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Math 125

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Homework 1 – 5.1 Measuring Distance Traveled

Introduction:

For this chapter, I learned about how to calculate distance traveled, velocities. Bad and better estimate, underestimate and overestimate, left sum and right sum and the scientific way to address a formula.

Homework:

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1. Figure 5.11 shows the velocity of a car for $0 \le t \le 12$ and the rectangles used to estimate the distance traveled.

   (a) Do the rectangles represent a left or a right sum?
   (b) Do the rectangles lead to an upper or a lower estimate?
   (c) What is the value of n?
   (d) What is the value of Δt?
   (e) Give an approximate value for the estimate.

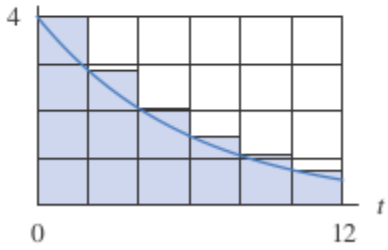

Figure 5.11

(a) Left Sum

(b) Upper estimate (Overestimate)

(c) 6

(d) $\Delta t = (12 - 0) / 6$
$= 2$

(e) Upper estimate (Overestimate) = 4 * 2 + 2.8 * 2 + 2 * 2 + 1.5 * 2 + 1.1 * 2 + 0.7 * 2 = 24.2

Lower estimate (Underestimate) = 2.8 * 2 + 2 * 2 + 1.5 * 2 + 1.1 * 2 + 0.7 * 2 + 0.5 * 2 = 17.2

3. Figure 5.13 shows the velocity of an object for $0 \le t \le 6$. Calculate the following estimates of the distance the object travels between $t = 0$ and $t = 6$, and indicate whether each result is an upper or lower estimate of the distance traveled.

(a) A left sum with $n = 2$ subdivisions
(b) A right sum with $n = 2$ subdivisions

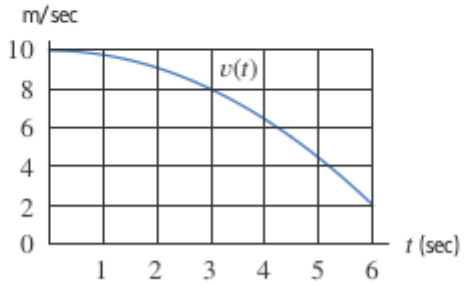

Figure 5.13

(a) Left sum (Upperestimate) = 10 * 2 + 9 * 2 + 6.5 * 2 = 51 meters

(b) Right sum (Underestimate) = 9 * 2 + 6.5 * 2 + 2 * 2 = 35 meters

5. Figure 5.15 shows the velocity, v, of an object (in meters/sec). Estimate the total distance the object traveled between $t = 0$ and $t = 6$.

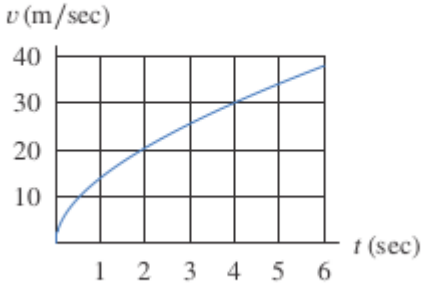

Figure 5.15

(a) $\Delta t = (6-0) / 6$
$= 1$

Upperestimate = 15 * 1 + 21 * 1 + 26 * 1 + 30 * 1 + 34 * 1 + 38 * 1 = 164 meters
Underestimate = 4 * 1 + 15 * 1 + 21 * 1 + 26 * 1 + 30 * 1 + 34 * 1 = 130 meters

Approximately the total distance the object traveled between t = 0 and t = 6 is 130 m ~ 164 m.

7. A bicyclist accelerates at a constant rate, from 0 ft/sec to 15 ft/sec in 10 seconds.

(a) Figure 5.17 shows the velocity of the bike while it is accelerating. What is the value of b in the figure?

(b) How far does the bike travel while it is accelerating?

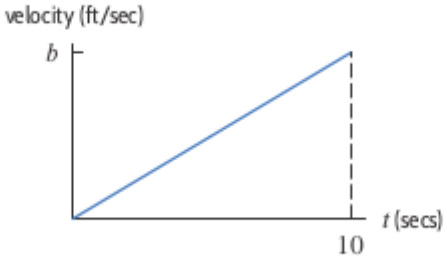

Figure 5.17

(a) b = 15 because b is on the 10th second.

(b) Becasue the cyclist accelerates at a constant rate, so I only have to calculate the value of the rectangle.

Thus, Distance = ½ vt = ½ * 15 * 10 = 75 meters.

9. A car slows down at a constant rate from 90 ft/sec to 20 ft/sec in 12 seconds.

(a) Figure 5.19 shows the velocity of the car while it is slowing down. What are the values of a, b and c in the figure?

(b) How far does the car travel while it is slowing down?

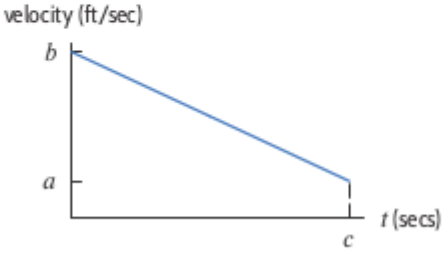

Figure 5.19

(a) According to the question, the car slows down from 90 ft/sec to 20 ft/sec in 12 seconds.

So, b = 90, a = 20, c = 12.

(b) Same as the previous question, Distance = ½ vt = ½ * (90 – 20) * 12 = 420 meters

11. The velocity $v(t)$ in Table 5.4 is decreasing, $2 \le t \le 12$. Using $n = 5$ subdivisions to approximate the total distance traveled, find

(a) An upper estimate **(b)** A lower estimate

Table 5.4

t	2	4	6	8	10	12
$v(t)$	44	42	41	40	37	35

(a) $\Delta t = (b - a) / n = (12 - 2) / 5 = 2$

Upperestimate = 44 * 2 + 42 * 2 + 41 * 2 + 40 * 2 + 37 * 2 = 408

(b) Lowerestimate = 42 * 2 + 41 * 2 + 40 * 2 + 37 * 2 + 35 * 2 = 390

13. Table 5.5 gives the ground speed of a small plane accelerating for takeoff. Find upper and lower estimates for the distance traveled by the plane during takeoff.

Table 5.5

Time (sec)	0	2	4	6	8	10
Speed (m/s)	2.7	2.7	4	6.3	8.5	11.6
Time (sec)	12	14	16	18	20	
Speed (m/s)	13.4	17.4	21.9	29.1	32.6	

(a) $\Delta t = (b - a) / n = (20 - 0) / 10 = 2$

Upperestimate = 2.7 * 2 + 4 * 2 + 6.3 * 2 + 8.5 * 2 + 11.6 * 2 + 13.4 * 2 +17.4 * 2 + 21.9 * 2 + 29.1 * 2 + 32.6 * 2 = 295.0 meters

(b) Lowerestimate = 2.7 * 2 + 2.7 * 2 + 4 * 2 + 6.3 * 2 + 8.5 * 2 + 11.6 * 2 + 13.4 * 2 +17.4 * 2 + 21.9 * 2 + 29.1 * 2 = 235.2 meters

23. Use the expressions for left and right sums on page 277 and Table 5.6.

(a) If $n = 4$, what is Δt? What are t_0, t_1, t_2, t_3, t_4? What are $f(t_0), f(t_1), f(t_2), f(t_3), f(t_4)$?

(b) Find the left and right sums using $n = 4$.

(c) If $n = 2$, what is Δt? What are t_0, t_1, t_2? What are $f(t_0), f(t_1), f(t_2)$?

(d) Find the left and right sums using $n = 2$.

Table 5.6

t	15	17	19	21	23
$f(t)$	10	13	18	20	30

(a) $\Delta t = (b - a) / n = (23 - 15) / 4 = 2$

t0 = 15, t1 = 17, t2 = 19, t3 = 21, t4 = 23
f(t0) = 10, f(t1) = 13, f(t2) = 18, f(t3) = 20. f(t4) = 30

(b) Leftestimate (Underestimate) = 10 * 2 + 13 * 2 + 18 * 2 + 20 * 2 = 122
Rightestimate (Overestimate) = 13 * 2 + 18 * 2 + 20 * 2 + 30 * 2 = 162

(c) $\Delta t = (b - a) / n = (23 - 15) / 2 = 4$
t0 = 15, t1 = 19, t2 = 23
f(t0) = 10, f(t1) = 18, f(t2) = 30

(d) Leftestimate (Underestimate) = 10 * 4 + 18 * 4 = 112
Rightestimate (Overestimate) = 18 * 4 + 30 * 4 = 192

Conclusion:

The amount of daily homework is massive… But it for sure helps me to get more familiar with the knowladge of chapter 5.1