Next Post-Class HW (HW01) due Tue morning 3am

Next Pre-Class HW (Learning Module) due Mon night midnight

Review:

$\int f(x)\,dx$ vs $\int_a^b f(x)\,dx$

this means a function $F(x)$ with $F'(x) = f(x)$

"antiderivative"

"indefinite integral"

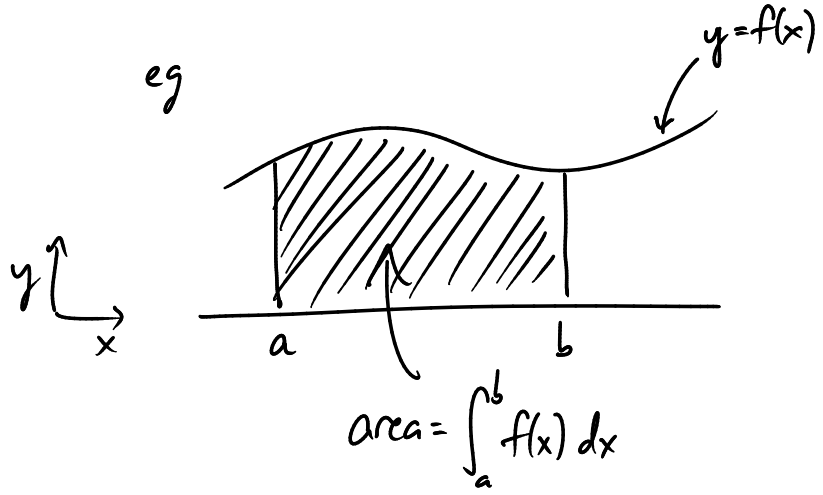
this means the (definite) integral of $f(x)$ from a to b

Ex $\int x\,dx = \frac{1}{2}x^2$

or: $= \frac{1}{2}x^2 + C$

or. $= \frac{1}{2}x^2 + 5$

eg



FTC says these 2 things are related

FTC ① $\frac{d}{dx}\left(\int_c^x f(t)\,dt\right) = f(x)$ ie $\int_c^x f(t)\,dt$ is an antiderivative of $f(x)$

Q What is the deriv. of

1) $F(x) = \int_{-4}^{x} \sin t\,dt$, 2) $F(x) = \int_{-2}^{x} \sin t\,dt$?

1) sin x $\quad \sin x - \sin(-4)$

2) sin x $\quad \sin x - \sin(-2)$

$\frac{d}{dx}\left(\int_{-4}^{x} \sin t\,dt\right)$ $\quad f(t) = \sin t$, $c = -4$

$= \sin x$

Q What is the deriv of

1) $\int_{1783}^{x^2} \frac{1}{1+t}\,dt$? 2) $\int_{3}^{\ln(1+2x)} \sqrt{1+t^2}\,dt$?

1): we know what's $\frac{d}{du}\int_{1783}^{u} \frac{1}{1+t}\,dt$

so, say $u = x^2$

then $\frac{d}{dx}\int_{1783}^{u} \frac{1}{1+t}\,dt = \underbrace{\frac{du}{dx}}\ \underbrace{\frac{d}{du}\int_{1783}^{u} \frac{1}{1+t}\,dt}$

$= 2x \cdot \frac{1}{1+u}$

$= 2x \cdot \frac{1}{1+x^2} = \frac{2x}{1+x^2}$

2) $\int_{3}^{\ln(1+2x)} \sqrt{1+t^2}\,dt = \sqrt{1+(\ln(1+2x))^2} \cdot \frac{2}{1+2x}$

Q What are the critical points of $F(x) = \int_{5}^{x} \frac{2-t}{1+t^3}\,dt$?

$x = 2$

$x = -1$

A critical pt of $F(x)$ occurs at x such that $F'(x)$ is 0 or undefined.

here $F'(x) = \frac{2-x}{1+x^3}$

$= 0$ just if $2-x=0$

$\boxed{x=2}$

undef just if $1+x^3 = 0$

$x^3 = -1$

$\boxed{x=-1}$

Q 1) What is $\frac{d}{dx}\left(\int_x^5 \tan(t^3)\,dt\right)$?

(★) 2) What is $\frac{d}{dx}\left(\int_x^{2x} \ln t\,dt\right)$?

1) $-\tan x^3$

$$\frac{d}{dx}\left(\int_x^5 \tan(t^3)\,dt\right)$$

$$= \frac{d}{dx}\left(-\int_5^x \tan(t^3)\,dt\right) = -\tan(x^3)$$ ✓

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

eg $\int_x^{2x} \ln t\,dt = \int_x^0 \ln t + \int_0^{2x} \ln t\,dt$

and do $\frac{d}{dx}$ of each..