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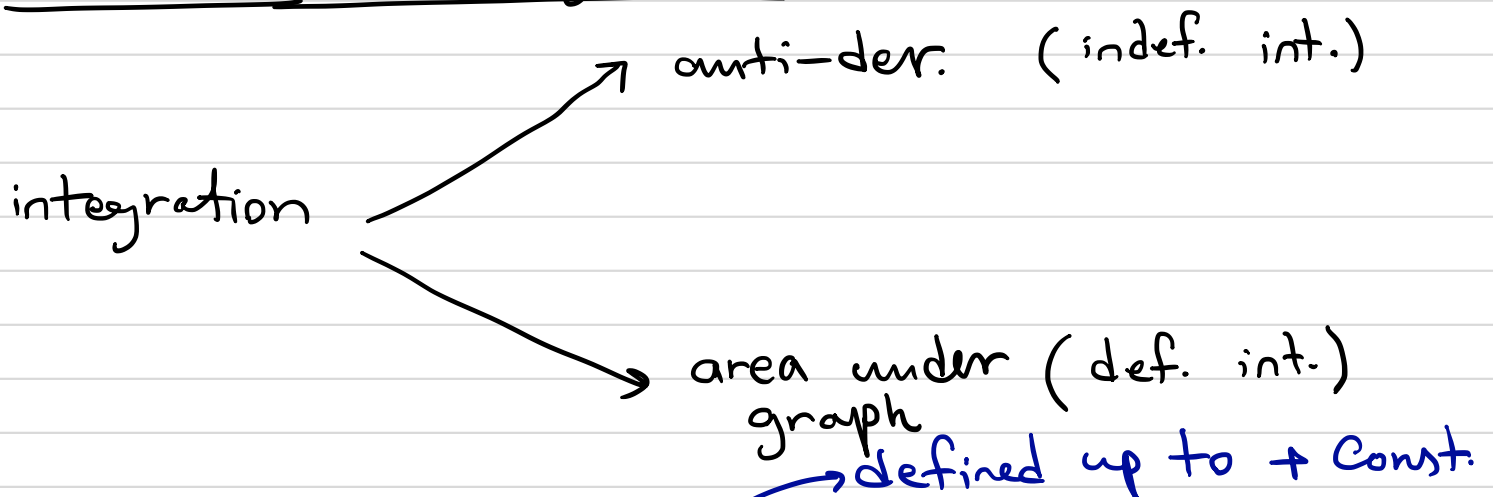


Calc 2

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Review of integration



$f(x)$ given \rightsquigarrow $F(x) = \int f(x) dx$

$F'(x) = f(x)$

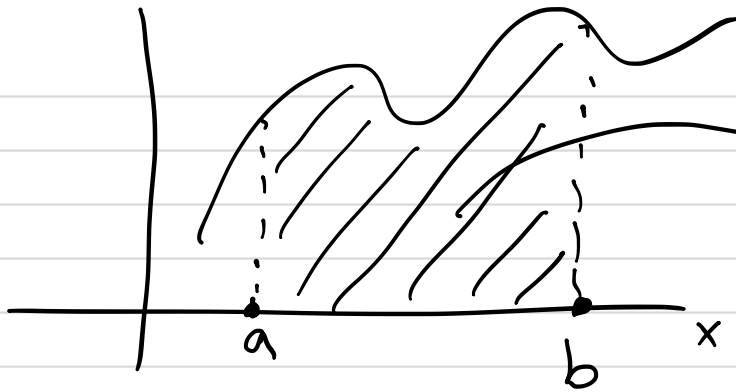
Ex. $f(x) = x$ $\int x dx = \frac{x^2}{2} + C$

Ex. $f(x) = \sin(x)$ $\int \sin(x) dx = -\cos(x) + C$

• Not every anti-der. has a formula expression.

$\int e^{(x^2)} dx \rightsquigarrow$ no formula

$$y=f(x)$$



$$\int_a^b f(x) dx$$

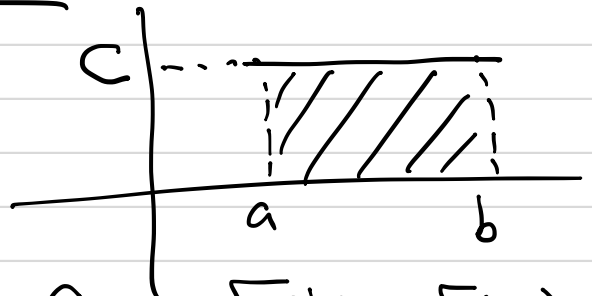
(Signed) number

F.T.C. $F(x) = \text{anti-der. of } f(x) = \int f(x) dx$

$$\int_a^b f(x) dx = F(b) - F(a).$$

• $f(x) = \text{Const.} = C$

$$F(x) = \int C dx = Cx$$



$$\text{area} = (b-a)C = Cb - Ca = F(b) - F(a).$$

F.T.C. is true basically because \odot is inverse of \otimes .

\hookrightarrow area of rect., int.

slope, der.

• Integration by substitution

$$\int f(g(x)) g'(x) dx = \int f(u) du$$

(proof: follows from chain rule for der.)

$$u = g(x)$$

$$\int_{x=a}^{x=b} f(g(x)) g'(x) dx = \int_{u=g(a)}^{u=g(b)} f(u) du$$

Ex. $\int_1^3 x e^{x^2} dx$

$$u = g(x) = x^2 \quad u' = 2x$$

$$\int x e^{x^2} dx$$

$$du = u' dx = 2x \cdot dx$$

$$\frac{1}{2} du = x dx$$

$$\frac{1}{2} \int e^u du$$

$$\frac{1}{2} \int_{1^2}^{3^2} e^u du = \frac{1}{2} \left[e^u \right]_{u=1}^{u=9}$$

$$= \frac{1}{2} (e^9 - e^1)$$

#51 $\int_e^{e^4} \frac{dx}{x \sqrt{\ln(x)}}$

$$u = \ln(x) \quad du = \frac{1}{x} dx$$

$$\int_1^4 \frac{du}{\sqrt{u}} = \left[\frac{u^{(-\frac{1}{2}+1)}}{(-\frac{1}{2}+1)} \right]_1^4$$

$$(\text{cloud}^x)' = \text{star} \cdot \text{cloud}^x$$

$$(e^x)' = 1 \cdot e^x$$

$$(\ln x)' = \frac{1}{x}$$

$$\ln(e^{\text{cloud}}) = \text{cloud}$$