

# Bowling Ball Activity

For each situation below, draw arrows in the diagram showing the ball's velocity. Then write a sentence describing how one must push or hit the bowling ball so it has the stated motion (under ideal circumstances) and add arrows to each diagram showing these pushes.

Use arrows that look like this for velocity:  $\longrightarrow$

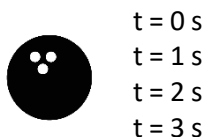
Use arrows that look like this for pushes:  $\boxed{\longrightarrow}$

You have two resources for discovering the answers: your actual bowling ball and an online simulation that can be found at

<https://nhsegal.github.io/Bowling-Ball-Activity/>

First explore all the scenarios with a real ball, then explore the simulation.

## Bowling Ball Remains at Rest:



## Bowling Ball Speeds Up Along a Line:



$t = 0\text{ s}$



$t = 1\text{ s}$



$t = 2\text{ s}$



$t = 3\text{ s}$

## Bowling Ball Slows Down Along a Line:



$t = 0\text{ s}$



$t = 1\text{ s}$

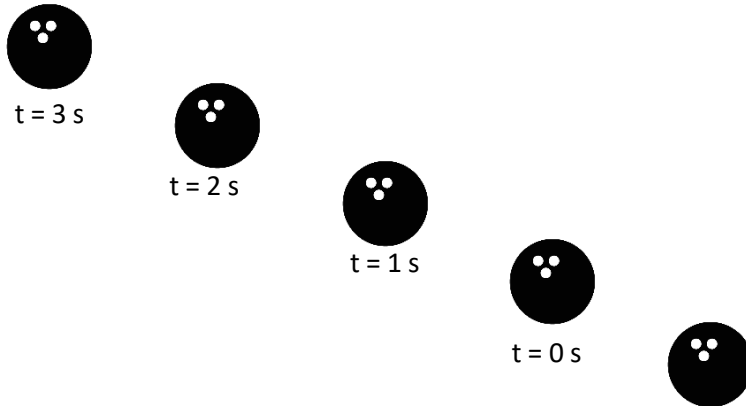


$t = 2\text{ s}$

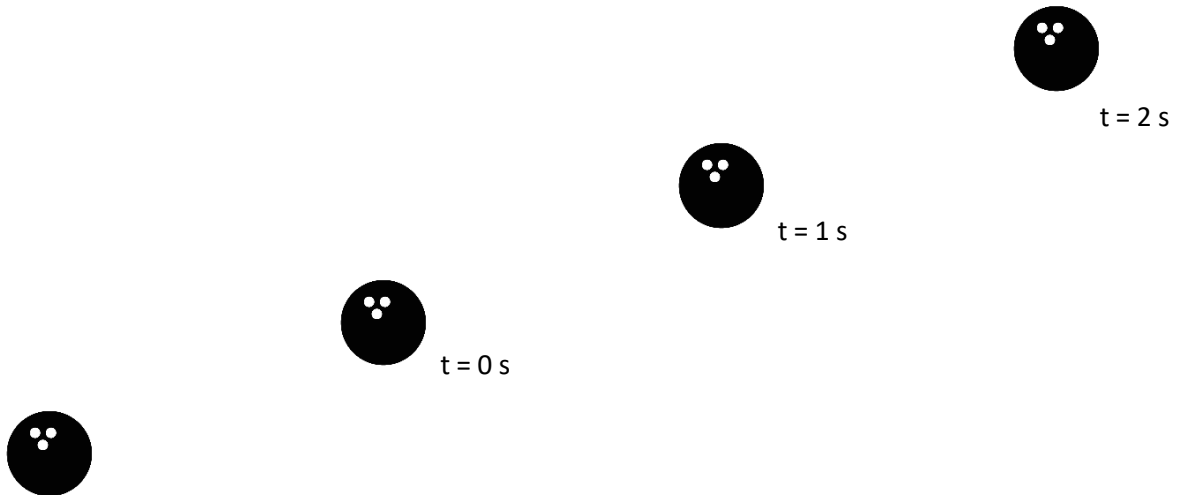


$t = 3\text{ s}$

**Bowling Ball Already in Motion Maintains a Constant Velocity:**



**Bowling Ball Already in Motion Maintains a Constant Velocity, Greater Than Before:**



**Abrupt Turn, Speed Unchanged:**



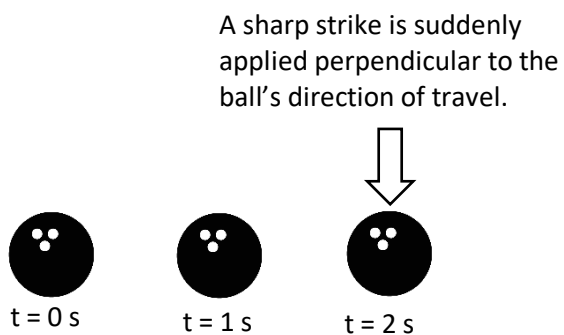
**Polygon or Circle at Constant Speed:**



What happens when the push and velocity are aligned? What happens when they are opposing each other? What happens when they are along different directions?

Formulate a general rule about the connection between the motion of the bowling ball and the pushes it receives:

For the following two situations, draw a prediction for the subsequent path of the bowling ball. Then perform the experiment and draw the observed path of the bowling ball:



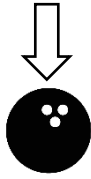
A gentle, steady push is applied perpendicular to the ball's direction of travel from this moment onward.



$t = 0 \text{ s}$



$t = 1 \text{ s}$



$t = 2 \text{ s}$

**Questions:**

1. While the ball is rolling does the floor push horizontally on the ball at all? How can you tell if the floor is pushing on the ball?
2. Restate your general rule about the connection between the pushes on an object and its motion. Also, the instructions at the beginning of the activity ask you to write how one must push the ball “under ideal circumstances.” Explain your interpretation of this phrase.
3. One student wrote for their general rule “*Objects always move in the direction they are pushed.*” Refute this statement by providing two or three different counter-examples from this activity.
4. Why did we use bowling balls and not marbles for this experiment?