Student: Arfaz Hossain **Date:** 12/05/21	**Instructor:** UVIC Math **Course:** MATH 100 (A01, A02, A03) Fall 2021 **Assignment:** Assignment 10

Find $\frac{dy}{dx}$ for $y = \left(\int_0^x \left(t^2+1\right)^3 dt\right)^8$.

Let $u = \int_0^x \left(t^2+1\right)^3 dt$, so that $y = u^8$, and apply the chain rule $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$.

The derivative of y with respect to u is $\frac{dy}{du} = 8u^7$.

The derivative of u with respect to x is $\frac{du}{dx} = \frac{d}{dx}\int_0^x \left(t^2+1\right)^3 dt$.

Part 1 of the Fundamental Theorem of Calculus states that $F'(x) = \frac{d}{dx}\int_a^x f(t)dt = f(x)$.

$$\frac{du}{dx} = \left(x^2+1\right)^3$$

Thus, $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx} = 8u^7\left(x^2+1\right)^3$. Substitute $u = \int_0^x \left(t^2+1\right)^3 dt$ into the equation.

$$\frac{dy}{dx} = 8\left(x^2+1\right)^3\left(\int_0^x \left(t^2+1\right)^3 dt\right)^7$$