

Exercise 18

For the following exercises, consider a stone tossed into the air from ground level with an initial velocity of 15 m/sec. Its height in meters at time t seconds is $h(t) = 15t - 4.9t^2$.

Compute the average velocity of the stone over the given time intervals.

- a. $[1, 1.05]$
- b. $[1, 1.01]$
- c. $[1, 1.005]$
- d. $[1, 1.001]$

Solution

The average velocity is calculated by

$$v_{\text{avg}} = \frac{h(t_2) - h(t_1)}{t_2 - t_1}.$$

Over the interval $[1, 1.05]$ the average velocity is

$$v_{\text{avg}} = \frac{h(1.05) - h(1)}{1.05 - 1} = \frac{[15(1.05) - 4.9(1.05)^2] - [15(1) - 4.9(1)^2]}{1.05 - 1} \approx 4.955.$$

Over the interval $[1, 1.01]$ the average velocity is

$$v_{\text{avg}} = \frac{h(1.01) - h(1)}{1.01 - 1} = \frac{[15(1.01) - 4.9(1.01)^2] - [15(1) - 4.9(1)^2]}{1.01 - 1} \approx 5.151.$$

Over the interval $[1, 1.005]$ the average velocity is

$$v_{\text{avg}} = \frac{h(1.005) - h(1)}{1.005 - 1} = \frac{[15(1.005) - 4.9(1.005)^2] - [15(1) - 4.9(1)^2]}{1.005 - 1} \approx 5.1755.$$

Over the interval $[1, 1.001]$ the average velocity is

$$v_{\text{avg}} = \frac{h(1.001) - h(1)}{1.001 - 1} = \frac{[15(1.001) - 4.9(1.001)^2] - [15(1) - 4.9(1)^2]}{1.001 - 1} \approx 5.1951.$$