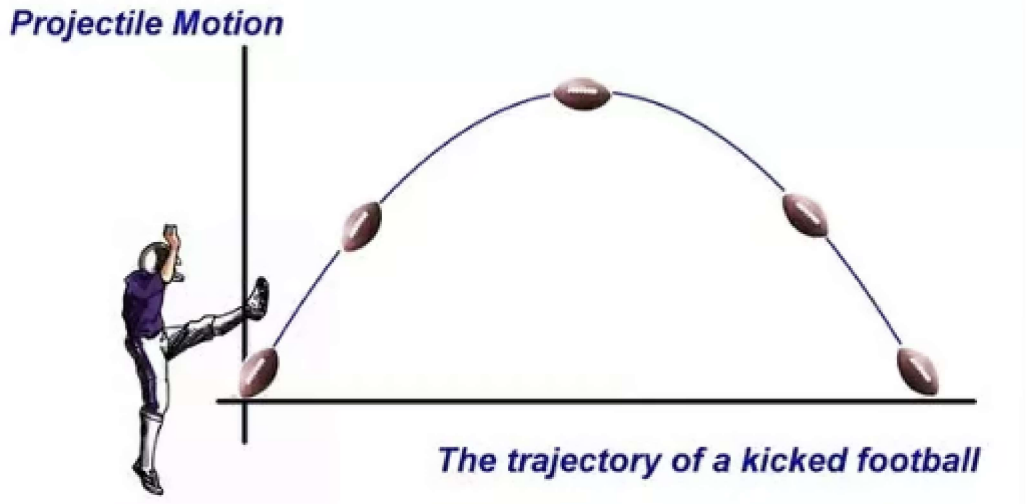
# Lab 03 - Projectile formula

**Note: If you are having trying touble seeing the lab instructions correctly please use this link**https://drive.google.com/file/d/1XBPii7b0a6vLYPvV_We1cNdZ4UNes3Lo/view?usp=sharing

*Learning Objective: demonstrate an understanding of creating functions with different return data types.*




Physics is full of formulas that we constantly use. For this lab, we are taking the projectile motion formula to find the maximum height of an object after it is launched into the air and the time it takes to reach that peak. The vertical projectile formula is

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where

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represents the height of the projectile at time

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,

×
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represents the acceleration (gravity),

×
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represents the initial velocity at time zero, and

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represents the initial height at time zero. The maximum height happens at time

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The acceleration value is a constant value -9.8

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This program could be used to solve problems like this: A baseball is thrown with an initial velocity of 39.2

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and from 2

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above the ground (initial height). Find the maximum height reached by the ball and the time it takes to get there.

Check out this link for more information about projectile motion: Click Here.
**Step 1:** Set a the global constant **ACCELERATION**. **Test it**.
**Step 2:** Define the function that will find the time it takes for the ball to reach the maximum height. Name the function **calc_time_max_height** which has one parameter for velocity and returns the time (see formula above). **Test it**.

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**Step 3:** Define the function that will find the maximum height the ball reaches. Name the function **calc_max_height** which has three parameters: velocity, initial_height, and time (in that order). The function should return the maximum height (see formula above). **Test it**.

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**Step 4:** In the main program, call the **calc_time_max_height** function to find the time of the maximum height uisng 39.2 as velocity. Assign the result to a variable. Call the **calc_max_height** function to find the the maximum height uisng 39.2 as velocity, 3 meter as initial height, and the time from the time max heigh return value. Assign the results to a variable.
**Step 5:** In the main program, print the function output and verify the result. Print using f-string "The maximum height of the ball with velocity 39.2 m/s and initial velocity 3 m is {} sec, with maxim height {} meters using the two functions." Make sure to format the values to two decimal places using :.2f.
**Step 6:** Define a function that combines the two previous functions and returns two outputs. Name the function **find_peak** which has two parameters, one for initial velocity and a second for initial height. The function should return two outputs: time and max_height.**Test it**
**Step 7:** In the main program, call the find_peak function to find the maximum height and time. Assign the results to two different variables.
**Step 8:** In the main program, print using f-string "The maximum height of the ball with velocity 39.2 m/s and initial velocity 3 m is {} sec, with maxim height {} meters using the two functions" using the return values from step 7. Make sure to format the values to two decimal places using :.2f.
**Test and Submit** There are four automated tests for this lab. Be sure they pass before submitting.
If you have any questions please reach out to your instructor, a peer, or a tutor at the STEM Center for assistance.