Cálculo Diferencial e Integral
Lista de Problemas 3.4

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Questão 01

Calcule a integral.

(a) $\displaystyle\int x \cos 5x \, dx$

(b) $\displaystyle\int r e^{r/2} \, dr$

(c) $\displaystyle\int (x^2 + 2x) \cos x \, dx$

(d) $\displaystyle\int \ln \sqrt[3]{x} \, dx$

(e) $\displaystyle\int \arctan 4t \, dt$

(f) $\displaystyle\int t \sec^2 2t \, dt$

(g) $\displaystyle\int (\ln x)^2 \, dx$

(h) $\displaystyle\int e^{2\theta} \sin 3\theta \, d\theta$

(i) $\displaystyle\int z^3 e^z \, dz$

(j) $\displaystyle\int \frac{x e^{2x}}{(1 + 2x)^2} \, dr$

(k) $\displaystyle\int_0^{1/2} x \cos \pi x \, dx$

(l) $\displaystyle\int_0^1 t \cosh t \, dt$

(m) $\displaystyle\int_1^3 r^3 \ln r \, dr$

(n) $\displaystyle\int_0^1 \frac{y}{e^{2y}} \, dy$

(o) $\displaystyle\int_0^{1/2} \cos^{-1} x \, dx$

(p) $\displaystyle\int \cos x \ln(\sin x) \, dx$

(q) $\displaystyle\int_1^2 x^4 (\ln x)^2 \, dx$

Questão 02

Demonstre a fórmula de redução

$$\int \cos^n x \, dx = \frac{1}{n} \cos^{n-1} x \sin x + \frac{n-1}{n} \int \cos^{n-2} x \, dx$$

Questão 03

Demonstre que, para potências pares de seno,

$$\int_0^{\pi/2} \sin^{2n} x \, dx = \frac{3 \times 5 \times 7 \times \cdots \times (2n-1)}{2 \times 4 \times 6 \times \cdots \times 2n} \frac{\pi}{2}$$

Questão 04

Demonstre que

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

Respostas

Questão 1

(a) $\frac{1}{5}x\sin 5x + \frac{1}{25}\cos 5x + C$ (b) $2(r-2)e^{r/2} + C$ (c) $(x^2+2x)\sin x + (2x+2)\cos x - 2\sin x + C$ (d) $x\ln\sqrt[3]{x} - \frac{1}{3}x + C$ (e) $t\arctan 4t - \frac{1}{8}\ln(1+16t^2) + C$ (f) $\frac{1}{2}t\tan 2t - \frac{1}{4}\ln|\sec 2t| + C$ (g) $x(\ln x)^2 - 2x\ln x + 2x + C$ (h) $\frac{1}{13}e^{2\theta}(2\sin 3\theta - 3\cos 3\theta) + C$ (i) $z^3 e^z - 3z^2 e^2 + 6ze^z - 6e^z + C$ (j) $\dfrac{e^{2x}}{4(2x+1)} + C$ (k) $\dfrac{\pi-2}{2\pi^2}$ (l) $1 - 1/e$ (m) $\frac{81}{4}\ln 3 - 5$ (n) $\frac{1}{4} - \frac{3}{4}e^{-2}$ (o) $\frac{1}{6}(\pi + 6 - 3\sqrt{3})$ (p) $\sin x(\ln\sin x - 1) + C$ (q) $\frac{32}{5}(\ln 2)^2 - \frac{64}{25}\ln 2 + \frac{62}{125}$