

TFC I

$$a) \frac{d}{dx} \int_3^x f(t) dt = f(x)$$

$$b) \frac{d}{dx} \int_3^x \cos(t^3) dt = \cos(x^3)$$

$$c) \frac{d}{dx} \int_4^x \cos(t^3) dt = \cos(x^3)$$

$$d) \frac{d}{dx} \int_3^x \cos(t^3) dt = \cos(x^3)$$

$$e) \frac{d}{dx} \int_3^{\boxed{x^2}} \cos(t^3) dt = \frac{d}{du} \int_3^u \cos(t^3) dt \cdot \frac{du}{dx}$$

TFC I

$$= \cos(u^3) \cdot \boxed{2x}$$

$$= \cos(x^6) \cdot 2x$$

$$f) \frac{d}{dx} \int_5^{\cos x} t^2 dt = \frac{d}{du} \int_5^u t^2 dt \cdot \frac{du}{dx}$$

TFC I

$$= u^2 \cdot (-\sin x)$$

$$= -\cos^2 x \sin x$$

$$g) \frac{d}{dx} \int_{-3}^{e^x} t dt = \frac{d}{du} \int_{-3}^u t dt \cdot \frac{du}{dx}$$

$$= u \cdot e^x$$

$$= e^x \cdot e^x = e^{2x}$$

$$h) \frac{d}{dx} \int_x^{3x} t^2 dt = \frac{d}{dx} \left(\int_x^a t^2 dt + \int_a^{3x} t^2 dt \right)$$

$$= \frac{d}{dx} \int_x^a t^2 dt + \frac{d}{dx} \int_a^{3x} t^2 dt$$

$$= -\boxed{\frac{d}{dx} \int_a^x t^2 dt} + \frac{d}{dx} \int_a^{3x} t^2 dt$$

TFC 2

$$= -x^2 + \frac{d}{du} \int_a^u t^2 dt \cdot \frac{du}{dx}$$

"De fora" "De dentro"

$$= -x^2 + u^2 \cdot 3$$

$$= -x^2 + 9x^4 \cdot 3$$

$$= -x^2 + 27x^4$$

$$= 26x^4$$

$$i) \frac{d}{dx} \int_{\cos x}^{\sin x} t^2 dt = \frac{d}{dx} \left(\int_{\cos x}^a t^2 dt + \int_a^{\sin x} t^2 dt \right)$$

$$= -\frac{d}{dx} \int_a^{\cos x} t^2 dt + \frac{d}{dx} \int_a^{\sin x} t^2 dt$$

$$= -\frac{d}{du} \int_a^u t^2 dt \cdot \frac{du}{dx} + \frac{d}{dw} \int_a^w t^2 dt \cdot \frac{dw}{dx}$$

TFC I TFC I

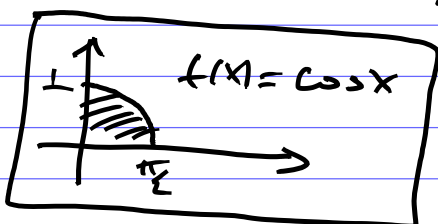
$$= -u^2 \cdot (-\sin x) + w^2 \cos x$$

$$= \cos^2 x \sin x + \sin^2 x \cos x$$

TFC.2

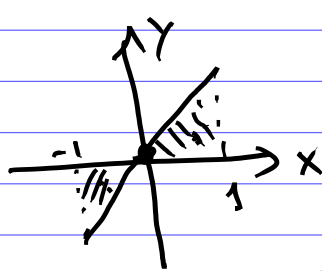
$$\int_a^b f(x) dx = F(b) - F(a)$$

$$\begin{aligned} \text{a)} \int_0^{\pi/2} \cos x dx &= \sin x \Big|_0^{\pi/2} \\ &= \sin \frac{\pi}{2} - \sin 0 \\ &= 1 - 0 = 1 \end{aligned}$$



$$\begin{aligned} \text{b)} \int_0^5 x^3 dx &= \frac{x^4}{4} \Big|_0^5 = \frac{5^4}{4} - \frac{0^4}{4} \\ &= \frac{625}{4} \end{aligned}$$

$$\begin{aligned} \text{c)} \int_{-1}^1 x dx &= \frac{x^2}{2} \Big|_{-1}^1 = \left(\frac{1}{2}\right) - \left(\frac{(-1)^2}{2}\right) \\ &= \frac{1}{2} - \left(\frac{1}{2}\right) = 0 \end{aligned}$$



$$\text{d)} \int_0^1 e^x dx = e^x \Big|_0^1 = e^1 - e^0$$

$$= e - 1$$

$$\text{e)} \int_0^1 2x e^{x^2} dx = e^{x^2} \Big|_0^1$$

$$= e^1 - e^0$$

$$= e - 1$$

Quem eu denovo
placou 2x e^{x^2}?

$$\frac{d e^{x^2}}{dx} = \frac{d e^u}{du} \cdot \frac{du}{dx} = e^u \cdot 2x = e^{x^2} \cdot 2x$$

$$\begin{aligned} \frac{d \cos^4 x}{dx} &= \frac{d u^4}{du} \cdot \frac{du}{dx} \\ &= 4u^3 \cdot (-\sin x) \\ &= -4 \cos^3 x \sin x \end{aligned}$$

Técnica da substituição

$$\text{a)} \int_0^1 \boxed{2x} \boxed{e^{x^2}} dx$$

$$u = x^2 \therefore \frac{du}{dx} = 2x$$

$$du = 2x dx$$

$$\text{Quando } x=0, u=0$$

$$'' \quad x=1, u=1$$

$$\int_0^1 2x e^{x^2} dx = \int_0^1 e^u du$$

$$= e^u \Big|_0^1 = e^1 - e^0 = e - 1$$

$$\text{b)} \int_0^{\pi/2} \sin x \cos x dx$$

$$u = \sin x \therefore \frac{du}{dx} = \cos x$$

$$du = \cos x dx$$

$$\text{Quando } x=0, u = \sin 0 = 0$$

$$'' \quad x = \frac{\pi}{2}, u = \sin \frac{\pi}{2} = 1$$

$$\int_0^{\pi/2} \sin x \cos x dx = \int_0^1 u du = \frac{u^2}{2} \Big|_0^1 = \frac{1^2}{2} - \frac{0^2}{2} = \frac{1}{2}$$

Da por opção substituição?

a) $\int_0^{\pi} e^{\cos x} \sin x \, dx$
SIM

$$u = \cos x$$

$$\frac{du}{dx} = -\sin x$$

$$du = -\sin x \, dx$$

b) $\int_0^1 x^2 \cos x^2 \, dx$

$$u = x^2 \therefore \frac{du}{dx} = 2x$$

NÃO

c) $\int_0^3 \underline{x} \cos x^2 \underline{dx}$

$$u = x^2 \therefore \frac{du}{dx} = 2x$$

$$du = 2x \, dx$$

$$\frac{du}{2} = \boxed{x \, dx}$$

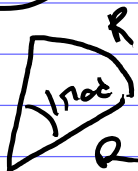
$$\text{Quando } x=0, u=0^2=0$$

$$\text{|| } x=3, u=3^2=9$$

$$= \int_0^9 \cos u \, \frac{du}{2} = \frac{\sin u}{2} \Big|_0^9$$

$$= \frac{\sin(9)}{2} - \frac{\sin 0}{2}$$

Sen 1



$$= \frac{\sin 9}{2}$$