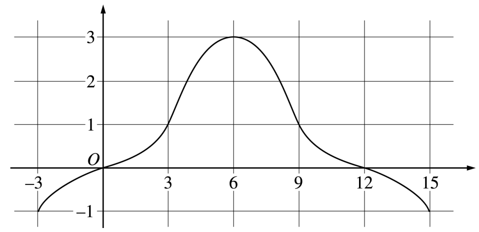
AP® CALCULUS AB
2002 SCORING GUIDELINES (Form B)

Question 4

The graph of a differentiable function f on the closed interval $[-3,15]$ is shown in the figure above. The graph of f has a horizontal tangent line at $x=6$. Let $g(x) = 5 + \int_6^x f(t)\,dt$ for $-3 \le x \le 15$.



Graph of f

(a) Find $g(6)$, $g'(6)$, and $g''(6)$.

(b) On what intervals is g decreasing? Justify your answer.

(c) On what intervals is the graph of g concave down? Justify your answer.

(d) Find a trapezoidal approximation of $\int_{-3}^{15} f(t)\,dt$ using six subintervals of length $\Delta t = 3$.

(a) $g(6) = 5 + \int_6^6 f(t)\,dt = 5$

$g'(6) = f(6) = 3$

$g''(6) = f'(6) = 0$

3 $\begin{cases} 1 : g(6) \\ 1 : g'(6) \\ 1 : g''(6) \end{cases}$

(b) g is decreasing on $[-3,0]$ and $[12,15]$ since $g'(x) = f(x) < 0$ for $x < 0$ and $x > 12$.

3 $\begin{cases} 1 : [-3,0] \\ 1 : [12,15] \\ 1 : \text{justification} \end{cases}$

(c) The graph of g is concave down on $(6,15)$ since $g' = f$ is decreasing on this interval.

2 $\begin{cases} 1 : \text{interval} \\ 1 : \text{justification} \end{cases}$

(d) $\frac{3}{2}(-1 + 2(0+1+3+1+0) - 1)$
$= 12$

1 : trapezoidal method