39. Let $A(x) = \int_0^x f(t)\,dt$, with $f(x)$ as in Figure 11.

(a) Does $A(x)$ have a local maximum at P?

(b) Where does $A(x)$ have a local minimum?

(c) Where does $A(x)$ have a local maximum?

(d) True or false? $A(x) < 0$ for all x in the interval shown.

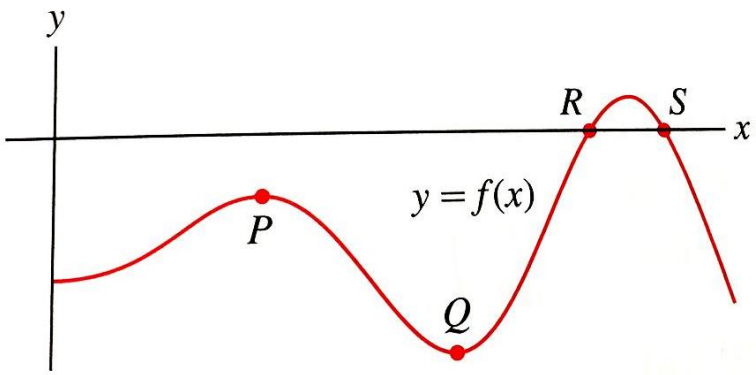

FIGURE 11 Graph of $f(x)$.

In Exercises 43–44, let $A(x) = \int_a^x f(t)\,dt$.

43. **Area Functions and Concavity** Explain why the following statements are true. Assume $f(x)$ is differentiable.

(a) If c is an inflection point of $A(x)$, then $f'(c) = 0$.

(b) $A(x)$ is concave up if $f(x)$ is increasing.

(c) $A(x)$ is concave down if $f(x)$ is decreasing.

45. Let $A(x) = \int_0^x f(t)\,dt$, with $f(x)$ as in Figure 12. Determine:

(a) The intervals on which $A(x)$ is increasing and decreasing

(b) The values x where $A(x)$ has a local min or max

(c) The inflection points of $A(x)$

(d) The intervals where $A(x)$ is concave up or concave down

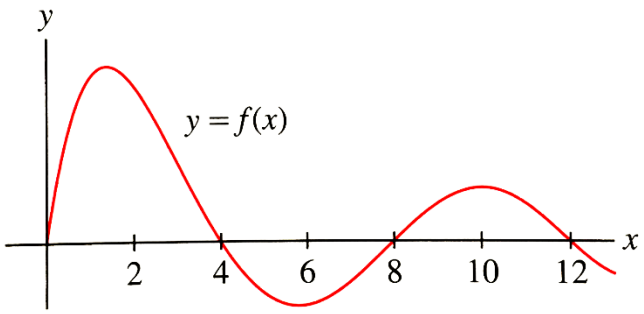

FIGURE 12

3. A survey shows that a mayoral candidate is gaining votes at a rate of $2000t + 1000$ votes per day, where t is the number of days since she announced her candidacy. How many supporters will the candidate have after 60 days, assuming that she had no supporters at $t = 0$?

5. Find the displacement of a particle moving in a straight line with velocity $v(t) = 4t - 3$ m/s over the time interval $[2, 5]$.

39. **(a)** $A(x)$ does not have a local maximum at P.
(b) $A(x)$ has a local minimum at R.
(c) $A(x)$ has a local maximum at S.
(d) True.

43. **(a)** If $x = c$ is an inflection point of $A(x)$, then $A''(c) = f'(c) = 0$.
(b) If $A(x)$ is concave up, then $A''(x) > 0$. Since $A(x)$ is the area function associated with $f(x)$, $A'(x) = f(x)$ by FTC II, so $A''(x) = f'(x)$. Therefore $f'(x) > 0$, so $f(x)$ is increasing.
(c) If $A(x)$ is concave down, then $A''(x) < 0$. Since $A(x)$ is the area function associated with $f(x)$, $A'(x) = f(x)$ by FTC II, so $A''(x) = f'(x)$. Therefore, $f'(x) < 0$ and so $f(x)$ is decreasing.

45. **(a)** $A(x)$ is increasing on the intervals $(0, 4)$ and $(8, 12)$ and is decreasing on the intervals $(4, 8)$ and $(12, \infty)$.
(b) Local minimum: $x = 8$; local maximum: $x = 4$ and $x = 12$.
(c) $A(x)$ has inflection points at $x = 2$, $x = 6$, and $x = 10$.
(d) $A(x)$ is concave up on the intervals $(0, 2)$ and $(6, 10)$ and is concave down on the intervals $(2, 6)$ and $(10, \infty)$.

3. 3,660,000 **5.** 33 meters