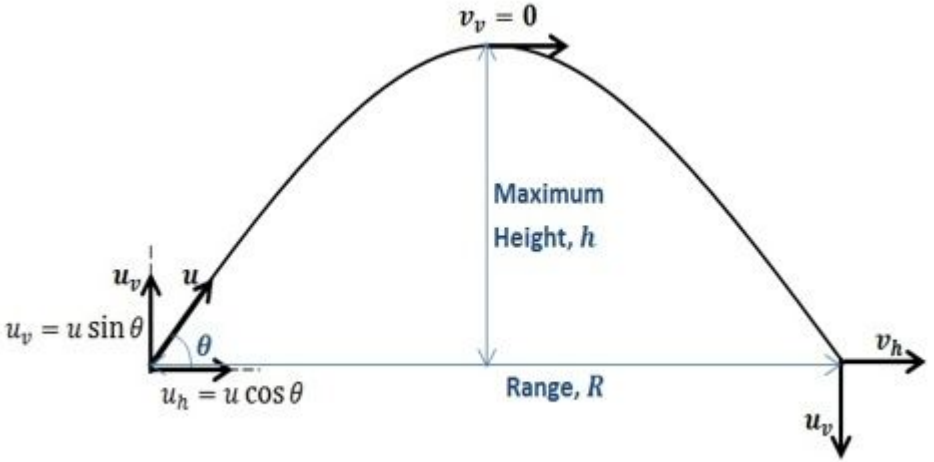
COMP 160
Object-oriented Programming
Lab 3

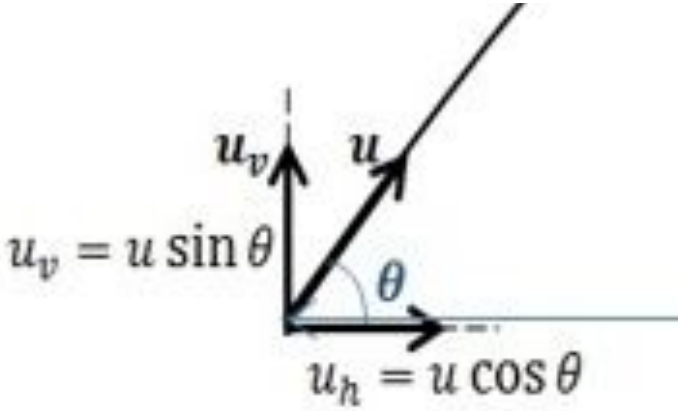
Ballistic Motion

- In this lab, we will simulate a ballistic motion using the time difference.
- First, let's review the properties of ballistic motion.



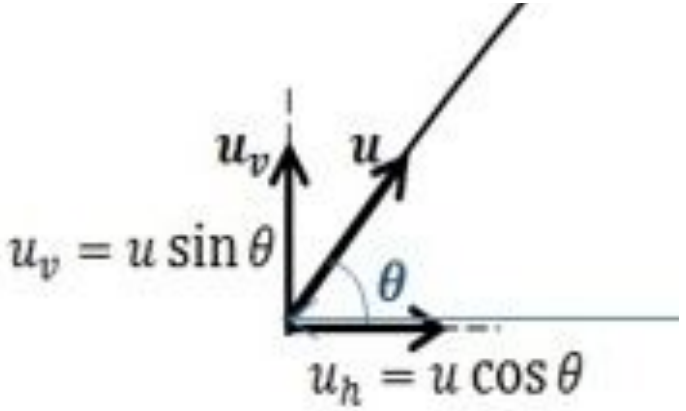
Ballistic Motion

- In ballistic motion, our ball will follow a parabolic motion under the effect of gravity.
- Calculate the X and Y velocity using the actual velocity and degree.



Ballistic Motion

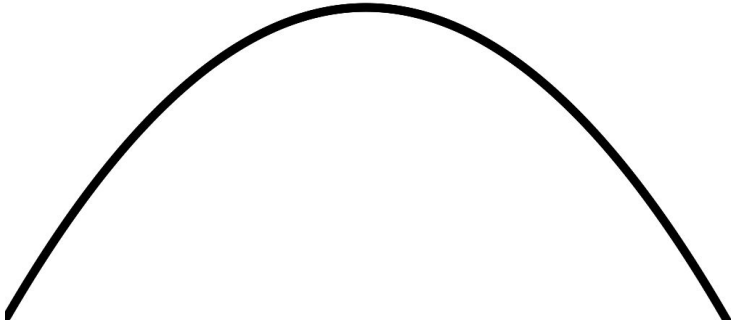
- Calculate the ball's current X and Y positions using time.
- If we know the starting point, velocity, theta degree, gravity, and the current time we can calculate the current positions!



$$x_t = x_0 + v_0 t \cos(\Theta)$$

$$y_t = y_0 + v_0 t \sin(\Theta) - \frac{1}{2} g t^2$$

Ballistic Motion



- In this lab we'll use a method to decide for the smoothness of the motion.

- We'll get the computer's real time and use it.

Getting the Time

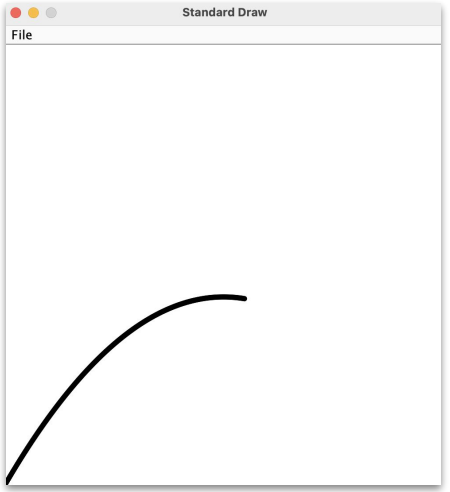
- We are going to use ***System.currentTimeMillis()*** function.
- This method returns the difference between the current time and midnight, January 1, 1970 UTC(coordinated universal time), measured in milliseconds.
- Specify the ***starting time*** just before motion starts, it will become our t = 0 point.
- Draw the frames using
  - ***t = current time - starting time***

Getting the Time

- Remember the basics of drawing. It will iterate through a while loop in every pause duration time. It will also cause a change in the time, we are going to use that.

```
while (true) {
  // some code here
  StdDraw.show();
  StdDraw.pause(pauseDuration);
}
```

Exercise 1: Ballistic Motion



1. Set the gravity, velocity, theta_degree to constants.
2. Set the canvas.
3. Do the necessary calculations.
4. Draw and show the motion frame by frame.

Suggested Constants:

Gravity = 9.8
Velocity = 75.0
Theta_degree = 60.0
Ball Size = 3

$$x_t = x_0 + v_0 t \cos(\theta)$$

$$y_t = y_0 + v_0 t \sin(\theta) - \frac{1}{2} g t^2$$

It is highly recommended that you change the pause duration to see the relation between pause duration and time.