Student: Arfaz Hossain **Date:** 11/28/21	**Instructor:** UVIC Math **Course:** MATH 100 (A01, A02, A03) Fall 2021 **Assignment:** Assignment 9

An object is dropped straight down from a helicopter. The object falls faster and faster but its acceleration (rate of change of its velocity) decreases over time because of air resistance. The acceleration is measured in ft/sec^2 and recorded every second after the drop for 7 sec, as shown. Find the following estimates.

t	0	1	2	3	4	5	6	7
a	32.00	19.41	11.77	7.14	4.33	2.63	1.59	0.97

a. Find an upper estimate for the speed when t = 7.

Since the acceleration is decreasing, an upper estimate for the velocity can be calculated using the largest acceleration in each interval. This acceleration corresponds to the value at the left endpoint.

Estimate the increase in velocity in each interval by assuming a constant acceleration equal to the left endpoint during that interval.

t	0-1	1-2	2-3	3-4	4-5	5-6	6-7
v	32.00	19.41	11.77	7.14	4.33	2.63	1.59

To determine the upper estimate for the speed when t = 7, add the estimated increases in velocity.

32.00 + 19.41 + 11.77 + 7.14 + 4.33 + 2.63 + 1.59 = 78.87 ft/sec

b. Find a lower estimate for the speed when t = 7.

Since the acceleration is decreasing, a lower estimate for the velocity can be calculated using the smallest acceleration in each interval. This acceleration corresponds to the value at the right endpoint.

Estimate the increase in velocity in each interval by assuming a constant acceleration equal to the right endpoint during that interval.

t	0-1	1-2	2-3	3-4	4-5	5-6	6-7
v	19.41	11.77	7.14	4.33	2.63	1.59	0.97

To determine the lower estimate for the speed when t = 7, add the estimated increases in velocity.

19.41 + 11.77 + 7.14 + 4.33 + 2.63 + 1.59 + 0.97 = 47.84 ft/sec

c. Find an upper estimate for the distance fallen when t = 3.

Using the upper estimates for velocity, find how far the object falls in each 1-second subinterval.

In the first 1-second subinterval, the object's velocity increases from 0 ft/sec to 32.00 ft / sec. Therefore, its velocity is 32.00 ft/sec for the first second it falls. Since it falls at a rate of 32.00 ft/s for 1 sec, the object falls 32.00 • 1 = 32.00 ft in the first second.

In the second 1-second subinterval, the object's velocity increases by 19.41 ft/sec. Since its velocity in the first 1-second subinterval was 32.00 ft/sec, its velocity in the second 1-second subinterval is 32.00 + 19.41 = 51.41 ft/sec.

Using the same reasoning as above, the object falls approximately 51.41 • 1 = 51.41 ft in the second 1-second subinterval.

In the third 1-second subinterval, the object's velocity increases by 11.77 ft/sec. Since its velocity in the second 1-second subinterval was 51.41, its velocity in the third 1-second subinterval is 51.41 + 11.77 = 63.18 ft/sec.

Using the same reasoning as above, the object falls approximately 63.18 • 1 = 63.18 ft in the third 1-second subinterval.

In the three 1-second subintervals, the object fell 32.00 ft, 51.41 ft, and 63.18 ft, respectively. Therefore, it fell a total distance of 32.00 + 51.41 + 63.18 = 146.59 ft in the first 3 seconds.