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

TFC I

$= \cos(u^3)\,2x$

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

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

$= u^2\cdot(-\text{sen}x)$

$= -\cos^2 x\,\text{sen}x$

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

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

"De fora" "De dentro"

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

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

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

$= 26x^2$

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

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

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

TFC I $\quad$ TFC I

$= -u^2\cdot(-\text{sen}x) + w^2\cos x$

$= \cos^2 x\,\text{sen}x + \text{sen}^2 x\cos x$

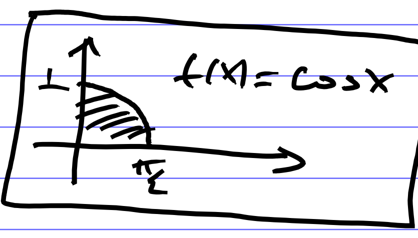
TFC.2

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

a) $\int_0^{\pi/2} \cos x \, dx = \operatorname{sen} x \Big|_0^{\pi/2}$

$= \operatorname{sen} \frac{\pi}{2} - \operatorname{sen} 0$

$= 1 - 0 = 1$

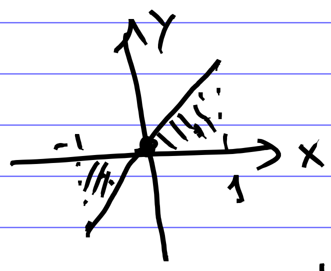


b) $\int_0^5 x^3 dx = \frac{x^4}{4}\Big|_0^5 = \frac{5^4}{4} - \frac{0^4}{4}$

$= \frac{625}{4}$

c) $\int_{-1}^1 x \, dx = \frac{x^2}{2}\Big|_{-1}^1 = \left(\frac{1}{2}\right) - \left(\frac{(-1)^2}{2}\right)$

$= \frac{1}{2} - \left(\frac{1}{2}\right) = 0$



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

$= e - 1$

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

$\boxed{\text{Quem eu derivo para achar } 2x e^{x^2} \text{ ?}}$ $= e^{1^2} - e^{0^2}$

$= e - 1$

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

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

$\frac{d \cos^4 x}{dx} = \frac{du^4}{du} \cdot \frac{du}{dx}$

$= 4u^3 \cdot (-\operatorname{sen} x)$

$= -4 \cos^3 x \operatorname{sen} x$

Técnica da substituição

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

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

$du = 2x \, dx$

Quando $x = 0$, $u = 0$

" $x = 1$, $u = 1$

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

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

$= e - 1$

b) $\int_0^{\pi/2} \operatorname{sen} x \cos x \, dx$

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

$du = \cos x \, dx$

Quando $x = 0$, $u = \operatorname{sen} 0 = 0$

" $x = \frac{\pi}{2}$, $u = \operatorname{sen} \frac{\pi}{2} = 1$

$\int_0^{\pi/2} \operatorname{sen} x \cos x \, dx = \boxed{\int_0^1 u \, du} = \frac{u^2}{2}\Big|_0^1$

$= \frac{1^2}{2} - \frac{0^2}{2}$

$= \frac{1}{2}$

Da para aplicar substituição?

a) $\int_0^{\pi} e^{\cos x} \boxed{\text{sen}\,x \, dx}$

SIM

$u = \cos x$

$\frac{du}{dx} = -\text{sen}\,x$

$du = -\text{sen}\,x \, dx$

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

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

NÃO

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

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

$du = 2x \, dx$

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

Quando $x = 0$, $u = 0^2 = 0$

" $x = 3$, $u = 3^2 = 9$

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

$$= \frac{\text{sen}\,9}{2} - \frac{\text{sen}\,0}{2}$$

$$= \frac{\text{sen}\,9}{2}$$

sen 1