Work for problem 4(a)

\[ g(6) = 5 + \int_{6}^{9} f(t) \, dt = 5 \]

\[ g'(6) = f(6) = 3 \]

\[ g''(6) = f'(6) = 0 \]

Work for problem 4(b)

\[ g'(x) = \frac{d}{dx} \int_{6}^{9} f(t) \, dt = f(x) \]

\[ g \text{ decreases when } f(x) < 0 \]

\[-3 < x < 0 , \quad 12 < x < 15\]
Work for problem 4(c)

\[ g''(x) = f''(x) < 0 \]

\[ f'(x) < 0 \text{ when } f(x) \text{ is decreasing} \]

\[ 6 < x < 15 \]

Work for problem 4(d)

\[
3 \times \left( \frac{-1+0}{2} \right) + 3 \times \left( \frac{0+1}{2} \right) + 3 \times \left( \frac{1+3}{2} \right) + 3 \times \left( \frac{3+1}{2} \right) + 3 \times \left( \frac{1+0}{2} \right) + 3 \times \left( \frac{0+(-1)}{2} \right)
\]

\[ = 3 \times 4 = 12 \]
NO CALCULATOR ALLOWED

CALCULUS
SECTION II, Part B
Time—45 minutes
Number of problems—3

No calculator is allowed for these problems.

Graph of $f$

Work for problem 4(a)

\[ g(6) = 5 + \int_{6}^{15} f(t) \, dt = 0 \]
\[ g'(x) = f(x) \]
\[ \therefore g'(6) = f(6) = 3 \]
\[ g''(6) = f'(6) = 0 \]

Work for problem 4(b)

\[ g'(x) = f(x) \text{ from } g'(x) = 0 + \frac{dg}{dx} \left[ \int_{6}^{x} f(t) \, dt \right] \]
\[ f(x) < 0 \text{ on } -3 < t < 0 \text{ and } 12 < t < 15 \]
\[ \therefore g(x) \text{ is decreasing on } -3 < t < 0 \text{ and } 12 < t < 15 \]
Work for problem 4(c)

\[ g''(x) = f'(x) \]

\[ f'(x) \text{ co on } 6 < t < 15 \]

\[ : \ g(x) \text{ is concave down on } 6 < t < 15 \]

Work for problem 4(d)

\[ A \approx \frac{18}{12} \left( 1 - 1 \right) + \left( 1 \right) \left( 2 \right) + \left( 3 \right) \left( 2 \right) + \left( 1 \right) \left( 2 \right) + \left( 1 - 1 \right) \]

\[ \approx \frac{18}{12} \left( 12 \right) \approx 18 \text{ squared units} \]