2nd Fundamental Theorem of Calculus

Make a Connection….

1. Given $g(x) = \int_3^x (t^2 - 2)\, dt$, find $g'(x)$.

2. In problem #1, can you see a connection between $g(x)$ and $g'(x)$? If yes, find $g'(x)$ in one step for each problem below.

a) $g(x) = \int_4^x (3t^2 - 2)\, dt$ b) $g(x) = \int_5^x (3t^2 - 2t)\, dt$

3. For $g(x) = \int_3^{x^2} (t^2 - 2)\, dt$, $g'(x) = 2x^5 - 4x$. Does your method apply to this problem? If not, how can you fix your method?

2nd FTC

If f is continuous on $[a, b]$ and

$$F(x) = \int_a^x f(t)\, dt \qquad \forall x \text{ in } [a, b]$$

then

and if $\qquad F(x) = \int_a^{g(x)} f(t)\, dt \qquad \forall x \text{ in } [a, b]$

then

Example 1:

Find $F'(x)$ where $F(x) = \int_x^\pi \sqrt{1 + \sec t}\, dt$.

Example 2:

If $h(x) = \int_1^{\tan x} \sqrt{t + \sqrt{t}}\, dt$, find $h'(x)$.

Example 3:

Given $y = \int_{e^x}^0 \sin^3 t\, dt$, find $\frac{dy}{dx}$.

Example 4:

Find $\frac{d}{dx} \int_4^{3x} \cos t\, dt$.

Example 5:

If $g(x) = \int_{2x}^{3x} \frac{t^2 - 1}{t^2 + 1}\, dt$, find $g'(x)$.