Name:____

Professors name:____

Due date: 10/23

In this Quiz, we will generalize the Fundamental Theorem of Calculus, Part 1 (FTC1).

1. Write the FTC1 for the area function $A(x) = \int_a^x f(t)\ dt$ (where a is a real number.) Then use the FTC1 to evaluate $\frac{d}{dx}\left(\int_a^x t^2\ dt\right)$.
2. Use the FTC1 and rules of integration to show $\frac{d}{dx}\left(\int_x^a f(t)\ dt\right) = -f(x)$. Then, use this result to evaluate $\frac{d}{dx}\left(\int_x^a t^2\ dt\right)$.
3. Let $A(x) = \int_a^x f(t)\ dt$ (the area function) and $g(x)$ be a differentiable function. Write out the composition $h(x) = A(g(x))$. Then, use the chain rule on $h'(x)$ to find $\frac{d}{dx}\left(\int_a^{g(x)} f(t)\ dt\right)$. Use this result to evaluate $\frac{d}{dx}\left(\int_a^{\sin(x)} t^2\ dt\right)$.
4. Notice that $\int_{k(x)}^{j(x)} f(t)\ dt = \int_{k(x)}^{a} f(t)\ dt + \int_a^{j(x)} f(t)\ dt$ for any real number a (this is a rule of integration). Use this fact and all the above to give a formula for $\frac{d}{dx}\left(\int_{h(x)}^{j(x)} f(t)\ dt\right)$, which has no integral signs.
5. Let $T(x) = \int_{\cos(x)}^{\sin(x)} t^2\ dt$. Use the previous part to show that $T'\left(-\frac{\pi}{4}\right) = 0$