C12 - 5.0 - Fundamental Theorem Part II/AP Notes

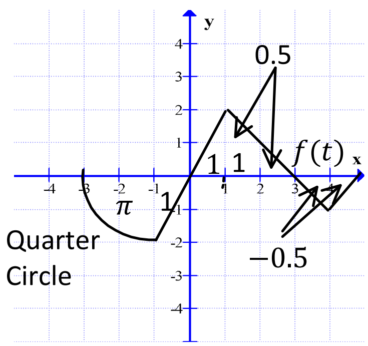
$$\frac{d}{dx}\int_0^x x^2\,dx = x^2 \times 1 - 0^2 \times 0$$
$$= x^2$$

Taking a Derivative of an Integral Cancels each other out*
Substitute the Upper Limit
Multiply by the Derivative of the Upper Limit
Substitute the Lower Limit
Multiply by the Derivative of the Lower Limit

$$\frac{d}{dx}\int_0^{x^2} (x+2)\,dx = (x^2+2)\times 2x - (0-2)\times 0$$
$$= 2x(x^2+2)$$

$$\frac{d}{dx}\int_1^{x^2} \frac{sint}{t}\,dt = \frac{sinx^2}{x^2}\times 2x - \frac{sin1}{1}\times 0$$
$$= \frac{2sinx^2}{x}$$

$$\int_1^b \frac{1}{x^2}\,dx = -\frac{1}{x}\Big|_1^b$$
$$-\frac{1}{b} - \left(-\frac{1}{1}\right)$$
$$-\frac{1}{b} + 1$$



$$g(x) = \int_1^x f(t)\,dt$$

$$g(3) = \int_1^3 f(t)\,dt = 1 + 0.5 + 0.5 = 2$$

$$g(-3) = \int_1^{-3} f(t)\,dt = -\int_{-3}^{1} f(t)\,dt = -(-\pi - 1 + 1) = \pi$$

$$g'(3) = \frac{d}{dx}\int_1^3 f(t)\,dt$$
$$= f(3) = 0$$

$$g''(3) = \frac{d}{dx}\frac{d}{dx}\int_1^3 f(t)\,dt$$
$$= f'(x) = -1$$

$$g(x) = \int f(t)dt$$
$$g'(x) = f(t)$$
$$g''(x) = f'(t)$$

t	$g(x)$	$g'(x)$	$g''(x)$
-3	π	0	und
-1	0	-2	und
0	-1	0	2
1	0	2	und
2	1.5	1.5	-1
3	2	0	-1
4	1.5	-1	und
5	1	0	1

$g(x)\ CP$ $\quad g'(x) = 0$ $\longrightarrow$ $f(x) = 0$

$\& \ g'(x) > 0 \rightarrow g'(x) < 0$ — Loc Max $x = 3$ — $\& \ f(x) > 0 \rightarrow f(x) < 0$

OR $\& \ g'(x) < 0 \rightarrow g'(x) > 0$ — $x = 0$ Loc Min — $\& \ f(x) < 0 \rightarrow f(x) > 0$

$g(x)\ IP$ $\quad g''(x) = 0$ $\longrightarrow$ $f'(x) = 0$

$\& \ g''(x) > 0 \rightarrow g''(x) < 0$ — $x = 1$ — $\& \ f'(x) > 0 \rightarrow f'(x) < 0$

OR $\& \ g''^{(x)} < 0 \rightarrow g''(x) > 0$ — $x = -1,4$ — $\& \ f'(x) < 0 \rightarrow f'(x) > 0$

Check Endpoints

$g(x)\ Abs\ Max$

$(-3, \pi)$