

## WORKSHOP 1.4

### Problem

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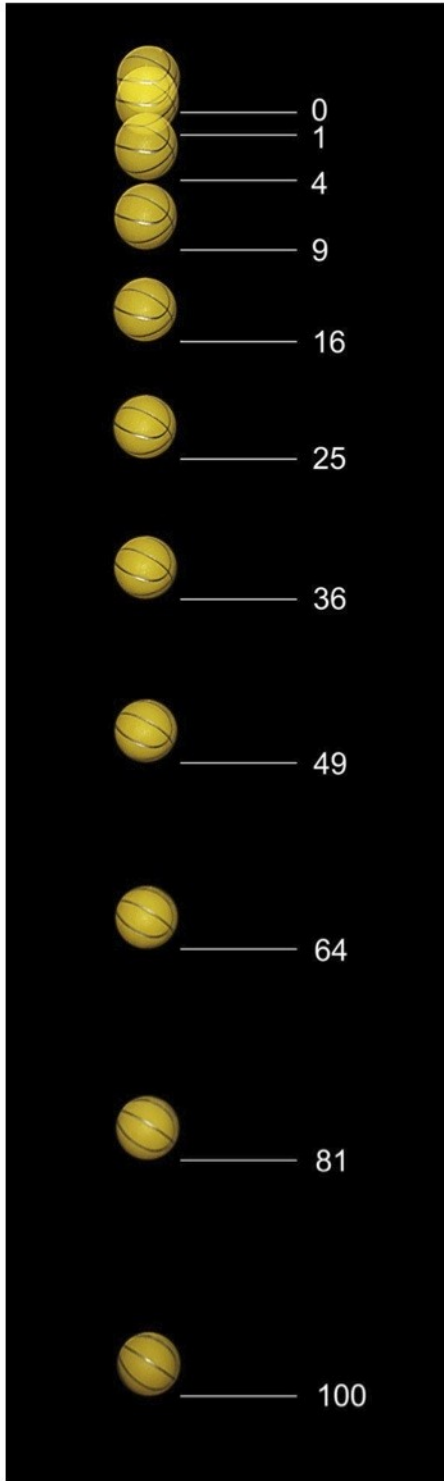


Figure 1: Description from [commons.wikimedia.org/wiki/File:Falling\\_ball.jpg](https://commons.wikimedia.org/wiki/File:Falling_ball.jpg)

This image, spanning half a second, was captured with a stroboscopic flash at 20 flashes per second. During the first  $1/20$ th of a second the ball drops one unit of distance (here, a unit is about 12 mm); by  $2/20$ ths it has dropped at total of 4 units; by  $3/20$ ths, 9 units and so on.

To take the picture, the ball - about the size of a tennis ball - was suspended by a short length of black thread and was released as the shutter was opened and the flash triggered. The shutter remained open for the whole of the half-second period, during which time the flash fired multiple times to capture the ball at  $1/20$  second intervals.

**Question:** Carefully sketch a graph of the distance the ball has fallen with respect to time. Using that graph, sketch a graph of the velocity of the ball with respect to time. Finally, sketch a graph of the acceleration of the ball with respect to time. Is your acceleration graph what you expect? Explain your answer in a few sentences.