
 - a. Yes
 - b. No
 - c. Sometimes
 - d. I have no idea
2. Ignoring air resistance, a horizontal component of velocity is....
 - a. Always increasing
 - b. Equal to twice the vertical velocity
 - c. Equal to half the vertical velocity
 - d. Zero

More Multiple Choice

3. Which angle yields the most horizontal distance?

- a. 5 degrees
- b. 25 degrees
- c. 45 degrees
- d. 75 degrees

4. A boy walks 32 m south, 18 m west, and 27 m north. What is his distance and displacement travelled?

- a. Distance: 77 m , Displacement: 18.7 m
- b. Distance: 77 m , Displacement: 17.3 m
- c. Distance: 17.3 m , Displacement: 18.7 m

Even More Multiple Choice

5. A ball is thrown with a horizontal velocity while another ball with the same mass is dropped straight down without a horizontal velocity. Which will hit the ground first?

- a. The ball with the horizontal velocity
- b. The ball without the horizontal velocity
- c. Both will hit at the same time
- d. Cannot tell with the given information

Kahoot

<https://play.kahoot.it/#/k/24179766-7121-4a0f-b466-48608a39ad65>