

Math 10B. Lecture Examples.

Section 5.1. How do we measure distance traveled?[†]

Example 1 At 10:00 AM one morning a truck driver is 100 miles east of his home town. He drives 75 miles per hour toward the east for two hours to make a delivery. Next, he drives west at 50 miles per hour for two hours to make another delivery and then drives east at 50 miles per hour for two more hours. According to this mathematical model, his velocity toward the east is the step function of Figure 1 with $t = 0$ at 10 AM. (a) How far is he from his home town at $t = 6$? (b) How is the answer to part (a) related to the areas of the rectangles in Figure 2?

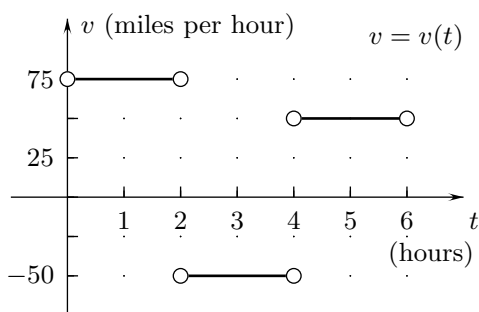


FIGURE 1

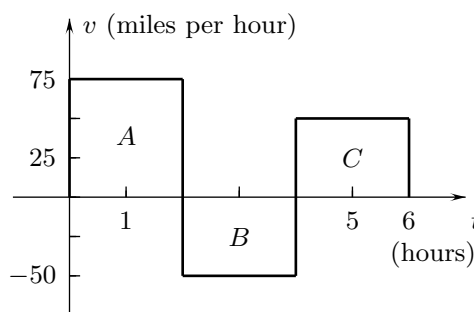


FIGURE 2

Answer: (a) At $t = 6$, the driver is 250 miles east of his home town. (b) His location at $t = 6$ equals his location at $t = 0$ plus the sum of the areas of rectangles A and C in Figure 2, minus the area of rectangle B .

Example 2 Suppose a water tank contains 300 gallons of water at time $t = 0$ (minutes) and that the rate of flow $r = r(t)$ (gallons per minute) into the tank for $0 \leq t \leq 70$ is the step function in Figure 3. How much water is in the tank at $t = 70$?

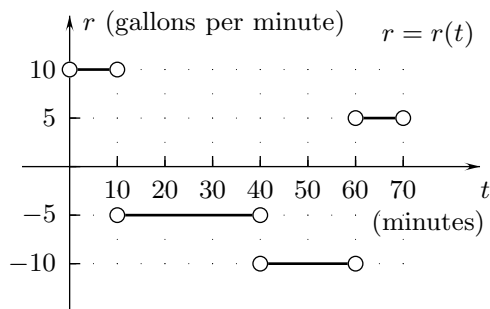


FIGURE 3

Answer: At $t = 70$ there are 100 gallons of water in the tank.

[†]Lecture notes to accompany Section 5.1 of *Calculus* by Hughes-Hallett et al.

Example 3 The step function $r = r(t)$ defined below gives the approximate rate of U.S. gasoline consumption, measured in millions of barrels per day, from the beginning of 1975 to the beginning of 1995. Based on this data, how much more gasoline was consumed in the U.S in the time period $1985 \leq t \leq 1995$ than in the time period $1975 \leq t \leq 1985$? (Disregard leap years and be careful with the units.)

$$r(t) = \begin{cases} 6.2 & \text{for } 1975 \leq t < 1980 \\ 5.8 & \text{for } 1980 \leq t < 1985 \\ 6.3 & \text{for } 1985 \leq t < 1990 \\ 6.5 & \text{for } 1990 \leq t < 1995 \end{cases}$$

Answer: 1460 million barrels more were produced in $1975 \leq t \leq 1985$ than in $1975 \leq t \leq 1985$.

Interactive Examples

Work the following Interactive Examples on Shenk's web page, <http://www.math.ucsd.edu/~ashenk/>:[‡]

Section 6.1: Examples 1 and 2

Section 6.6: Example 3

[‡]The chapter and section numbers on Shenk's web site refer to his calculus manuscript and not to the chapters and sections of the textbook for the course.