

**AP<sup>®</sup> CALCULUS AB/CALCULUS BC  
2017 SCORING GUIDELINES**

**Question 3**

(a)  $f(-6) = f(-2) + \int_{-2}^{-6} f'(x) dx = 7 - \int_{-6}^{-2} f'(x) dx = 7 - 4 = 3$

$$f(5) = f(-2) + \int_{-2}^5 f'(x) dx = 7 - 2\pi + 3 = 10 - 2\pi$$

(b)  $f'(x) > 0$  on the intervals  $[-6, -2]$  and  $(2, 5)$ .

Therefore,  $f$  is increasing on the intervals  $[-6, -2]$  and  $[2, 5]$ .

(c) The absolute minimum will occur at a critical point where  $f'(x) = 0$  or at an endpoint.

$$f'(x) = 0 \Rightarrow x = -2, x = 2$$

$x$	$f(x)$
-6	3
-2	7
2	$7 - 2\pi$
5	$10 - 2\pi$

The absolute minimum value is  $f(2) = 7 - 2\pi$ .

(d)  $f'''(-5) = \frac{2 - 0}{-6 - (-2)} = -\frac{1}{2}$

$$\lim_{x \rightarrow 3^-} \frac{f'(x) - f'(3)}{x - 3} = 2 \text{ and } \lim_{x \rightarrow 3^+} \frac{f'(x) - f'(3)}{x - 3} = -1$$

$f''(3)$  does not exist because

$$\lim_{x \rightarrow 3^-} \frac{f'(x) - f'(3)}{x - 3} \neq \lim_{x \rightarrow 3^+} \frac{f'(x) - f'(3)}{x - 3}.$$

3 :  $\left\{ \begin{array}{l} 1 : \text{uses initial condition} \\ 1 : f(-6) \\ 1 : f(5) \end{array} \right.$

2 : answer with justification

2 :  $\left\{ \begin{array}{l} 1 : \text{considers } x = 2 \\ 1 : \text{answer with justification} \end{array} \right.$

2 :  $\left\{ \begin{array}{l} 1 : f'''(-5) \\ 1 : f'''(3) \text{ does not exist,} \\ \text{with explanation} \end{array} \right.$