

## Section 5.2

1. (a) Right sum.

(b) Highlighted area is larger than the area under the curve. Sum represents an overestimate.

(c)  $n = 3$ .

(d)  $6/3 = 2$ .

3. Dividing the interval from 0 to 6 into 2 equal subintervals gives  $\Delta x = 3$ . Using  $f(x) = 2^x$ , we have

$$\begin{aligned}\text{Left-hand sum} &= f(0) \cdot \Delta x + f(3) \cdot \Delta x \\ &= 2^0 \cdot 3 + 2^3 \cdot 3 \\ &= 27.\end{aligned}$$

7. We estimate  $\int_0^{40} f(x)dx$  using left- and right-hand sums:

$$\text{Left sum} = 350 \cdot 10 + 410 \cdot 10 + 435 \cdot 10 + 450 \cdot 10 = 16,450.$$

$$\text{Right sum} = 410 \cdot 10 + 435 \cdot 10 + 450 \cdot 10 + 460 \cdot 10 = 17,550.$$

We estimate that

$$\int_0^{40} f(x)dx \approx \frac{16450 + 17550}{2} = 17,000.$$

In this estimate, we used  $n = 4$  and  $\Delta x = 10$ .

9.

Since we are given a table of values, we must use Riemann sums to approximate the integral. Values are given every 0.2 units, so  $\Delta t = 0.2$  and  $n = 5$ . Our best estimate is obtained by calculating the left-hand and right-hand sums, and then averaging the two.

$$\text{Left-hand sum} = 25(0.2) + 23(0.2) + 20(0.2) + 15(0.2) + 9(0.2) = 18.4$$

$$\text{Right-hand sum} = 23(0.2) + 20(0.2) + 15(0.2) + 9(0.2) + 2(0.2) = 13.8.$$

We average the two sums to obtain our best estimate of the integral:

$$\int_3^4 W(t)dt \approx \frac{18.4 + 13.8}{2} = 16.1.$$

11.

$\int_0^{20} f(x) dx$  is equal to the area shaded. We can use Riemann sums to estimate the area, or we can count grid squares in Figure 5.14. There are about 15 grid squares and each grid square represents 4 square units, so the area shaded is about 60. We have  $\int_0^{20} f(x) dx \approx 60$ .

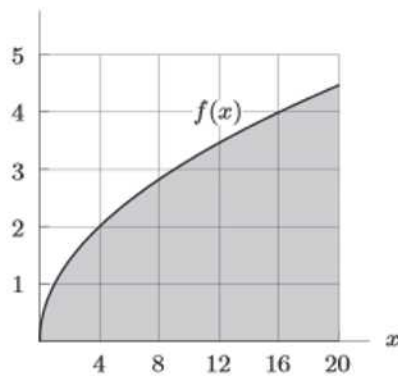


Figure 5.14

15.

The integral represents the area below the graph of  $f(x)$  but above the  $x$ -axis. Since each square has area 1, by counting squares and half-squares we find

$$\int_1^6 f(x) dx = 8.5.$$

21.  $\int_{1.1}^{1.7} e^t \ln t dt = 0.865$

22.  $\int_0^3 \ln(y^2 + 1) dy \approx 3.406$

25. Since the integrals are the same, the total value is 0.