DATE: ____________

2^{nd} Fundamental Theorem of Calculus: Multiple-Choice Practice

1. $\dfrac{d}{dx}\displaystyle\int_{-17}^{x} t\cos\left(t^2\right)\,dt =$ $x \cos x^2$ (by 2nd FTC)

(A) $\dfrac{1}{2}\sin x^2 - \dfrac{1}{2}\sin\left(-17^2\right)$
(B) $x\cos(x^2) - (-17)\cos(-17^2)$
(C) $\dfrac{1}{2}\sin x^2$
$\boxed{\textbf{(D)}\ x\cos(x^2)}$
(E) None of the above

2. If $F(x) = \displaystyle\int_{\pi}^{x} e^{2t}\sin^2(3t)\,dt$, then $F'(x) =$ $\dfrac{d}{dx}\displaystyle\int_{\pi}^{x} e^{2t}\sin^2(3t)\,dt$

$= e^{2x}\sin^2(3x)$

by 2nd FTC

$\boxed{\textbf{(A)}\ e^{2x}\sin^2(3x)}$
(B) $\displaystyle\int_{\pi}^{x} e^{2t}\sin^2(3t)\,dt - \int_{\pi}^{x} e^{2\pi}\sin^2(3\pi)\,dt$
(C) $e^{2\pi}\sin^2(3x)$
(D) 0
(E) None of the above

3. $\dfrac{d}{dx}\underbrace{\displaystyle\int_{-3}^{1}\left(2t^3+3\right)dt}_{\text{constant}} =$ $\dfrac{d}{dx}(\text{constant}) = 0$

(A) $2t^3+3$
(B) 56
(C) 5
(D) -28
$\boxed{\textbf{(E)}\ 0}$

4. If $F(x) = \displaystyle\int_{7}^{x} t^2\sin(t)\,dt$, then $F'\left(\dfrac{5\pi}{2}\right) =$

(A) 0
(B) 29.493
$\boxed{\textbf{(C)}\ 61.685}$
(D) $x^2\sin(x)$
(E) None of the above

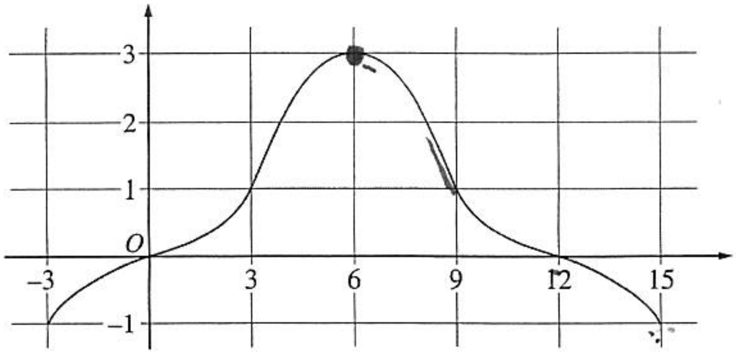
$F'(x) = \dfrac{d}{dx}\displaystyle\int_{7}^{x} t^2 \sin t\,dt$

$F'(x) = x^2 \sin x$

$F'\left(\frac{5\pi}{2}\right) = \left(\frac{5\pi}{2}\right)^2 \sin\frac{5\pi}{2}$

2^{nd} Fundamental Theorem of Calculus: Free-Response Practice

No calculator is allowed for these problems.



Graph of f

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 $-3 \le x \le 15$.

   (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.

a) $g(6) = 5 + \int_6^6 f(t)\,dt$ $\quad g'(6) = f(6)$ $\quad g'(x) = \frac{d}{dx}\left(5 + \int_6^x f(t)\,dt\right)$

$= 5 + 0$ $\quad g'(6) = 3$ $\quad = \frac{d}{dx}\int_6^x f(t)\,dt$

$= 5$

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

$g''(6) = f'(6)$ $\quad g''(x) = f'(x)$

$g''(6) = 0$

b) g dec when $g'(x) < 0$. Since $g'(x) = f(x)$
find where $f(x) < 0$

g dec on $[-3, 0) \cup (12, 15]$ b/c $g'(x) = f(x) < 0$ on these intervals

c) g concave down when $g''(x) < 0$. Since $g''(x) = f'(x)$
find where $f'(x) < 0$

f(x) dec

g concave down on $(6, 15)$

b/c $g''(x) = f'(x) < 0$ on that interval