October 9

SWBAT:

Derive the second part of Fundamental Theorem of Calculus

$$\int_{\frac{8}{27}}^{1} \frac{10t^{4/3}-8t^{1/3}}{t^2}\,dt = \int_{\frac{8}{27}}^{1} \frac{10t^{4/3}}{t^2} - \frac{8t^{1/3}}{t^2}\,dt$$

$$= \int_{\frac{8}{27}}^{1} 10t^{-2/3} - 8t^{-5/3}\,dt = 30t^{1/3} + 12t^{-2/3}\Big|_{\frac{8}{27}}^{1}$$

$$\frac{d}{dx}(?) = 10t^{-2/3} - 8t^{-5/3}$$

$$? = \frac{10t^{1/3}}{\frac{1}{3}} - \frac{8t^{-2/3}}{-\frac{2}{3}}$$

$$= 30t^{1/3} + \frac{3}{2}(8)t^{-2/3}$$

$$= 30t^{1/3} + 12t^{-2/3}$$

$$= 30(1)^{1/3} + 12(1)^{-2/3} - \left(30\left(\frac{8}{27}\right)^{1/3} + 12\left(\frac{8}{27}\right)^{-2/3}\right)$$

$$= 30 + 12 - \left(30\left(\frac{2}{3}\right) + 12\left(\frac{2}{3}\right)^{-2}\right)$$

$$= 42 - \left(20 + 12\left(\frac{3}{2}\right)^2\right) = 42 - \left(20 + 12\left(\frac{9}{4}\right)\right)$$

$$= 42 - (20 + 27)$$

$$= 42 - 47 = -5$$

$$\int_b^a x^4\,dx = \frac{x^5}{5}\Big|_b^a$$

$$\frac{d}{dx}(?) = x^4$$

$$? = \frac{x^5}{5}$$

$$= \frac{a^5}{5} - \frac{b^5}{5}$$

$$= \frac{1}{5}(a^5 - b^5)$$

$$\frac{d}{dx}\left(\int_x^{x^2} \ln(\sec t)\,dt\right)$$

$$\frac{d}{dt}(?) = \ln(\sec t) = F'(t)$$

$$? = F(t)$$

① anti-derivative $= F(t)$

$$\frac{d}{dx}\left(\int_x^{x^2} \ln(\sec t)\,dt\right)$$

② evaluate $F(t)$ at the bounds

$$= \frac{d}{dx}\left(F(t)\Big|_x^{x^2}\right) = \frac{d}{dx}\left(F(x^2) - F(x)\right)$$

③ take the derivative using chain rule

$$= F'(x^2)(2x) - F'(x)(1)$$

$$= \ln(\sec x^2)(2x) - \ln(\sec x)(1)$$

④ plug back in to original function $(F'(t))$