

AP[®] CALCULUS AB/CALCULUS BC
2019 SCORING GUIDELINES

Question 3

(a) $\int_{-6}^5 f(x) dx = \int_{-6}^{-2} f(x) dx + \int_{-2}^5 f(x) dx$
 $\Rightarrow 7 = \int_{-6}^{-2} f(x) dx + 2 + \left(9 - \frac{9\pi}{4}\right)$
 $\Rightarrow \int_{-6}^{-2} f(x) dx = 7 - \left(11 - \frac{9\pi}{4}\right) = \frac{9\pi}{4} - 4$

(b) $\int_3^5 (2f'(x) + 4) dx = 2\int_3^5 f'(x) dx + \int_3^5 4 dx$
 $= 2(f(5) - f(3)) + 4(5 - 3)$
 $= 2(0 - (3 - \sqrt{5})) + 8$
 $= 2(-3 + \sqrt{5}) + 8 = 2 + 2\sqrt{5}$

— OR —

$$\int_3^5 (2f'(x) + 4) dx = [2f(x) + 4x]_{x=3}^{x=5}$$

$$= (2f(5) + 20) - (2f(3) + 12)$$

$$= (2 \cdot 0 + 20) - (2(3 - \sqrt{5}) + 12)$$

$$= 2 + 2\sqrt{5}$$

(c) $g'(x) = f(x) = 0 \Rightarrow x = -1, x = \frac{1}{2}, x = 5$

x	$g(x)$
-2	0
-1	$\frac{1}{2}$
$\frac{1}{2}$	$-\frac{1}{4}$
5	$11 - \frac{9\pi}{4}$

On the interval $-2 \leq x \leq 5$, the absolute maximum value of g is $g(5) = 11 - \frac{9\pi}{4}$.

(d) $\lim_{x \rightarrow 1} \frac{10^x - 3f'(x)}{f(x) - \arctan x} = \frac{10^1 - 3f'(1)}{f(1) - \arctan 1}$
 $= \frac{10 - 3 \cdot 2}{1 - \arctan 1} = \frac{4}{1 - \frac{\pi}{4}}$

$$3 : \begin{cases} 1 : \int_{-6}^5 f(x) dx = \int_{-6}^{-2} f(x) dx + \int_{-2}^5 f(x) dx \\ 1 : \int_{-2}^5 f(x) dx \\ 1 : \text{answer} \end{cases}$$

$$2 : \begin{cases} 1 : \text{Fundamental Theorem of Calculus} \\ 1 : \text{answer} \end{cases}$$

$$3 : \begin{cases} 1 : g'(x) = f(x) \\ 1 : \text{identifies } x = -1 \text{ as a candidate} \\ 1 : \text{answer with justification} \end{cases}$$

1 : answer