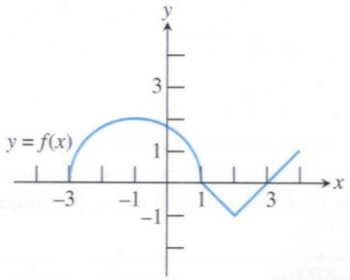
# AP Calculus – Chapter 5 – Integral and Area Under Curve Review

**54.** The graph of a function $f$ consists of a semicircle and two line segments as shown below.




Let g(x) = $\int_1^x f(t)dt$.

a) Find g(1) b) Find g(3) c) Find g(-1)

d) Find all values of x on the open interval (-3, 4) at which g has a relative maximum.

e) Write an equation for the tangent line to the graph of g at x = -1.

f) Find the x-coordinate of each point of inflection of the graph of g on the open interval (-3, 4).

## AP *Examination Preparation

You may use a graphing calculator to solve the following problems.

**58.** The rate at which water flows out of a pipe is given by a differentiable function $R$ of time $t$. The table below records the rate at 4-hour intervals for a 24-hour period.

| $t$ (hours) | $R(t)$ (gallons per hour) |
|---|---|
| 0 | 9.6 |
| 4 | 10.3 |
| 8 | 10.9 |
| 12 | 11.1 |
| 16 | 10.9 |
| 20 | 10.5 |
| 24 | 9.6 |

(a) Use the Trapezoidal Rule with 6 subdivisions of equal length to approximate $\int_0^{24} R(t)\,dt$. Explain the meaning of your answer in terms of water flow, using correct units.

(b) Is there some time $t$ between 0 and 24 such that $R'(t) = 0$? Justify your answer.

(c) Suppose the rate of water flow is approximated by $Q(t) = 0.01(950 + 25x - x^2)$. Use $Q(t)$ to approximate the average rate of water flow during the 24-hour period. Indicate units of measure.

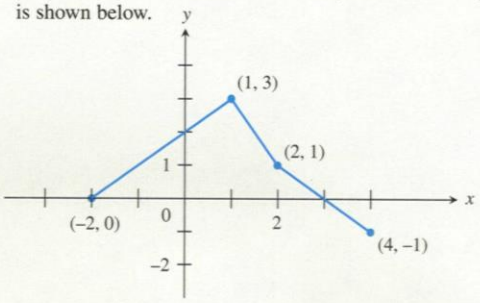
**59.** Let $f$ be a differentiable function with the following properties.

**i.** $f'(x) = ax^2 + bx$ **ii.** $f'(1) = -6$ and $f''(x) = 6$

**iii.** $\int_1^2 f(x)\,dx = 14$

Find $f(x)$. Show your work.

**60.** The graph of the function $f$, consisting of three line segments, is shown below.




Let $g(x) = \int_1^x f(t)\,dt$.

(a) Compute $g(4)$ and $g(-2)$.

(b) Find the instantaneous rate of change of $g$, with respect to $x$, at $x = 2$.

(c) Find the absolute minimum value of $g$ on the closed interval $[-2, 4]$. Justify your answer.

(d) The second derivative of $g$ is not defined at $x = 1$ and $x = 2$. Which of these values are $x$-coordinates of points of inflection of the graph of $g$? Justify your answer.