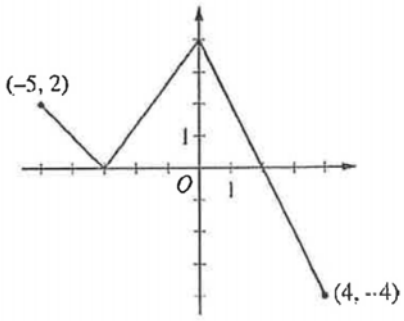
# P7 Rubric

Monday, April 3, 2017 1:57 PM

## AP® CALCULUS AB/CALCULUS BC
## 2014 SCORING GUIDELINES

### Question 3

The function $f$ is defined on the closed interval $[-5, 4]$. The graph of $f$ consists of three line segments and is shown in the figure above. Let $g$ be the function defined by $g(x) = \int_{-3}^{x} f(t)\,dt$.



Graph of $f$

(a) Find $g(3)$.

(b) On what open intervals contained in $-5 < x < 4$ is the graph of $g$ both increasing and concave down? Give a reason for your answer.

(c) The function $h$ is defined by $h(x) = \frac{g(x)}{5x}$. Find $h'(3)$.

(d) The function $p$ is defined by $p(x) = f\left(x^2 - x\right)$. Find the slope of the line tangent to the graph of $p$ at the point where $x = -1$.

---

(a) $g(3) = \int_{-3}^{3} f(t)\,dt = 6 + 4 - 1 = 9$

1 : answer

(b) $g'(x) = f(x)$

The graph of $g$ is increasing and concave down on the intervals $-5 < x < -3$ and $0 < x < 2$ because $g' = f$ is positive and decreasing on these intervals.

2 : { 1 : answer; 1 : reason }

(c) $h'(x) = \frac{5xg'(x) - g(x)5}{(5x)^2} = \frac{5xg'(x) - 5g(x)}{25x^2}$

$h'(3) = \frac{(5)(3)g'(3) - 5g(3)}{25 \cdot 3^2}$

$= \frac{15(-2) - 5(9)}{225} = \frac{-75}{225} = -\frac{1}{3}$

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

(d) $p'(x) = f'\left(x^2 - x\right)(2x - 1)$

$p'(-1) = f'(2)(-3) = (-2)(-3) = 6$

3 : { 2 : $p'(x)$; 1 : answer }