Exercise 20

For the following exercises, consider a rocket shot into the air that then returns to Earth. The height of the rocket in meters is given by $h(t) = 600 + 78.4t - 4.9t^2$, where t is measured in seconds.

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

a. $[9, 9.01]$

b. $[8.99, 9]$

c. $[9, 9.001]$

d. $[8.999, 9]$

Solution

The average velocity is calculated by

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

Over the interval $[9, 9.01]$ the average velocity is

$$v_{\text{avg}} = \frac{h(9.01) - h(9)}{9.01 - 9} = \frac{[600 + 78.4(9.01) - 4.9(9.01)^2] - [600 + 78.4(9) - 4.9(9)^2]}{9.01 - 9} \approx -9.849.$$

Over the interval $[8.99, 9]$ the average velocity is

$$v_{\text{avg}} = \frac{h(9) - h(8.99)}{9 - 8.99} = \frac{[600 + 78.4(9) - 4.9(9)^2] - [600 + 78.4(8.99) - 4.9(8.99)^2]}{9 - 8.99} \approx -9.751.$$

Over the interval $[9, 9.001]$ the average velocity is

$$v_{\text{avg}} = \frac{h(9.001) - h(9)}{9.001 - 9} = \frac{[600 + 78.4(9.001) - 4.9(9.001)^2] - [600 + 78.4(9) - 4.9(9)^2]}{9.001 - 9} \approx -9.8049.$$

Over the interval $[8.999, 9]$ the average velocity is

$$v_{\text{avg}} = \frac{h(9) - h(8.999)}{9 - 8.999} = \frac{[600 + 78.4(9) - 4.9(9)^2] - [600 + 78.4(8.999) - 4.9(8.999)^2]}{9 - 8.999} \approx -9.7951.$$