1. Consider the graph in Figure 5.1.

(a) Give an interval on which the left-hand sum approximation of the area under the curve on that interval is an underestimate.

(b) Give an interval on which the left-hand sum approximation of the area under the curve on that interval is an overestimate.

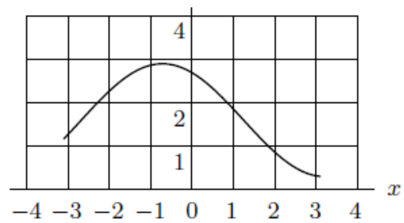

Figure 5.1

2. The velocities of two cyclists, traveling in the same direction, are given in Figure 5.2. If initially the two cyclists are alongside each other, when does Cyclist 2 overtake Cyclist 1?

(a) Between 0.75 and 1.25 minutes
(b) Between 1.25 and 1.75 minutes
(c) Between 1.75 and 2.25 minutes

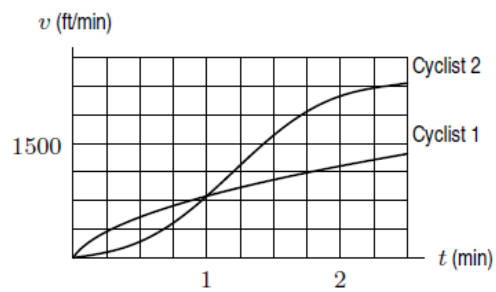

Figure 5.2

3. A bicyclist starts from home and rides back and forth along a straight east/west highway. Her velocity is given in Figure 5.6 (positive velocities indicate travel toward the east, negative toward the west).

(a) On what time intervals is she stopped?
(b) How far from home is she the first time she stops, and in what direction?
(c) At what time does she bike past her house?
(d) If she maintains her velocity at $t = 11$, how long will it take her to get back home?

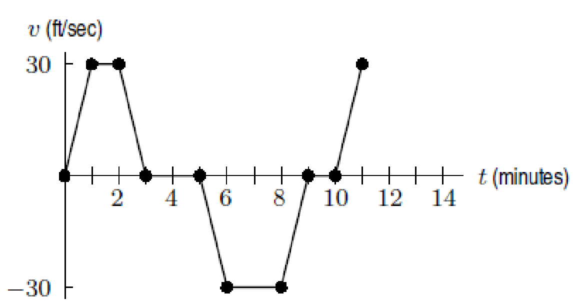

Figure 5.6

Solutions:

1

ANSWER:

(a) $[-3, -1]$ because the function is increasing there.
(b) $[0, 3]$ because the function is decreasing there.

2.

ANSWER:

(b). Between 1.25 and 1.75 minutes, because the area under the two curves is about equal at some point in this interval.

3.

ANSWER:

(a) On $[3, 5]$ and on $[9, 10]$, since $v = 0$ there.
(b) 3600 feet to the east, since this is the area under the velocity curve between $t = 0$ and $t = 3$.
(c) At $t = 8$ minutes, since the areas above and below the curve between $t = 0$ and $t = 8$ are equal.
(d) It will take her 30 seconds longer. By calculating areas, we see that at $t = 11$,

$$\text{Distance from home } = 2 \cdot 30 \cdot 60 - 3 \cdot 30 \cdot 60 + 0.5 \cdot 30 \cdot 60 = -900 \text{ feet.}$$

Thus, at $t = 11$, she is 900 feet west of home. At a velocity of 30 ft/sec eastward, it takes $900/30 = 30$ seconds to get home.