Essential Question: How do we model the motion of an accelerating object algebraically?

Background: In this lab you will be collecting kinematic data from the popular N64 video game "Mario Kart". You will then use this data to calculate other kinematic information.

Materials:
3 Stopwatches

Procedure:
The instructor will start the "Mario Kart" game and choose a character. This character will drive a straight section of the track on the course "Luigi's Raceway".

The character will carry out the following actions:

- Start accelerating from rest.
- Reach a maximum velocity.
- Remain at that constant velocity until running into a wall.

While the character drives on a set part of the track, you will be collecting data as group. To make sure that all of the relevant data is collected, the following roles must be assigned to a member of your group.

A. One member will time the kart from when it starts moving until it hits the wall.
B. One member will time the kart from when it starts moving to when it reaches it maximum velocity.
C. One group member will be looking at the speedometer for the character (in the lower right of the screen), and record the character's final velocity (before hitting the wall).

Data:

Record the following data for the character in standard units. **All times and velocities should be in standard metric units. Show your work for any required conversions.**

Character's initial velocity: _____

Character's final, maximum velocity: _____

Total time: _____

Time required to reach final velocity:_____

Time at top speed before hitting the wall: _____

Graphing Motion:

1. Describe the motion of the racer. What were the two parts to their motion? Use the following terms as necessary in your description: stopped, moving in the positive direction, moving in the negative direction, speeding up, slowing down, constant speed, positive acceleration, negative acceleration.
2. Sketch an **x-t** graph for the motion of the racer. (Remember that this should match the description of the motion).
3. Sketch a **v-t** graph for the motion of the racer. (Remember that this should match the description of the motion).
4. Sketch an **a-t** graph for the motion of the racer. (Remember that this should match the description of the motion).

Calculations: Please complete the following on your own.

1. Write out all of your knowns and unknowns for the first part of the kart's motion.
2. Calculate the acceleration for the first part of the motion. Show all of your calculations below.
3. Calculate the displacement for the first part of the motion. Show all of your calculations below.

4. Write out all of your knowns and unknowns for the second part of the kart's motion.
5. Calculate the acceleration for the second part of the motion. Show all of your calculations below.
6. Calculate the displacement for the second part of the motion. Show all of your calculations below.

Conclusions: Please complete the following on your own.

1. How far did the character travel before hitting the wall? Show all of your calculations/work.
2. How can we analyze the kinematics of multi-part motion? Describe the process seen in this lab in 2-3 sentences below.