P3 Rubric

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f(g) f' g'

AP® CALCULUS AB
2016 SCORING GUIDELINES

Question 6

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	–6	3	2	8
2	2	–2	–3	0
3	8	7	6	2
6	4	5	3	–1

The functions f and g have continuous second derivatives. The table above gives values of the functions and their derivatives at selected values of x.

(a) Let $k(x) = f(g(x))$. Write an equation for the line tangent to the graph of k at $x = 3$.

(b) Let $h(x) = \dfrac{g(x)}{f(x)}$. Find $h'(1)$.

(c) Evaluate $\int_1^3 f''(2x)\,dx$.

(a) $k(3) = f(g(3)) = f(6) = 4$
$k'(3) = f'(g(3)) \cdot g'(3) = f'(6) \cdot 2 = 5 \cdot 2 = 10$

An equation for the tangent line is $y = 10(x - 3) + 4$.

3 : { 2 : slope at $x = 3$; 1 : equation for tangent line }

(b) $h'(1) = \dfrac{f(1) \cdot g'(1) - g(1) \cdot f'(1)}{(f(1))^2}$
$= \dfrac{(-6) \cdot 8 - 2 \cdot 3}{(-6)^2} = \dfrac{-54}{36} = -\dfrac{3}{2}$

3 : { 2 : expression for $h'(1)$; 1 : answer }

(c) $\int_1^3 f''(2x)\,dx = \dfrac{1}{2}\left[f'(2x)\right]_1^3 = \dfrac{1}{2}[f'(6) - f'(2)]$
$= \dfrac{1}{2}[5 - (-2)] = \dfrac{7}{2}$

3 : { 2 : antiderivative ; 1 : answer }