Gabriel Cotrim Faria Oliveira - 20.1.4004 - Turma 08

1) $\int \frac{dx}{\sqrt{16x^2+16x-12}} = \int \frac{dx}{\sqrt{4(4x^2+4x-3)}} =$

$= \int \frac{dx}{2\sqrt{4x^2+4x-3}} = \frac{1}{2}\int \frac{dx}{\sqrt{(4x^2+4x)-3}} =$

a^2 $2ab$

1º) $a^2 = 4x^2$ $\quad 2ab = 4x$

$\boxed{a = 2x}$ $\rightarrow$ $2 \cdot 2x \cdot b = 4x$

$4x \cdot b = 4x$

$\boxed{b = 1}$

2º) $= \frac{1}{2}\int \frac{dx}{\sqrt{(2x+1)^2 - 1 - 3}} = \frac{1}{2}\int \frac{dx}{\sqrt{(2x+1)^2 - 4}}$

1^2 $\qquad$ u

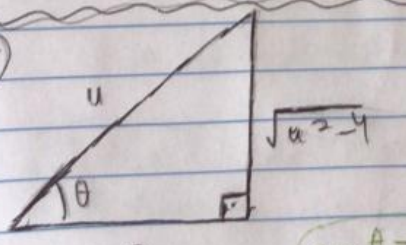
$u = 2x$

$du = 2\,dx$

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

$= \frac{1}{4}\int \frac{1}{\sqrt{u^2-4}}\,du$

3º)



$\cos\theta = \frac{2}{u}$

$u = 2\,\frac{1}{\cos\theta}$

$\sec\theta = \frac{u}{2}$ $\rightarrow$ $\boxed{u = 2\sec\theta}$

$\boxed{du = 2\sec\theta\,\mathrm{tg}\,\theta\,dx}$

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④* $\sqrt{(2\sec\theta)^2 - 4}$

$\sqrt{4\sec^2\theta - 4}$

$\sqrt{4\cdot(\sec^2\theta - 1)} = 2|tg\,\theta|$

$\sec^2\theta - 1 = tg^2 u$

↳ Como $0 \leq \theta < \frac{\pi}{2}$ ou $\pi \leq \theta < \frac{3\pi}{2}$

↳ $2tg\,\theta$

⑤ $\frac{1}{4}\int \frac{2\sec\theta\, tg\,\theta\, d\theta}{2tg\,\theta}$

$\frac{1}{4}\int \sec\theta\, d\theta = \frac{1}{4}\cdot \ln|\sec\theta + tg\,\theta| =$

$= \frac{1}{4}\left[\ln\left|\frac{u}{2} + \frac{\sqrt{u^2-4}}{2}\right|\right] =$

$= \frac{1}{4}\left[\ln\left|\frac{2x+1\ \sqrt{(2x+1)^2-4}}{2}\right|\right]$

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2) $\int \frac{\ln(2-x)}{x^2}\,dx = \int \underbrace{\ln(2-x)}_{u}\ \underbrace{\frac{1}{x^2}\,dx}_{dv}$

1) $u = \ln(2-x)$ $\qquad dv = \frac{1}{x^2}\,dx$

$\boxed{du = \frac{-1}{2-x}\,dx}$ $\qquad \boxed{V = \int x^{-2}\,dx = -x^{-1} = -\frac{1}{x}}$

2) $\int \frac{\ln(2-x)}{x^2} = \ln(2-x)\cdot\frac{-1}{x} - \int \frac{-1}{x}\cdot\frac{-1}{2-x}\,dx$

$\int \frac{\ln(2-x)}{x^2} = -\frac{\ln(2-x)}{x} - \int \frac{1}{2x-x^2}\,dx$

$\int \frac{\ln(2-x)}{x^2} = -\frac{\ln(2-x)}{x} - \underbrace{\int \frac{1}{x(2-x)}\,dx}$

$*$

3) $* \quad \frac{1}{2x-x^2} = \frac{A}{x} + \frac{B}{2-x} \rightarrow \int \frac{\frac{1}{2}}{x} + \frac{\frac{1}{2}}{2-x}$

4) $1 = 2A - Ax + Bx$

$1 = x(-A+B) + 2A$

$\begin{cases} 2A = 1 \rightarrow \boxed{A = \frac{1}{2}} \\ -A + B = 0 \end{cases}$

$\therefore \boxed{B = \frac{1}{2}}$

$\frac{1}{2}\int \frac{1}{x} + \frac{1}{2}\int \underbrace{\frac{1}{2-x}}_{u}$

$u = 2-x$

$-du = dx$

↓

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$$\frac{1}{2}\int \frac{1}{x}\,dx - \frac{1}{2}\int \frac{1}{u}\,du$$

$$\frac{1}{2}\ln|x| - \frac{1}{2}\ln|u| + C$$

$$\boxed{\frac{1}{2}\ln|x| - \frac{1}{2}\ln|2-x| + C}$$

⑤ $$\int \frac{\ln|2-x|}{x^2} = -\frac{\ln(2-x)}{x} - \frac{1}{2}\left(\ln|x| - \ln|2-x|\right) + C$$

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3) $\int \frac{3e^{3x}}{4e^x+3} = \int \frac{3(e^x)^3}{4e^x+3}\,dx =$

(u under $4e^x+3$)

1º $u = 4e^x + 3 \rightarrow \boxed{\frac{u-3}{4} = e^x}$

$\frac{du}{dx} = 4e^x$

$\boxed{\frac{du}{4} = e^x dx}$

$= $ 2º $\int \frac{3(e^x)^2 \cdot e^x \cdot dx}{4e^x+3}$ (with u under $4e^x+3$ and $\frac{du}{4}$ over $e^x \cdot dx$)

$\int \frac{3 \cdot \left(\frac{u-3}{4}\right)^2}{u} \frac{du}{4}$

$\frac{1}{4} \int \frac{\frac{3(u^2-6u+9)}{16}}{u}$

$\frac{1}{4} \int \frac{3(u^2-6u+9)}{16u}$

$\frac{3}{64} \int \frac{u^2-6u+9}{u}$ } ✱

3º

✱ $u^2 - 6u + 9 \;\lfloor u$

$-u^2 \qquad\qquad u - 6$

$-6u + 9$

$+6u$

9

$\frac{u^2-6u+9}{u} = \frac{(u-6) \cdot u}{u} + \frac{9}{u}$

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$$\frac{3}{64}\int u - 6 + 9\,\frac{1}{u}$$

$$\frac{3}{64}\left(\frac{1}{2}u^2 - 6u + 9\ln|u|\right) + C$$

$$\frac{3}{64}\left(\frac{1}{2}(4e^x+3)^2 - 6(4e^x+3) + 9\ln|4e^x+3|\right) + C$$

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4) $\int \frac{1}{x - \sqrt{x+6}} dx$ (u = $\sqrt{x+6}$)

1º $u = \sqrt{x+6}$

$u^2 = x + 6 \rightarrow x = u^2 - 6$

$dx = 2u\,du$

2º $\int \frac{2u\,du}{u^2 - 6 - u} = 2\int \frac{u}{u^2 - u - 6} =$ (*)

3º $\frac{u}{u^2 - u - 6} = \frac{A}{u-3} + \frac{B}{u+2}$

$u^2 - u - 6 = (u-3)\cdot(u+2)$

$u = Au + 2A + Bu - 3B$

$u = u\,(A + B) + 2A - 3B$

$\begin{cases} (A+B) = 1 \rightarrow A = 1 - B \\ 2A - 3B = 0 \end{cases}$

$\hookrightarrow A = 1 - \frac{2}{5}$

$A = \frac{5-2}{5} \rightarrow A = \frac{3}{5}$

$\hookrightarrow 2(1-B) - 3B = 0$

$2 - 2B - 3B = 0$

$-5B = -2$

$B = \frac{2}{5}$

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(4º) $2\int \frac{\frac{2}{5}}{u-3} + \frac{\frac{3}{5}}{u+2} = 2\left(\frac{2}{5}\int \frac{1}{u-3} + \frac{3}{5}\int \frac{1}{u+2}\right) =$

$= \frac{4}{5}\int \frac{1}{u-3} + \frac{6}{5}\int \frac{1}{u+2} =$

$= \frac{4}{5} \ln|u-3| + \frac{6}{5}\ln|u+2| + C =$

$= \frac{4}{5} \ln|\sqrt{x+6} - 3| + \frac{6}{5}\ln|\sqrt{x+6} + 2| + C$

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5) $\int_0^{\frac{\pi}{2}} \operatorname{sen} x - \operatorname{sen}^3 x$

$\underbrace{\int_0^{\frac{\pi}{2}} \operatorname{sen} x}_{*} - \underbrace{\int_0^{\frac{\pi}{2}} \operatorname{sen}^3 x}_{**}$

1° ** $\int_0^{\frac{\pi}{2}} \underbrace{\operatorname{sen}^2 x}_{1-\cos^2 x} \cdot \operatorname{sen} x \, dx$

$-\int_0^{\frac{\pi}{2}} (1 - \underbrace{\cos^2 x}_{u}) \cdot \underbrace{\operatorname{sen} x \, dx}_{-du} =$

$u = \cos x$

$-du = \operatorname{sen} x \cdot dx$

$= + \int_1^0 (1 - u^2) \cdot du$

$= + \left[u - \frac{1}{3} u^3 \right]_1^0 =$

Troca de valores

$u = \cos \frac{\pi}{2}$

$u = 0$

$u = \cos 0$

$u = 1$

$= + \left[\left(0 - \frac{1}{3} 0^3\right) - \left(1 - \frac{1}{3}\right) \right] =$

$= + \left(\frac{3 - 1}{3} \right) = \frac{-2}{3}$

2° * $\int_0^{\frac{\pi}{2}} \operatorname{sen} x = -\cos x \Big]_0^{\frac{\pi}{2}} =$

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

$-(0 - 1) = +1$

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/ /100

③ Área entre curvas

$$1 - \frac{2}{3} = \frac{3-2}{3} = \boxed{\frac{1}{3}}$$